THE NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING



OCCUPATIONAL STANDARDS

OCCUPATION: WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER

LEVEL: NTA LEVEL 7

FEBRUARY 2024

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ABBREVIATIONS

CAD Computer-aided Design

CASS Topographic/Cadastral Mapping Software (Developed by South

Digital Technology Co., Ltd.)

CBET Competency Based Education and Training

NACTVET National Council for Technical and Vocational Education and Training

NOS National Occupational Standards

OS Occupational Standards

TET Technical Education and Training

TVET Technical and Vocational Education and Training

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: food service).

Occupational Standards:

Specific requirements of competences for personnel in a particular occupational area, including knowledge and relevant attitudes. They also act as performance tools of assessment of the prescribed outcomes.

Occupational/Job

Analysis:

A process used to identify the tasks that are important to employees in

any given occupation.

Performance Criteria:

Indicate expected end results or outcomes in the form of evaluative

statements.

Skills:

The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.

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, as well as safety concerns required for the 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

products, service, or decisions.

Underpinning Crucial knowledge that an individual must acquire in order to

Knowledge: demonstrate competences that are associated in performing a given task.

Verification process: The process of having experts review and confirm the importance of the

task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as

validation.

Occupational The application of knowledge and skills that consistently meet the

Competence: standards required by the working conditions.

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 STANDARD 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 OCCUPATION STANDARDS FOR WATER CONSERVANCY AND HYDROPOWER ENGINEERS

These standards cover a broad range of duties and tasks that can be performed by a Water Conservancy and Hydropower Engineer. However, the occupational standards are not meant to replace individual job descriptions. Instead, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Water Conservancy and Hydropower Engineer 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.

Working in coordination with other engineers, the Water Conservancy and Hydropower Engineer completes the survey, planning, design, construction and operation and maintenance management of hydraulic hub projects. At the construction site of water conservancy projects, Water Conservancy

and Hydropower Engineering Engineers can guide and organize technicians to complete various construction tasks, from the composition of water conservancy hubs, the design of various parts of the building size to the drawing of engineering drawings, the construction organization and design work such as construction scheme preparation and schedule development according to the design documents, and finally the organization and management work at the site to ensure the quality, schedule, cost and safety of water conservancy construction projects to achieve the objectives. Generally, the Water Conservancy and Hydropower Engineer performs the following duties:

- a) Water conservancy engineering construction
- b) Water conservancy project management
- c) Safety monitoring of hydraulic structure
- d) Design of small and medium sized hydraulic projects
- e) Water Project O&M Management
- f) Safety monitoring of hydraulic structure

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA LEVEL 7 and 8.

4.0. VALIDITY PERIOD

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

5.0. OCCUPATIONAL STANDARDS

5.1. OCCUPATIONAL STANDARDS FOR WATER CONSERVANCY AND HYDROPOWER ENGINEER - NTA LEVEL 7

ОС	CUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	OCCUPATION CODE	
DU	TY TITLE	CONSTRUCT SMALL WATER CONSERVANCY WORKS	DUTY NO.	701
TA	SK TITLE	CONSTRUCT SMALL SLUICES	TASK NO.	7011
	RFORMANCE ITERIA	The person performing this task accordance with the requireme specifications, design documents	nts of the relevan	t technical standards,
	NGE ATEMENT	 The task can be performed in supervision of the senior engine engineering. The tools and equip Computer and office operations Information on the topograp other construction conditions Design documents for small Manuals on the performance concrete works, electrome structure installation works. Safety gear. 	er of water conservement to be used incoming system; hy, hydrology, metes of the project site; sluice works; of construction made	ancy and hydropower lude: eorology, geology and chinery for earthworks,
		EVIDENCE REQUIR	EMENT	
PR	ACTICAL PERF	ORMANCE	UNDERPINNIN	G KNOWLEDGE
		ing this task must be able to do	Detailed knowled	lge about:
	following:	d	1.0 Methods	
1. 2.	Analyze construct	ion technology and site;	The person perfor able to explain ho	ming this task must be
3.	Select construction	on diversion methods and carry diversion buildings;	-	onstruction diversion
4.	Determine the contreatment;	nstruction scheme for foundation	1.2 Determine the for foundation	e construction scheme n treatment;
5.	small sluices;	gineering construction scheme for	1.3 Determine construction	the engineering scheme for small
6.		od interception plan;	sluices;	netwation schodule
7. 8.	Prepare the work Conduct the const		1.4 Prepare co plans;	nstruction schedule
9.		truction general layout; ssurance measures for quality, le:	1.5 Prepare the construction s	9
10.	Prepare the resour		1.6 Prepare cons design docum	struction organization ents.

11. Compile and prepare engineering construction	2.0 Principles
organization design documents for small sluices.	The person performing this task must be
12. Observe health, occupational and environmental	able to explain the following principles:
safety rules and regulations.	2.1 Basic principles of hydraulics;
	2.2 Principles of geotechnics and
	engineering geology;
	2.3 Basic principles of concrete structures;
	2.4 Principles of reservoir flood regulation algorithms.
	3.0 Theories
	The person performing this task must be able to explain the following:
	3.1 Theory of schedule control and budget;
	3.2 Theory of construction site layout;
	3.3 Theory of value engineering;
	3.4 Theory of construction organization design.
	3.5 Theory of occupational health and safety.
	3.6 Theory of Stakeholders' involvement.
	4.0 Essential Skills
	4.1 Communication skills;
	4.2 Learning skills;
	4.3 Management and leadership skills;
	4.4 Skills for operating computer software;
	4.5 Teamwork skills;
	4.6 Report writing skills;
	4.7 IT skills.
	5.0 Mathematical skills;
	5.1 Numerical computation;
	5.2 Geometry.
DESCRIPTION OF THE END PRODUCT /	The small sluices are constructed in
SERVICE THE END TROBECT /	accordance with the requirements of the
	relevant technical standards,
	specifications, design documents and work contracts.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about:
	1. Structural components of the sluices;

2. Quality assessment and acceptance
standards for the engineering
construction of water conservancy
projects;
3. Properties and basic principles of
commonly-used building materials;
4. Rules for the preparation of project
estimates

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	OCCUPATION CODE	
DUTY TITLE	CONSTRUCT SMALL WATER CONSERVANCY WORKS	DUTY NO.	701
TASK TITLE	CONSTRUCT SMALL PUMP STATIONS	TASK NO.	7012
PERFORMANCE CRITERIA	The person performing this stations in accordance with specifications, design docume	the requirements of te	
RANGE STATEMENT	other construction condit 3. Engineering design docu 4. Manuals on the performa	gineer of water conservance puipment to be used include rating system; graphy, hydrology, meteore ions of the project site; ments for small pump station one of construction machine omechanical installation	ey and hydropower e: clogy, geology and dons; ery for earthworks,
	5. Safety gear	,	
	EVIDENCE REQU	JIREMENT	
PRACTICAL PERF	ORMANCE	UNDERPINNING KNO	OWLEDGE
	ing this task must be able to	Detailed knowledge abo	out:
do the following: 1. Analyze construc	tion conditions:	1.0 Methods	
	ion technology and site;	The person performing able to explain how to:	this task must be
3. Select construct	ion diversion methods and gn of diversion buildings;	1.1 Determine construores;	uction diversion
4. Determine the foundation treatm	construction scheme for	1.2 Determine the const	ruction scheme for
Touridation treatif	nent;	foundation treatment	••
5. Determine the eng of small pump sta	gineering construction scheme ations;	1.3 Determine the engine scheme for small pur	eering construction mp stations;
5. Determine the engof small pump sta6. Determine the flo	gineering construction scheme ations; od interception plan;	1.3 Determine the engine scheme for small put1.4 Prepare construction	eering construction mp stations; schedule plans;
5. Determine the engof small pump sta6. Determine the flo7. Prepare the work	gineering construction scheme ations; od interception plan; schedule;	1.3 Determine the engine scheme for small put1.4 Prepare construction1.5 Prepare the layout of	eering construction mp stations; schedule plans;
5. Determine the engof small pump sta6. Determine the flo7. Prepare the work8. Conduct the cons	gineering construction scheme ations; sod interception plan; schedule; truction general layout; surance measures for quality,	1.3 Determine the engine scheme for small put1.4 Prepare construction	eering construction mp stations; schedule plans; of the construction
 Determine the engof small pump sta Determine the flo Prepare the work Conduct the cons Prepare target assafety and schedu Prepare the resou 	gineering construction scheme ntions; od interception plan; schedule; truction general layout; surance measures for quality, ale; rce planning;	 1.3 Determine the engine scheme for small pur 1.4 Prepare construction 1.5 Prepare the layout of site; 1.6 Prepare construction design documents. 	eering construction mp stations; schedule plans; of the construction
 5. Determine the engof small pump sta 6. Determine the flo 7. Prepare the work 8. Conduct the cons 9. Prepare target as safety and schedu 10. Prepare the resou 11. Compile and prepare organization designations. 	gineering construction scheme ntions; nod interception plan; schedule; truction general layout; surance measures for quality, ale;	 1.3 Determine the engine scheme for small pur 1.4 Prepare construction 1.5 Prepare the layout of site; 1.6 Prepare construction 	eering construction mp stations; schedule plans; of the construction ion organization this task must be

	4. Rules for the preparation of water conservancy project estimates.
	3. Properties and basic principles of commonly-used building materials;
	projects;
	standards for the engineering construction of water conservancy
	stations; 2. Quality assessment and acceptance
	1. Structural components of the pumping
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about:
SERVICE	according to the pump station design objectives and technical requirements.
DESCRIPTION OF THE END PRODUCT /	The small pump stations are constructed
	5.2 Geometry.
	5.0 Mathematical skills5.1 Numerical computation;
	50 Mothematical skills
	4.6 Report writing skills.
	4.5 Teamwork skills;
	4.4 Skills for operating computer software;
	4.2 Learning skills;4.3 Management skills;
	4.1 Communication skills;
	4.0 Essential Skills
	3.4 Theory of construction organization design.
	3.3 Theory of value engineering;
	3.2 Theory of construction site layout;
	3.1 Theory of schedule control;
	The person performing this task must be able to explain the following:
	3.0 Theories
	algorithms.
	2.4 Principles of reservoir flood regulation
	2.3 Basic principles of concrete structures;
	2.2 Principles of geotechnics and engineering geology;

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	OCCUPATION CODE	
DUTY TITLE	CONSTRUCT SMALL WATER CONSERVANCY WORKS	DUTY NO.	701
TASK TITLE	CONSTRUCT CANAL STRUCTURES	TASK NO.	7013
PERFORMANCE CRITERIA	The person performing this task in accordance with the require specifications, design documen	ments of the relevant technic	
RANGE STATEMENT	and other construction conEngineering design documManuals on the perform	eer of water conservancy and ipment to be used include: ating system; raphy, hydrology, meteorologitions of the project site; tents for canal structures; mance of construction maks, electromechanical instal	hydropower ogy, geology achinery for
	5. Safety gear		
	EVIDENCE REQUIR	EMENT	
PRACTICAL PERFO	DRMANCE	UNDERPINNING KNOW	VLEDGE
	ng this task must be able to do	Detailed knowledge about	•
the following:1. Analyze constructi	on conditions:	1.0 Methods	414 1
_	on technology and site;	The person performing this able to explain how to:	task must be
*	n diversion methods and carry	1.1 Determine construction options;	on diversion
4. Determine the cons	struction scheme for foundation		
treatment;	struction scheme for foundation	1.2 Determine the construction for foundation treatmer	
5. Determine engineer the canal structures	ering construction schemes for s;	for foundation treatmer 1.3 Determine engineering schemes for the canal s	construction tructures;
5. Determine engined the canal structures6. Determine the floor	ering construction schemes for s; d interception plan;	for foundation treatmer 1.3 Determine engineering schemes for the canal s 1.4 Prepare construction sc	construction tructures; hedule plans;
5. Determine engined the canal structures6. Determine the floo7. Prepare the work s	ering construction schemes for s; d interception plan; chedule;	for foundation treatmer 1.3 Determine engineering schemes for the canal s 1.4 Prepare construction sc 1.5 Prepare the layou	construction tructures; hedule plans;
5. Determine engined the canal structures6. Determine the floo7. Prepare the work s8. Conduct the constr	ering construction schemes for s; d interception plan; chedule; ruction general layout; surance measures for quality,	for foundation treatmer 1.3 Determine engineering schemes for the canal s 1.4 Prepare construction sc	construction tructures; hedule plans; t of the
 Determine engined the canal structures Determine the floo Prepare the work s Conduct the constr Prepare target assafety and schedule Prepare the resource 	ering construction schemes for s; d interception plan; chedule; cuction general layout; surance measures for quality, e; ce planning;	for foundation treatmer 1.3 Determine engineering schemes for the canal s 1.4 Prepare construction sc 1.5 Prepare the layou construction site; 1.6 Prepare construction design documents.	construction tructures; hedule plans; t of the
 Determine engined the canal structures Determine the floo Prepare the work s Conduct the constr Prepare target ass safety and schedule Prepare the resource Compile and pre organization des structures. 	ering construction schemes for s; d interception plan; chedule; ruction general layout; surance measures for quality, e;	for foundation treatmer 1.3 Determine engineering schemes for the canal s 1.4 Prepare construction sc 1.5 Prepare the layou construction site; 1.6 Prepare construction	tt; construction tructures; hedule plans; t of the organization task must be

	2.2 Principles of geotechnics and
	engineering geology; 2.3 Basic principles of concrete structures;
	2.4 Principles of reservoir flood regulation algorithms.
	3.0 Theories
	The person performing this task must be
	able to explain the following:
	3.1 Theory of schedule control;
	3.2 Theory of construction site layout;
	3.3 Theory of value engineering;
	3.4 Theory of construction organization design;
	3.5 Theory of Engineering surveying.
	4.0 Essential Skills
	4.1 Communication skills;
	4.2 Learning skills;
	4.3 Management skills;
	4.4 Skills for operating computer software;
	4.5 Teamwork skills;
	4.6 Report writing skills.
	5.0 Mathematical skills
	5.1 Numerical computation;
	5.2 Geometry.
DESCRIPTION OF THE END PRODUCT / SERVICE	The canal structures are constructed in accordance with the design objectives and technical requirements and
	standards.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about:
	1. Structural composition of canal structures;
	2. Quality assessment and acceptance standards for the engineering construction of water conservancy projects;
	3. Properties and basic principles of commonly-used building materials;
	4. Rules for the preparation of water conservancy project estimates.

OCCUPATION	WATER CONSERVANCY	OCCUPATION	
	AND HYDROPOWER ENGINEERING ENGINEER	CODE	
DUTY TITLE	CONSTRUCT SMALL WATER CONSERVANCY WORKS	DUTY NO.	701
TASK TITLE	CONSTRUCT SMALL EARTH-ROCK DAMS	TASK NO.	7014
PERFORMANCE CRITERIA	The person performing this task rock dams in accordance with t standards, specifications, design	he requirements of the re	elevant technical
RANGE STATEMENT	The task can be performed in supervision of the senior engine engineering. The tools and equipart 1. Computer and office operat 2. Information on the topogrand other construction cond 3. Engineering design documed 4. Manuals on the perform earthworks, concrete work and metal structure installated 5. Safety gear	er of water conservancy pment to be used include ing system; aphy, hydrology, meteo litions of the project site; ents for small earth-rock nance of construction as, electromechanical in	and hydropower e: orology, geology dams; machinery for
	EVIDENCE REQUIR	FMFNT	
PRACTICAL PERFO		UNDERPINNING KN	NOWLEDGE
	ng this task must be able to do	Detailed knowledge al	
the following:		1.0 Methods	
1. Analyze constructi	ion conditions; on technology and site;	The person performing able to explain how to:	
2. Prepare construction	on reconnoingly and sile	rable to exblain now to:	
	n diversion methods and carry out	1.1 Determine construoptions;	
3. Select construction the design of diver	n diversion methods and carry out	1.1 Determine construoptions;1.2 Determine the confor foundation trea	action diversion struction scheme
 Select construction the design of diver Determine the contreatment; Determine the engonal earth-rock design of diver 	n diversion methods and carry out rsion buildings; astruction scheme for foundation gineering construction scheme of ams;	 1.1 Determine construoptions; 1.2 Determine the confor foundation trea 1.3 Determine the construction schedule 	struction scheme tment; engineering
 Select construction the design of diver Determine the contreatment; Determine the engonal earth-rock date Determine the floor 	n diversion methods and carry out rsion buildings; instruction scheme for foundation gineering construction scheme of ams; od interception plan;	1.1 Determine construoptions;1.2 Determine the confor foundation trea1.3 Determine the	struction scheme tment; engineering eme for small
 Select construction the design of diver Determine the contreatment; Determine the engonal earth-rock does not be designed. Determine the floor not be designed. Prepare the work services. 	n diversion methods and carry out rsion buildings; instruction scheme for foundation gineering construction scheme of ams; od interception plan;	 1.1 Determine construoptions; 1.2 Determine the construction trea 1.3 Determine the construction scheearth-rock dams; 1.4 Prepare constructions; 	struction diversion struction scheme tment; engineering eme for small etion schedule
 Select construction the design of diver Determine the contreatment; Determine the eng small earth-rock date Determine the floor Prepare the work standard construction Conduct the construction 	n diversion methods and carry out rsion buildings; astruction scheme for foundation gineering construction scheme of ams; od interception plan; schedule; ruction general layout; ssurance measures for quality,	 1.1 Determine construoptions; 1.2 Determine the construction trea 1.3 Determine the construction scheearth-rock dams; 1.4 Prepare constructions; 1.5 Prepare the lacconstruction site; 	struction diversion struction scheme tment; engineering eme for small etion schedule ayout of the
 Select construction the design of diver Determine the contreatment; Determine the engonal earth-rock doesn't be designed. Determine the floor. Prepare the work selection. Prepare target as safety and schedul. Prepare the resource. 	n diversion methods and carry out rsion buildings; astruction scheme for foundation gineering construction scheme of ams; od interception plan; schedule; ruction general layout; ssurance measures for quality, e; ce planning;	 1.1 Determine construoptions; 1.2 Determine the construction trea 1.3 Determine the construction scheearth-rock dams; 1.4 Prepare constructions; 1.5 Prepare the laconstruction site; 1.6 Prepare construction 	struction diversion struction scheme tment; engineering eme for small ection schedule ayout of the on organization
 Select construction the design of diversely. Determine the construction treatment; Determine the engogenal earth-rock design. Determine the floor. Prepare the work selection. Prepare target as safety and schedul. Prepare the resource. Compile and presented. 	n diversion methods and carry out rsion buildings; estruction scheme for foundation gineering construction scheme of ams; od interception plan; eschedule; ruction general layout; essurance measures for quality, e;	 1.1 Determine construoptions; 1.2 Determine the construction trea 1.3 Determine the construction scheearth-rock dams; 1.4 Prepare constructions; 1.5 Prepare the lacconstruction site; 	struction scheme tment; engineering eme for small etion schedule ayout of the
 Select construction the design of diver Determine the contreatment; Determine the eng small earth-rock da Determine the flood Prepare the work s Conduct the construction Prepare target as safety and schedul Prepare the resource Compile and preorganization designams; 	n diversion methods and carry out resion buildings; instruction scheme for foundation gineering construction scheme of ams; od interception plan; schedule; ruction general layout; ssurance measures for quality, e; ce planning; epare engineering construction	 1.1 Determine construoptions; 1.2 Determine the construction trea 1.3 Determine the construction scheearth-rock dams; 1.4 Prepare constructions; 1.5 Prepare the laconstruction site; 1.6 Prepare constructions design documents; 1.7 Analysis model sediments. 	struction scheme tment; engineering eme for small ection schedule ayout of the
 Select construction the design of diversed the design of diversed. Determine the construction treatment; Determine the engognal earth-rock designal earth-rock designation designation	n diversion methods and carry out rsion buildings; instruction scheme for foundation gineering construction scheme of ams; od interception plan; schedule; ruction general layout; ssurance measures for quality, e; ce planning; epare engineering construction in documents for small earth-rock analysis (hydrological);	 1.1 Determine construoptions; 1.2 Determine the construction trea 1.3 Determine the construction scheearth-rock dams; 1.4 Prepare constructions; 1.5 Prepare the laconstruction site; 1.6 Prepare construction design documents; 1.7 Analysis model 	struction scheme tment; engineering eme for small etion schedule ayout of the

2.1 Basic p 2.2 Princip engine 2.3 Structut earthw 2.4 Princip regular 3.0 Theory The person able to exp 3.1 Theory 3.2 Theory 3.3 Theory 3.4 Theory 3.5 Theory analys 4.0 Essent 4.1 Comm 4.2 Learni 4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7 Model 5.0 Mathe 5.1 Numen 5.2 Geome DESCRIPTION OF THE END PRODUCT / The sma constructed dam desig requiremen CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock di	n performing this task must be blain the following principles:
2.2 Principle engine 2.3 Structute earthw 2.4 Principle regular 3.0 Theory The person able to exp 3.1 Theory 3.2 Theory 3.3 Theory 3.4 Theory 3.5 Theory 3.5 Theory analys 4.0 Essent 4.1 Comm 4.2 Learni 4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7 Model 5.0 Mathe 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / SERVICE DESCRIPTION OF THE END PRODUCT / SERVICE CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structute rock di 2. Quality	principles of hydraulics;
2.3 Structue earthw 2.4 Princip regular 3.0 Theor The person able to exp 3.1 Theory 3.2 Theory 3.3 Theory 3.4 Theory organi 3.5 Theory analys 4.0 Essent 4.1 Comm 4.2 Learni 4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7 Model 5.0 Mathe 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / The sma constructed dam desig requiremer CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock dam desig requiremer CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock dam desig requiremer	ples of geotechnics and eering geology;
regular 3.0 Theor The person able to exp 3.1 Theory 3.2 Theory 3.3 Theory 3.4 Theory organi 3.5 Theory analys 4.0 Essent 4.1 Comm 4.2 Learni 4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7 Model 5.0 Mathe 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / The sma constructed dam desig requirement CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock dd 2. Quality	ural fundamentals of
The person able to exp 3.1 Theory 3.2 Theory 3.3 Theory 3.4 Theory 3.5 Theory analys 4.0 Essent 4.1 Comm 4.2 Learni 4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7. Model 5.0 Mathe 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / The sma constructed dam desig requiremer CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock da 2. Quality	ples of reservoir flood tion algorithms.
able to exp 3.1 Theory 3.2 Theory 3.3 Theory 3.4 Theory organi 3.5 Theory analys 4.0 Essent 4.1 Comm 4.2 Learni 4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7 Model 5.0 Mathe 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / The sma constructed dam desig requiremer CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structu- rock di 2. Quality	ries
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3.3 Theory organi 3.5 Theory analys 4.0 Essent 4.1 Comm 4.2 Learni 4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7. Model 5.0 Mathe 5.1 Numer 5.2 Geome 5.2 Geome CIRCUMSTANTIAL KNOWLEDGE DESCRIPTION OF THE END PRODUCT / The sma constructed dam desig requirement constructed and design requirement constructed dam design req	y of schedule control;
3.4 Theory organi 3.5 Theory analys 4.0 Essent 4.1 Comm 4.2 Learni 4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7 Model 5.0 Mathe 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / The sma constructed dam design requirement CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock di 2. Quality	y of construction site layout;
organi 3.5 Theory analys 4.0 Essent 4.1 Comm 4.2 Learni 4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7 Model 5.0 Mathe 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / The sma constructed dam desig requirement CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock di 2. Quality	y of value engineering;
### date of the construction of the service dam designated in the constructed dam designated in the construction of the construction of the construction of the construction of the construction days are constructed as the construction of the const	y of construction ization design;
4.1 Comm 4.2 Learni 4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7 Model 5.0 Mathe 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / The sma constructed dam desig requirement CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock da 2. Quality	y of catchment and sediment sis.
4.2 Learni 4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7 Model 5.0 Mathe 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / SERVICE CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock da 2. Quality	
4.3 Manag 4.4 Skills softwa 4.5 Teamv 4.6 Report 4.7 Model 5.0 Mathe 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / The sma constructed dam desig requirement CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock da 2. Quality	nunication skills;
4.4 Skills softward 4.5 Teamward 4.6 Report 4.7 Model 5.0 Mather 5.1 Numer 5.2 Geometric 5.2 Geometric 5.2 Geometric 5.2 Geometric 5.2 Geometric 6.2 Geomet	•
softward 4.5 Teamword 4.6 Report 4.7. Model 5.0 Mathematical 5.1 Numer 5.2 Geometric 5.2 Geometric 5.2 Geometric 5.2 Geometric 5.2 Geometric 6.2 Geometric	
4.6 Report 4.7. Model 5.0 Mathe 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / The small constructed dam design requirement CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock da 2. Quality	, and the second
4.7. Model 5.0 Mather 5.1 Numer 5.2 Geome DESCRIPTION OF THE END PRODUCT / The smart constructed dam design requirement CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structur rock day 2. Quality	,
DESCRIPTION OF THE END PRODUCT / The sma constructed dam designequirement. CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock day 2. Quality	t writing skills;
DESCRIPTION OF THE END PRODUCT / The sma constructed dam designequirement. CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structurock day 2. Quality	ling of programming skills.
DESCRIPTION OF THE END PRODUCT / The small constructed dam design requirement. CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structur rock day 2. Quality	ematical skills
DESCRIPTION OF THE END PRODUCT / The small constructed dam design requirement. CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structur rock day 2. Quality	rical computation;
SERVICE constructed dam design requirement CIRCUMSTANTIAL KNOWLEDGE Detailed k 1. Structur rock de 2. Quality	etry.
1. Structurock de 2. Quality	all earth-rock dams are d according to the earth-rock gn objectives and technical nts and standards.
rock de 2. Quality	knowledge about:
2. Quality	ural components of earth-
	ruction of water conservancy

1	
3.	Properties and basic principles of
	commonly-used building materials;
4.	Rules for the preparation of water
	conservancy project estimates.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	OCCUPATION CODE	
DUTY TITLE	MONITOR THE SAFETY OF HYDRAULIC STRUCTURES	DUTY NO.	702
TASK TITLE	MONITOR THE SAFETY OF HYDRAULIC CONCRETE STRUCTURES	TASK NO.	7021
PERFORMANCE CRITERIA	The person performing this task n hydraulic concrete structure in acc relevant technical standards, re requirements.	ordance with the requirements	of the
RANGE STATEMENT	The task can be performed in the supervision of the senior engineer of engineering. The tools and equipment 1. Computer and office operating structures; 3. Environmental volumes, define equipment; 4. Stress-strain and temperature medical structure in the stru	of water conservancy and hydro at to be used include: ystem; for the safety of hydraulic co formation and seepage moni	power
<u> </u>	EVIDENCE REQUIRE	MENT	
<u></u>			
PRACTICAL PER	RFORMANCE	UNDERPINNING KNOWLE	DGE
The person perform	AFORMANCE ming this task must be able to do the	Detailed knowledge about:	DGE
The person perform following: 1. Operate intellig			
The person perform following: 1. Operate intellige of hydraulic control	ning this task must be able to do the ent monitoring system for the safety	Detailed knowledge about: 1.0 Methods The person performing this task	c must
The person perform following: 1. Operate intellige of hydraulic contact of the equipment; 2. Operate environment; 3. Operate deform 4. Operate seepage	ming this task must be able to do the ent monitoring system for the safety acrete structures; ironmental quantity monitoring ation monitoring equipment; e monitoring equipment;	Detailed knowledge about: 1.0 Methods The person performing this task be able to explain how to: 1.1 Select safety monitoring systems of the system of th	c must
The person perform following: 1. Operate intellige of hydraulic contact of hydraulic contact equipment; 3. Operate deform 4. Operate seepage 5. Operate stressequipment;	ning this task must be able to do the sent monitoring system for the safety acrete structures; ironmental quantity monitoring ation monitoring equipment; e monitoring equipment; estrain and temperature monitoring	Detailed knowledge about: 1.0 Methods The person performing this task be able to explain how to: 1.1 Select safety monitoring system of the	x must stems; lumes,
The person perform following: 1. Operate intellige of hydraulic content	ming this task must be able to do the gent monitoring system for the safety acrete structures; aronmental quantity monitoring ation monitoring equipment; e monitoring equipment; estrain and temperature monitoring judge the operational status of ipment;	Detailed knowledge about: 1.0 Methods The person performing this task be able to explain how to: 1.1 Select safety monitoring systems of the select safety monitoring systems of the select safety monitoring systems of the select safety monitoring equipment; 1.3 Select stress-strain temperature monitoring equipment; 1.4 Select monitoring data and	stems; lumes, eepage and itoring
The person perform following: 1. Operate intellige of hydraulic content	ming this task must be able to do the gent monitoring system for the safety acrete structures; aronmental quantity monitoring ation monitoring equipment; e monitoring equipment; estrain and temperature monitoring judge the operational status of apment; judge the operational status of ems;	Detailed knowledge about: 1.0 Methods The person performing this task be able to explain how to: 1.1 Select safety monitoring system of the	stems; lumes, eepage and itoring
The person perform following: 1. Operate intellige of hydraulic consequipment; 2. Operate environment; 3. Operate deform 4. Operate seepage 5. Operate stressequipment; 6. Analyze and monitoring equipment; 7. Analyze and monitoring system 8. Analyze and judata;	ming this task must be able to do the sent monitoring system for the safety acrete structures; ironmental quantity monitoring ation monitoring equipment; e monitoring equipment; estrain and temperature monitoring judge the operational status of ipment; judge the operational status of ems; dge the reasonableness of monitoring	Detailed knowledge about: 1.0 Methods The person performing this task be able to explain how to: 1.1 Select safety monitoring systems: 1.2 Choose environmental volution deformation and semonitoring equipment; 1.3 Select stress-strain temperature monition equipment; 1.4 Select monitoring data and methods; 1.5 Prepare safety monitional analysis.	stems; lumes, eepage and storing
The person perform following: 1. Operate intellige of hydraulic contains a contain of hydraul	ming this task must be able to do the sent monitoring system for the safety acrete structures; fronmental quantity monitoring ation monitoring equipment; e monitoring equipment; estrain and temperature monitoring judge the operational status of ipment; judge the operational status of ems; dge the reasonableness of monitoring monitoring reports for hydraulic ares. th, occupational and environmental	Detailed knowledge about: 1.0 Methods The person performing this task be able to explain how to: 1.1 Select safety monitoring system of the	stems; lumes, eepage and atoring nalysis storing

	2.2 Working principles of the monitoring system.
	 3.0 Theories The person performing this task must be able to explain the following: 3.1 Theory of safety monitoring of hydraulic concrete structures; 3.2 Theory of mathematical and statistical analysis;
	3.3 Theory of protocols for the integration of safety monitoring information.
	4.0 Essential Skills
	4.1 Communication skills;
	4.2 Learning skills;
	4.3 Management skills;
	4.4 Relevant software and hardware operating skills and AI;
	4.5 Teamwork skills;
	4.6 Report writing skills;
	4.7 Data analysis and processing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The safety of hydraulic concrete structures is monitored accordance with the requirements of the technical standards, the integral regulations and technical requirements for the safety monitoring, of hydraulic concrete structures, the environmental volume, deformation, seepage, stress-strain and temperature of hydraulic concrete structures.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about:
	Design and construction of hydraulic concrete structures;
	2. Internet of Things;
	3. Sensor arrangement and installation.

OC	CUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	OCCUPATION CODE	
DU	TY TITLE	MONITOR THE SAFETY OF HYDRAULIC STRUCTURES	DUTY NO.	702
TA	SK TITLE	MONITOR THE STRUCTURAL SAFETY OF SLUICES	TASK NO.	7022
	RFORMANCE ITERIA	The person performing this task is sluices in accordance with the restandards, rectification protocols are	equirements of the relevant to	•
	NGE ATEMENT	E The task can be performed in the office or construction site under the		
EVIDENCE REQUIREMENT				
PRACTICAL PERFORMANCE UNDERPINNING KNOWLEDGE			EDGE	
		ng this task must be able to do the	Detailed knowledge about:	
foll 1. 2.	owing: Operate the intell safety of sluice structure of control of the control o	lligent monitoring system for the ructures; onmental quantity monitoring	1.0 MethodsThe person performing this ta be able to explain how to:1.1 Select safety monitoring so1.2 Choose environmental volume	systems; olumes,
foll 1. 2. 3. 4.	Operate the intell safety of sluice structure operate environment; Operate deformation operate seepage recognitions.	digent monitoring system for the ructures; onmental quantity monitoring ion monitoring equipment; monitoring equipment;	 1.0 Methods The person performing this tale able to explain how to: 1.1 Select safety monitoring sometimes 1.2 Choose environmental valeformation and monitoring equipment; 	systems; olumes, seepage
foll 1. 2. 3. 4. 5.	Operate the intell safety of sluice strongerate environge equipment; Operate deformate Operate seepage requipment;	digent monitoring system for the ructures; onmental quantity monitoring ion monitoring equipment; monitoring equipment; rain and temperature monitoring	 1.0 Methods The person performing this tale able to explain how to: 1.1 Select safety monitoring sometimes 1.2 Choose environmental value deformation and monitoring equipment; 1.3 Select stress-strain temperature monitoring environmental value monitoring environment; 	systems; olumes,
foll 1. 2. 3. 4.	Operate the intell safety of sluice strongerate environge equipment; Operate deformate Operate seepage rooperate stress-strongerate equipment; Analyze and jumonitoring equipment	digent monitoring system for the ructures; onmental quantity monitoring ion monitoring equipment; monitoring equipment; rain and temperature monitoring adde the operational status of ment;	 1.0 Methods The person performing this tale able to explain how to: 1.1 Select safety monitoring some select safety monitoring some select safety monitoring some select select stress-strain temperature money equipment; 1.3 Select stress-strain temperature money equipment; 1.4 Select monitoring data select stress select stress-strain temperature money equipment; 	systems; olumes, seepage and nitoring
foll 1. 2. 3. 4. 5.	Operate the intell safety of sluice strongerate environge equipment; Operate deformate Operate seepage rooperate stress-strongerate equipment; Analyze and jumonitoring equipment	digent monitoring system for the ructures; onmental quantity monitoring ion monitoring equipment; monitoring equipment; rain and temperature monitoring adde the operational status of ment; adde the operational status of	 1.0 Methods The person performing this tale able to explain how to: 1.1 Select safety monitoring sometimes. 1.2 Choose environmental vale deformation and monitoring equipment; 1.3 Select stress-strain temperature money equipment; 1.4 Select monitoring data and methods; 	systems; olumes, seepage and nitoring
foll 1. 2. 3. 4. 5. 6.	Operate the intell safety of sluice strongerate environge equipment; Operate deformate Operate seepage of Operate stress-strongerate equipment; Analyze and jumonitoring equipment is analyze and jumonitoring system	digent monitoring system for the ructures; onmental quantity monitoring ion monitoring equipment; monitoring equipment; rain and temperature monitoring adde the operational status of ment; adde the operational status of	 1.0 Methods The person performing this tale able to explain how to: 1.1 Select safety monitoring sometimes. 1.2 Choose environmental vale deformation and monitoring equipment; 1.3 Select stress-strain temperature money equipment; 1.4 Select monitoring data and methods; 	systems; olumes, seepage and nitoring analysis
foll 1. 2. 3. 4. 5. 6. 7.	Operate the intell safety of sluice stroperate environment; Operate deformate Operate seepage of Operate stress-strequipment; Analyze and jumonitoring equipment analyze and jumonitoring system Analyze and judg data;	digent monitoring system for the ructures; onmental quantity monitoring ion monitoring equipment; monitoring equipment; rain and temperature monitoring adde the operational status of ment; adde the operational status of mes;	 1.0 Methods The person performing this tale able to explain how to: 1.1 Select safety monitoring sometimes 1.2 Choose environmental valeformation and monitoring equipment; 1.3 Select stress-strain temperature monequipment; 1.4 Select monitoring data and methods; 1.5 Prepare safety money 	systems; olumes, seepage and nitoring analysis nitoring

	3.0 Theories
	The person performing this task must be able to explain the following:
	3.1 Theory of safety monitoring of sluice structures;
	3.2 Theory of mathematical and statistical analysis;
	3.3 Theory of protocols for the integration of safety monitoring information.
	4.0 Essential Skills
	4.1 Communication skills;
	4.2 Learning skills;4.3 Management skills;
	4.4 Relevant software and hardware
	operating skills and AI;
	4.5 Teamwork skills;
	4.6 Report writing skills;
	4.7 Data analysis and processing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The structural safety of sluices is monitored in accordance with the requirements of the technical standards, the integral regulations and
	technical requirements for the safety
	monitoring of sluices, the
	environmental volume, deformation, seepage, stress-strain and temperature
	of sluices.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about:
	1. Design and construction of sluice structures;
	2. Internet of Things;
	3. Sensor arrangement and installation;
	4. Gate installation and operation
	management.

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING CODE ENGINEER		
DUTY TITLE	MONITOR THE SAFETY OF HYDRAULIC STRUCTURES	DUTY NO.	702
TASK TITLE	MONITOR THE SAFETY OF EARTH-ROCK DAMS	TASK NO.	7023
PERFORMANCE CRITERIA			
RANGE STATEMENT	ANGE The task can be performed in the office or construction site under		
	EVIDENCE REQUIREME	ENT	
PRACTICAL PERFO	PRACTICAL PERFORMANCE UNDERPINNING KNOWLEDGE		
 The person performing this task must be able to do the following: Operate the intelligent monitoring system for the safety of earth-rock dams; Operate environmental quantity monitoring equipment; Operate deformation monitoring equipment; Operate seepage monitoring equipment; Operate pressure (stress) and temperature monitoring equipment; Analyze and judge the operational status of monitoring equipment; Analyze and judge the operational status of monitoring systems; Analyze and judge the reasonableness of monitoring data; Preparation of safety monitoring reports for earth-rock dams. Observe health, occupational and environmental safety rules and regulations.		systems; 1.2 Choose envious volumes, deformate seepage requipment; 1.3 Adopt pressure (statemperature requipment. 1.4 Select monitoring analysis methods; 1.5 Prepare safety reanalysis. 2.0 Principle The person performing must be able to extended following principles:	fronmental tion and monitoring tress) and monitoring ag data monitoring
		2.1 Working princip monitoring equipme	

	2.2 Working principles of the monitoring system.
	3.0 Theories
	The person performing this task must be able to explain the following:
	3.1 Theory of safety monitoring of earth-rock dams;
	3.2 Theory of mathematical and statistical analysis;
	3.3 Theory of protocols for the integration of safety monitoring information.
	4.0 Essential Skills
	4.1 Communication skills;
	4.2 Learning skills;
	4.3 Management skills;
	4.4 Relevant software and hardware operating skills and AI;
	4.5 Teamwork skills;
	4.6 Report writing skills;
	4.7 Data analysis and processing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The safety of earth-rock dams is monitored iin accordance with the requirements of the technical standards, the integral regulations and technical requirements for the safety monitoring of earth-rock dams, the environmental volume, deformation, seepage, stress-strain and temperature of earth-rock dams.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about:
	1. Design and construction of earth-rock dams;
	2. Internet of Things;
	3. Sensor arrangement and installation.

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OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	OCCUPATION CODE	
DUTY TITLE	MONITOR THE SAFETY OF HYDRAULIC STRUCTURES	DUTY NO.	702
TASK TITLE	PREVENT AND TREAT THE DEFECTS OF HYDRAULIC CONCRETE DISEASE CONTROL AND EARTH-ROCK DAMS		
PERFORMANCE CRITERIA			
RANGE STATEMENT	The task can be performed in the office or construction site under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Detection equipment on the strength of hydraulic concrete; 3. Equipment for the repair of hydraulic concrete surfaces; 4. Equipment for the treatment of defects in earth-rock dams. 5. Safety gear		
		ICE REQUIREMENT	
PRACTICAL PER		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following:		Detailed knowledge about: 1.0 Methods	
1. Correctly analyze and evaluate the presence of disease problems in hydraulic concrete structures;		The person performing this task must be able how to: 1.1 Analyze and evaluate hydraulic concre	-
2. Correctly analyze and evaluate the problems of deficiencies in earthrock dams;		problems; 1.2 Analyze and evaluate the problem of dam defects;	
-	on equipment on the nydraulic concrete	1.3 Select equipment and methods for the hydraulic concrete defects;	
4. Operate equipment for the treatment of surface defects in hydraulic concrete structures;		1.4 Select equipment and methods for de defects in earth-rock dams;1.5 Prepare summary reports on the handlin	
		2.0 Principles	

- 5. Operate earth-rock dam defect treatment equipment;
- 6. Develop implementation programs for the prevention and control of hydraulic concrete defects;
- 7. Develop implementation programs for the treatment of defects in earthrock dams;
- 8. Prepare summary reports on disease control and defect treatment.
- 9. Observe health, occupational and environmental safety rules and regulations.

The person performing this task must be able to explain the following principles:

- 2.1 Principles of hydraulic concrete disease control;
- 2.2 Principles of earth-rock dam defect treatment.

3.0 Theories

The person performing this task must be able to explain the following:

- 3.1 Theory of quality control of hydraulic concrete structures;
- 3.2 Quality control theory for earth-rock dams;
- 3.3 Theory of hydraulic concrete materials testing;
- 3.4 Theory of earth and rock material testing.

4.0 Essential Skills

- 4.1 Communication skills;
- 4.2 Learning skills;
- 4.3 Management skills;
- 4.4 Relevant software and hardware operating skills;
- 4.5 Teamwork skills;
- 4.6 Report writing skills;
- 4.7 Data analysis and processing skills.

DESCRIPTION OF THE END PRODUCT / SERVICE

The defects of hydraulic concrete disease control and earth-rock dams are prevented and treated according to the requirements of the relevant technical standards, technical requirements and project information, disease problems such as cracking, strength, the prevention of exposed reinforcement and breakage of hydraulic concrete,, the prevention of defects such as seepage and compaction of earth-rock dams.

CIRCUMSTANTIAL KNOWLEDGE

Detailed knowledge about:

- 1. Design and construction of earth-rock dams;
- 2. Design and construction of hydraulic concrete structures;
- 3. Knowledge of dam safety monitoring.

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OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	OCCUPATION CODE	
DUTY TITLE	MONITOR THE SAFETY OF HYDRAULIC STRUCTURES	DUTY NO.	702
TASK TITLE	EVALUATE THE SAFETY OF HYDRAULIC STRUCTURES	TASK NO.	7025
PERFORMANC CRITERIA	hydraulic structures	ning this task must be able to evaluate the s in accordance with the requirements of the , monitoring data, project information and	e relevant
RANGE STATEMENT	supervision of the sengineering. The to 1. Computer and c	erformed in the office or hydropower station under the senior engineer of water conservancy and hydropower cols and equipment to be used include: office operating system; ring systems for hydraulic structures; uipment for hydraulic structures; n of project information and historical monitoring data.	
	EVIDENC	E REQUIREMENT	
PRACTICAL PI	ERFORMANCE	UNDERPINNING KNOWLEDGE	
able to do the fol	The person performing this task must be able to do the following: Detailed knowledge about: 1.0 Methods		
query historic 2. Operate the	monitoring equipment to	The person performing this task must b explain how to: 1.1 Select methods for assessing the qual	
query historical data; 3. Assess the quality of hydraulic structures in combination with monitoring data;		work; 1.2 Select structural safety assessment met 1.3 Select seepage safety assessment meth 1.4 Select O&M assessment methods;	
4. Assess the structural safety of hydraulic structures in combination with monitoring data;		1.5 Select comprehensive assessment me the safety of hydraulic structures.	ethods for
	epage safety of hydraulic in combination with ata;	ge safety of hydraulic	
6. Assess the o	peration management of ructures in combination	explain the following principles: 2.1 Principles and guidelines for qua operational management assessment;	ality and

- Assess the comprehensive safety of hydraulic structures in combination with monitoring data; Prepare a safety assessment report for conclusions of the assessment. 9. Observe health, occupational and
- hydraulic structures to give the

safety

rules

and

environmental

regulations.

- 2.2 Principles and guidelines for seepage and structural safety assessment;
- 2.3 Integrated assessment principles and guidelines.

3.0 Theories

The person performing this task must be able to explain the following:

- 3.1 Theory of safety monitoring of hydraulic structures;
- 3.2 Theory of mathematical and statistical analysis;
- 3.3 Theory of integrated safety evaluation of hydraulic structures.

4.0 Essential Skills

- 4.1 Communication skills;
- 4.2 Learning skills;
- 4.3 Management skills;
- 4.4 Relevant software and hardware operating skills;
- 4.5 Teamwork skills;
- 4.6 Report writing skills;
- 4.7 Data analysis and processing skills.

DESCRIPTION **OF** THE **END** PRODUCT / SERVICE

The safety of hydraulic structures is evaluated in accordance with the relevant technical standards, monitoring data, project information and the requirements of the technical requirements, the safety of the hydraulic structures in terms of quality, operation and management, seepage and structure is comprehensively assessed.

CIRCUMSTANTIAL KNOWLEDGE

Detailed knowledge about:

- Design and construction of hydraulic structures;
- 2. Operation and management of hydraulic structures;
- 3. Knowledge of protocols for compiling safety monitoring information on dams.

O CICILIDA FILONI	WA MED	OCCUPATION CODE	
OCCUPATION	WATER CONSERVANCY AND HYDROPOWER	OCCUPATION CODE	
	ENGINEERING ENGINEER		
DUTY TITLE	CONDUCT THE OPERATION AND MAINTENANCE MANAGEMENT OF WATER CONSERVANCY PROJECTS	DUTY NO.	703
TASK TITLE	CARRY OUT THE MAINTENANCE AND MANAGEMENT OF GATES AND THEIR OPENING AND CLOSING EQUIPMENT	TASK NO.	7031
PERFORMANCE CRITERIA	The person performing this task must be able to carry out the maintenance and management of gates and their opening and closing equipment, i.e. inspect, operate, maintain and repair gates of hydraulic structures and their opening and closing equipment in accordance with the technical requirements for gates and opening and closing equipment and the manufacturer's maintenance manual.		
RANGE STATEMENT	The task can be performed in the office or hydropower station under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include:		
	1. Computer and office of		
	2. Metal testing instrume	ent;	
	_	as tape measures and vernier calipers;	
	4. All types of wrenche tools;	s, bench vices, hand hammers and oth	ner pincer
		s pliers, grinders and soldering irons;	
		as grease guns or oil cans.	
	, ,	EQUIREMENT	
PRACTICAL DED		UNDERPINNING KNOWLEDGE	
PRACTICAL PERFORMANCE			
The person performing this task must be able to do the following:		Detailed knowledge about: 1.0 Methods	
	d parts found to be covered as aquatic life attachments	The person performing this task must explain how to:	
2. Inspect whether and that door	gates are found to be tilted r slots are free from	1.1 Inspect gates and parts for clipamming, loose fasteners and defect corrosion coatings;	
_	fasteners are found to be ed in various parts of the	1.2 Operate the opening and closing of gates in situ and their disposal after operation;	

- gates and their opening and closing equipment;
- 4. Inspect whether steel gates and their opening and closing equipment are found to be deficient in their anti-corrosion coating;
- 5. Operate the opening and closing of gates in situ:
- 6. Reset buttons and switches after shutdown;
- Clean silt, adherents and upstream and downstream floating objects from gates and parts; Use oil guns or oil pots to lubricate support wheels, guide wheels and sliders;
- 8. Use manual wrenches to tighten the connecting bolts of the various parts of the gates and opening and closing equipment;
- 9. Clean the gates and all parts of the opening and closing equipment prior to surface corrosion treatment;
- 10. Record the inspection, operation, maintenance and repair of gates and opening and closing equipment.
- 11. Observe health, occupational and environmental safety rules and regulations.

- 1.3 Use wrenches, grease guns and oil cans;
- 1.4 Clean the surface of the gates and opening and closing equipment and meet the requirements for anti-corrosion treatment.

2.0 Principles

The person performing this task must be able to explain the following principles:

- 2.1 Types and properties of materials commonly-used in the maintenance and repair of gates and opening and closing equipment;
- 2.2 Knowledge of inspection, operation, maintenance and repair of gates and opening and closing equipment.

3.0 Theories

The person performing this task must be able to explain the following:

- 3.1 Safety operation procedures and precautions;
- 3.2 Conditions in which gates and opening and closing equipment may be in danger and commonly-used methods of rescue;
- 3.3 Basic theory of mechanical and hydraulic transmissions.

4.0 Essential Skills

- 4.1 Communication skills;
- 4.2 Interdisciplinary learning skills;
- 4.3 Management skills;
- 4.4 Teamwork skills;

DESCRIPTION OF THE END PRODUCT / SERVICE

The maintenance and management of gates and their opening and closing equipment in accordance with the technical requirements for gates and opening and closing equipment for hydraulic structures and the manufacturer's maintenance manual, inspection of gates and their opening and closing equipment for hydraulic structures,

CIRCUMSTANTIAL KNOWLEDGE

Detailed knowledge about:

- 1. Safety operation of measuring instruments;
- 2. Safety operation of operating machines and tools;
- 3. Provisions for the inspection of gates and opening and closing equipment;
- 4. Knowledge of work safety and environmental protection.

OCCUPATION	WATER CONSERVAN HYDROPOWER ENGINEER	CY AND GINEERING	OCCUPATION CODE	
DUTY TITLE	CONDUCT THE OPERA MAINTENANCE MANAC WATER CONSERVANCY	GEMENT OF	DUTY NO.	703
TASK TITLE	CARRY OUT THE MAI AND REPAIR OF CONCR		TASK NO.	7032
PERFORMANCE CRITERIA	The person performing the maintainenance and repair of characteristics and the proper them safe, intact and function	of concrete dan erties of the con	ns, according to their acrete material, in or	r structural
RANGE STATEMENT	The task can be performed supervision of the senior engineering. The tools and each of the senior engineering and senior engineering the	gineer of wate equipment to be erating system ng crack width	r conservancy and hy e used include: n;	ydropowei
	3. Pens, notepads, camera		lers, etc.;	
	4. Mortar materials of all	types of protec	tion;	
5. Steel wire brushes, wind and sand guns.			ıs.	
6. Safety gear				
	EVIDENCE REQU	JIREMENT		
PRACTICAL PERF	ORMANCE	UNDERPIN	NING KNOWLED	OGE
	ing this task must be able to	Detailed kno	owledge about:	
do the following:		1.0 Method		
honeycomb, poc	ce defects in concrete such as kmarks, holes, missing edges	The person able to expla	performing this task in how to:	k must be
2. Inspect for crack	in the dam body, dam base and	cracks, l	for concrete surface eaks in the base and leakage a	d the body
4. Be able to clean concrete surfaces and trenches of loose material, weeds, rubbish, etc. and keep surfaces clean and tidy;		in the su	ninor defects and mi rface of concrete; ne the causes of leak	
5. Repair minor defects in concrete surfaces using cement mortar;		hazards;	ne une cuases of feat	ago ana ic
6. Repair microscopic cracks in the surface layer		2.0 Principl		
by spraying;Determine initial	ly the causes of leakage and its	_	performing this task in the following prin	
hazards;	-y	_		-
hazards;	inspection, maintenance and e dams.	2.1 Concrete 2.2 Knowled	e material properties dge of concrete dami	;

	The person performing this task must be		
	able to explain the following:		
	3.1 Safety operation procedures and precautions;		
	3.2 Investigation of concrete cracks and analysis of their causes;		
	3.3 Inspection of concrete surface defects, cracks, leaks in the base and body of the dam and leakage around the dam;		
	4.0 Essential Skills		
	4.1 Communication skills;		
	4.2 Management skills;		
	4.3 Teamwork skills;		
	4.4 Entrepreneurial skills.		
DESCRIPTION OF THE END PRODUCT / SERVICE	/ Concrete dams are maintained and repaired according to their structural characteristics and the properties of the concrete material		
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about:		
	1. Safety operation of measuring instruments;		
	2. Safety operation of operating machines and tools;		
	3. Provisions for the inspection and maintenance of concrete dams;		
	4. Knowledge of work safety and environmental protection.		

OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	OCCUPATION CODE	
DUTY TITLE	CONDUCT THE OPERATION AND MAINTENANCE MANAGEMENT OF WATER CONSERVANCY PROJECTS DUTY NO. 703		
TASK TITLE	CARRY OUT THE MAINTENANCE AND REPAIR OF PUMP STATIONS	TASK NO. 7033	
PERFORMANCE CRITERIA	The person performing this task must be able to carry out the maintenance and repair of the pump stations in accordance with their working principles and the manufacturer's manual to keep the pumping station running safely, smoothly and properly.		
RANGE STATEMENT	The task can be performed in the office or hydropower station under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include:		
	1. Computer and office operating systems;		
	2. Wrench fastening tools;		
	3. Lubricating oil/lubricating grease;		
	4. Testing instruments such as ammeters, voltmeters and pressure gauges.		
	5. Safety gear		
	ELIDENICE DECLUDENCENTE	<u> </u>	

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE

The person performing this task must be able to do the following:

- 1. Rotate the coupling to observe whether the pump rotation is flexible and smooth, whether there is debris in the pump, whether there is noise in the bearings and other phenomena, and whether the belt is loose or tight;
- 2. Inspect and tighten all bolts and screws;
- 3. Inspect the connection of the motor traverses to ensure the normal direction of rotation of the pump;
- 4. Inspect whether the instruments are in working order;
- 5. Replace the lubricating oil and lubricating grease in the bearings at regular intervals;
- 6. Keep the unit clean by drying the water and oil stains on the pump and pipes after stopping.
- 7. Observe health, occupational and environmental safety rules and regulations.

UNDERPINNING KNOWLEDGE

Detailed knowledge about:

1.0 Methods

The person performing this task must be able to explain how to:

- 1.1 Inspect whether the pump rotates flexibly and smoothly, whether there is debris in the pump, whether there is noise in the bearings and whether the belt is loose or tight;
- 1.2 Operate the pump in situ and dispose after operation.

2.0 Principles

The person performing this task must be able to explain the following principles:

2.1 Principle of water pump operation.

3.0 Theories

The person performing this task must be able to explain the following:

- 3.1 Safety operation procedures and precautions;
- 3.2 Selection and matching of units;
- 3.3 Common faults and elimination methods.

	 4.0 Essential Skills 4.1 Communication skills; 4.2 Interdisciplinary learning skills; 4.3 Management skills; 4.4 Teamwork skills; 4.5 Entrepreneurial skills. 	
DESCRIPTION OF THE END PRODUCT / SERVICE	Pump stations are maintained and repaired in accordance with their working principles and the manufacturer's manual, and pumping stations are operated safely, smoothly and properly.	
CIRCUMSTANTIAL KNOWLEDGE	 Detailed knowledge about: Safety operation of meter testing instruments; Safety operation of operating machines and tools; Common faults and troubleshooting methods for various types of pumps; Knowledge of work safety and environmental protection. 	

OCCUPATION DUTY TITLE	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER CONDUCT THE OPERATION AND MAINTENANCE MANAGEMENT OF WATER	OCCUPATION CODE DUTY NO.	703
TASK TITLE	CONSERVANCY PROJECTS EARTHEN EMBANKMENT PIPE SURGE HAZARD PROTECTION	TASK NO.	7034
PERFORMANCE CRITERIA	surge hazard surge pr	The person performing this task must be able to earthen embankment pipe surge hazard surge protection in accordance with the causes of the surges and the appropriate rescue measures	
STATEMENT the senior engineer of The tools and equipmen		med at the scene of danger under the sur water conservancy and hydropower of ent to be used include: ice operating system;	
	EVIDENCE F	REQUIREMENT	
PRACTICAL PER	FORMANCE	UNDERPINNING KNOWLEDGE	
 The person performing this task must be able to do the following: 1. Inspect for precursors to the occurrence of pipe surges in earthen embankments, such as overturned sand and bulging water and 		Detailed knowledge about: 1.0 Methods The person performing this task must explain how to: 1.1 Inspect for precursors to the or	
bubbling springs;2. Analyze the causes of tube surges;3. Determine the severity of a pipe surge hazard;		pipe surges in earthen embankme overturned sand and bulging bubbling springs; 1.2 Conduct rescue construction of	ents, such as water and
4. Use woven bags or sacks filled with soil to snatch and build sand and gravel around the well at the exit of the pipe gushing, which is synchronously filled with antifiltration material, and never use impermeable materials;		wells; 1.3 Fill the back filter gland; 1.4 Use the channel behind the embed the pond water level to store pressure to stabilize the tube surger.	oankment or water back
anti-filtration lay	able materials to fill in the yer gland when groups of ar in the embankment;	2.0 Principle The person performing this task must explain the following principles:	st be able to

Use the channel behind the embankment 2.1 Causes of tube surges; or the pond water level to store water back 2.2 Precursor phenomena to the occurrence of pressure to stabilize the tube surge hazard. pipe surges and their severity; Use straw 10-20cm thick in the raised part 2.3 Principle of tube surge rescue measures. of the bale, willow branches or reeds 20-30cm thick on top of it, and finally pressed 3.0 Theories with bags of soil or blocks of stone; The person performing this task must be able to Clean up the site and observe the 8. explain the following: subsequent development of the danger. 3.1 Safety operation procedures and precautions. 9. Observe health, occupational and environmental safety rules and 4.0 Essential Skills regulations. 4.1 Communication skills; 4.2 Interdisciplinary learning skills; 4.3 Management skills; 4.4 Teamwork skills; 4.5 Entrepreneurial skills. DESCRIPTION OF THE END PRODUCT The embankment pipe surge hazard protection is / SERVICE earthened according to the appropriate rescue measures for pipe surges. based on the causes of the surges. CIRCUMSTANTIAL KNOWLEDGE **Detailed knowledge about:** Safety operation of operating machines and Provisions for routine and flood inspections of earth embankments; Knowledge of work safety and environmental protection.

OCCUPATION	WATER CONSERV HYDROPOWER ENGINEER	ANCY AND ENGINEERING	OCCUPATION CODE	
DUTY TITLE	DESIGN SMA CONSERVANCY WOR		DUTY NO.	704
TASK TITLE	DESIGN SMALL SLUI	CES	TASK NO.	7041
PERFORMANCE CRITERIA	The person performing according to the requirer geological conditions an	nents of the small s	luice, in combination	
RANGE STATEMENT	The task can be performed in the office, construction site or other sides under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Information on the topography, hydrology, meteorology, geology and other construction conditions of the project site; 3. Specifications relating to sluices; 4. CAD design drawing software; 5. Relevant engineering calculation software. 6. Safety gear			
	PRACTICAL PERFORMANCE UNDERPINNING KNOWLEDGE The person performing this task must be able Detailed knowledge about:			
PRACTICAL PERFORMANCE The person performing this task must be able to do the following: 1. Conduct site selection for small sluices; 2. Describe the construction and the requirements of the gate chamber; 3. Design gate holes; 4. Design the energy-dissipation and scour prevention; 5. Calculate gate chamber stresses and slip stability calculations; 6. Consider flood design of sluice gates. 7. Observe health, occupational and environmental safety rules and regulations.		explain how to: 1.1 Site selection 1.2 Design gate h 1.3 Design the oprevention; 1.4 Carry out calculations a for the lock of 1.5 Perform foun 1.6 Perform flood 2.0 Principles The person perfore explain the follow 2.1 Basic princip 2.2 Basic princip	structural designand slip stability can hamber; dation treatment; danalysis and interpretable this task must ving principles: les of hydraulics;	and scour n, stress alculations pretation. be able to

	3.0 Theories	
	The person performing this task must be able to explain the following:	
	3.1 Theory of gate design;	
	3.2 Theory of energy-dissipation and scour prevention design;	
	3.3 Theory of slip stability design and stress calculation;	
	3.4. Theory of flood analysis and climate change.	
	4.0 Essential Skills	
	4.1 Data collection skills;	
	4.2 Software operation;	
	4.3 Teamwork;	
	4.4 Report preparation;	
	4.5 Drawing reading and interpretation.	
DESCRIPTION OF THE END PRODUCT / SERVICE	The small schemes are designed according to the requirements of the small schemes, in combination with the geological conditions and relevant technical requirements	
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about:	
	Hydrological parameters and geological conditions	
	2. Classification of water conservancy and hydropower engineering classes and hydraulic structure classes	
	3. Foundation treatment	
	4. Weir flow hydraulics calculations	

OC	CUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	OCCUPATION CODE	
DU	TY TITLE	DESIGN SMALL WATER CONSERVANCY WORKS	DUTY NO.	704
TA	SK TITLE	DESIGN SMALL PUMP STATIONS	TASK NO.	7042
CR	RFORMANCE ITERIA	stations in accordan pump stations and ir	ning this task must be able to design ce with the requirements of the construct accordance with the relevant technical referenced in the efficiency accordance.	tion of small equirements.
	NGE ATEMENT	under the supervision hydropower engineer	formed in the office, construction site of on of the senior engineer of water conse ering. The tools and equipment to be used	ervancy and
		_	office operating system;	
			lated information;	
		<u> </u>	relating to pumps;	
4. CAD design dr			awing software.	
		5. Safety gear		
		EVIDENCI	EREQUIREMENT	
PR	ACTICAL PERFO	RMANCE	UNDERPINNING KNOWLEDGE	
		g this task must be	Detailed knowledge about:	
	e to do the followin	0	1.0 Methods	
1. Classify pumps and confirming pump models;			The person performing this task must explain how to:	t be able to
2.	capacity;	confirm the installed	1.1 Select the type of pump and in applications;	ts range of
3.		ping unit according	1.2 Confirm the pump type;	
4.	to actual needs; 4. Identify pump head characteristic curves;		1.3 Determine the pumping unit of the1.4 Identify pump head characteristic c	
5. Classify the types of pumping stations, according to the characteristics of the foundation structure;		haracteristics of the	1.5 Classify types of pumping houses;1.6 Carry out the design of pumping piping arrangements.	g units and
6. Carry out the design of the piping arrangement;		sign of the piping	2.0 Principles	
7. Consider flood design of small pump stations.		sign of small pump	The person performing this task must explain the following principles:	t be able to
8.			2.1 Basic principles of hydraulics;2.2 Working principles of pumps;2.3 Principles of the hydraulic properties	es.

	3.0 Theories
	The person performing this task must be able to explain the following:
	3.1 Pump head characteristic curves;
	3.2 Pipeline hydraulic characteristic curves;
	3.3 Pump operating conditions.
	4.0 Essential Skills
	4.1 Data collection skills;
	4.2 Software operation;
	4.3 Teamwork;
	4.4 Report preparation;
	4.5 Drawing reading.
DESCRIPTION OF THE END	Small pump sations are designed in
PRODUCT / SERVICE	accordance with the requirements of the
	construction of small pump stations and in
	accordance with the relevant technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about:
	1. Hydrological parameters and geological conditions;
	2. Classification of water conservancy and
	hydropower engineering classes and hydraulic structure classes;
	3. Foundation treatment;
	4. Weir flow hydraulics calculations.

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OCCUPATION	WATER CONSERVANCY AND HYDROPOWER ENGINEERING ENGINEER	OCCUPATION CODE	
DUTY TITLE	DESIGN SMALL WATER CONSERVANCY WORKS	DUTY NO.	704
TASK TITLE	DESIGN CANAL STRUCTURES	TASK NO.	7043
PERFORMANCE CRITERIA	according to the requirem	nis task must be able to design canal ents of the canal structures, in combin and relevant technical requirements.	
RANGE STATEMENT	 The task can be performed in the office, construction site or other sides under the supervision of the senior engineer of water conservancy and hydropower engineering. The tools and equipment to be used include: 1. Computer and office operating system; 2. Information on the topography, hydrology, meteorology, geology and other construction conditions of the project site; 3. Relevant regulations of canal structures; 4. CAD design drawing software. 5. Safety gear 		
	EVIDENCE R	EQUIREMENT	
PRACTICAL PER	FORMANCE	UNDERPINNING KNOWLEDGE	
	ming this task must be	Detailed knowledge about:	
able to do the follow	_	1.0 Methods	
 Determine the arrangement of canal structures; Reasonably arrange the location and spacing of canals and canal structures, taking into account factors such as the topography and landform, water flow path, water quantity requirements and soil conditions; Choose the right channel route based on the function and needs of the channel. Select and optimize channel routes, taking into account factors such as topographic slope, water velocity, soil stability and environmental protection; Consider the general layout and design elements when designing the ferry, including determining the type of ferry (e.g. open, concealed, etc.), size, water supply competence, choice of materials, etc.; 		 The person performing this task must explain how to: 1.1 Identify the types of canal structheir roles; 1.2 Carry out the classification of chairrigation purposes; 1.3 Make channel route choices; 1.4 Carry out the design of crossing siphons and steep slopes and drop 2.0 Principles The person performing this task must explain the following principles: 2.1 Basic principles of hydraulics; 2.2 Principles of reservoir flood algorithms. 	ctures and nannels for s, inverted os.
etc.;		3.0 Theories	

4.	Determine the conditions of application for	The person performing this task must be able to
	inverted siphons and design suitable	explain the following:
	inverted siphons as required;	3.1 Theory of channel design;
5.	Understand the forms and main functions of steep slopes and drops. Provide suitable	3.2 Theory of ferry design.
	steep slopes and drops as required to allow smooth flow and slow down the velocity of	4.0 Essential Skills
	the water to protect the stability of the	4.1 Data collection skills;
	channel and canal structures.	4.2 Software operation;
6.	Observe health, occupational and	4.3 Teamwork;
	environmental safety rules and regulations.	4.4 Report preparation;
		4.5 Drawing reading.
DESCRIPTION OF THE END PRODUCT / SERVICE		The canal structures are designed according to the construction requirements of the canal structures, in combination with the geological conditions and in accordance with relevant technical requirements.,
CIRCUMSTANTIAL KNOWLEDGE		Detailed knowledge about:
		1. Knowledge of hydrology, geology, etc.;
		2. Calculation of open channel uniform flow;
		3. Drawing of the water surface line.

APPENDIX: DACUM CHARTS FOR WATER CONSERVANCY AND HYDROPOWER ENGINEER - NTA LEVEL 7

DUTIES	TASKS	ENABLERS
1.0 Construct small	1.1 Construct small sluices.	General skills and knowledge
water conservancy works	1.2 Construct small pump stations.	Drafting, surveying and proofing
	1.3 Construct canal structures.	Communication skills
	1.4 Construct small earth-rock	Analysis competence
	dams.	• Computer knowledge
		Design competenceSoftware operating competence
		Software operating competenceTeamwork skills
		Ability of innovation
		 Report writing skills
		Tools and equipment
		Measuring Instrument
		• Computer
		Earthmoving machinery
		Transportation machinery
		Earth compaction machinery
		Lifting machinery
		Pile machine
		Grouting pump
		Grout mixer
		Concrete mixers
		Water pump
		Hole-drilling equipment
		• Reinforcement processing machinery
		Concrete vibrator
		• Cooling equipment, etc.
		Materials
		• Formwork
		Reinforcement
		• Steel sections and sheet piles
		• Coarse and fine aggregates,
		earth, stone, cement and timber
		• Explosives, diesel, petrol, small
		hardware, water and electricity
		Compressed air, cables, water supply pines air supply duets
		supply pipes, air supply ducts, bricks, blocks and other
		materials
		• Office supplies

DUTIES	TASKS	ENABLERS
		Requirements for employees
		 Professional dedication Innovative spirit Teamwork spirit Team spirit Honesty and trustworthiness Scientific spirit and rigor Safety consciousness Environmental protection awareness
		Big-picture awareness
2.0 Monitor the safety of hydraulic structures	 2.1 Monitor the Safety of hydraulic concrete structures. 2.2 Monitor the structural safety of sluices. 2.3 Monitor the Safety of earthrock dams. 2.4 Prevent and treat the defects of hydraulic concrete disease control and earth-rock dams. 2.5 Evaluate the safety of hydraulic structures. 	General skills and knowledge Communication skills Learning skills Management skills Software and hardware operating skills Teamwork skills Report writing skills Data analysis and processing skills Office software operation skills Tools and equipment Computer and its operating system Safety monitoring system Security monitoring equipment Data analysis software Materials Safety monitoring specification manual Project information and historical monitoring data Technical standards for automated safety monitoring Requirements for employees Teamwork spirit Honesty and trustworthiness Scientific spirit and rigor Safety consciousness Environmental protection awareness

DUTIES	TASKS	ENABLERS
3.0 Conduct the operation and maintenance management of	3.1 Carry out the maintenance and management of gates and their opening and closing equipment.	 General skills and knowledge Safety operation and safety precautions Use of the statute book
water conservancy projects	3.2 Carry out the maintenance and repair of concrete dams.	Engineering Hydrology and Hydraulics
	3.3 Carry out the maintenance and management of pump stations.	 Interpretation of technical drawings Conservation and maintenance material science
	3.4 Earthen embankment pipe surge hazard protection.	Tools and equipment
		 Computer and its operating system Inspection of survey measurement tools Maintenance and repair of construction machines and
		tools Materials
		 Commonly-used materials for conservation and maintenance Basic engineering data and drawings
		 Requirements for employees Dedicated to work Pursuit of excellence Professional dedication
4.0 Design small	4.1 Design small sluices.	Rigor and truthfulness General skills and knowledge
water conservancy works	4.2 Design small pump stations.4.3 Design canal structures.	 Communication skills Learning skills Management skills Software and hardware operating skills Teamwork skills Report writing skills Data calculation and processing Office software operation skills
		 Tools and equipment Computer and its operating system CAD design drawing software

DUTIES	TASKS	ENABLERS
		 Information on the topography, hydrology, meteorology, geology and other construction conditions of the project site Relevant specifications Related engineering calculation software
		Materials
		Printer
		A4 paper
		• Other materials required for manual calculation needs (pens, books, etc.)
		Requirements for employees
		Teamwork spirit
		 Honesty and trustworthiness
		 Scientific spirit and rigor
		• Safety consciousness
		• Environmental protection awareness
		Big-picture awareness