



ECSA

ENGINEERING COUNCIL OF SOUTH AFRICA

An Effective Regulator Assuring Engineering Excellence

**Sub Discipline-specific Training Guide for Registration as a
Dam Specialist in Specified Category**

R-05-DAM-SC

REVISION 0: 23 October 2024

ENGINEERING COUNCIL OF SOUTH AFRICA

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DEFINITIONS

Accredited qualification: A qualification awarded on successful completion of an accredited programme.

Alternative Route: Applies to an applicant who does not have the accredited or recognised qualifications to become registered in a Professional Category but who proposes to meet the educational requirement through assessment. See **R-01-POL-SC**.

Benchmark Route: The normal process to attain registration that consists of the completion of an accredited, recognised or evaluated substantial equivalent qualification and a well-structured and effectively executed programme of training and experience for the category of registration. See **R-01-POL-SC**.

Candidate: A person holding a qualification or combination of qualifications evaluated by ECSA as meeting its standard as a Dam Specialist or a person undergoing individual assessment approved by ECSA toward achievement of professional registration.

Commitment: The expressed resolve of employers and mentors to afford every possible opportunity and ongoing support and guidance to candidate engineers during their periods of training and professional development as an indication of their alignment with and substantive support for the ideals of the profession.

Competency area: The performance area where all the outcomes can be demonstrated at the level prescribed in a specific technology in an integrated manner.

Competency Assessment: A summative assessment of an individual's competency against the prescribed standard based on evidence from the individual's work, reports by qualified observers and other tests that may include a Professional Review.


Competency indicators: The typifying guide to evidence indicating competence which is not normative.

Competency Standard: Statement of competence required for a defined purpose.

Continuing Professional Development: The systematic maintenance, improvement and broadening of knowledge and skills, and the development of personal qualities necessary for

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the execution of professional and engineering duties through a person's engineering career. It is the learning and development that takes place after completion of relevant engineering studies and refers to activities through which registered persons maintain and develop competencies to continue to perform their role ably and efficiently.

Dam: Includes any existing or proposed structure that is capable of containing, storing or impounding water (including temporary impoundment or storage), whether that water contains any substance or not.

Dam with a safety risk: This means any dam:

- (i) that can contain, store or dam more than 50 000 cubic metres of water, whether that water contains any substance or not, and that has a wall of a vertical height of more than five metres, measured as the vertical difference between the lowest downstream ground elevation or the outside of the dam wall and the non-overspill crest level or the general top level of the dam wall
- (ii) belonging to a category of dams declared under section 118(2) of the National Water Act (NWA) to be dams with safety risk; or
- (iii) declared under section 118(3)(c) of the National Water Act (NWA) to be a dam with a safety risk.


Dam Specialist: A registered person who develops design methodologies, commencing with the functional and legislative requirements of any existing or proposed structure, including the generation of appropriate engineering specifications, drawings and undertaking of dam safety inspections and evaluations, remedial works to existing dams that are capable of containing, storing or impounding water (including temporary impoundment or storage), whether that water contains any substance or not.

Experience Appraisal: A documentary assessment of the applicant's evidence of competence.

Engineering problem: A problematic situation that is amenable to analysis and solution using engineering sciences and methods.

Engineering science: A body of knowledge, based on the natural sciences and using mathematical formulation where necessary, that extends knowledge and develops models and

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methods to support its application, solve problems and provide the knowledge base for engineering specialisations.

Generic baseline competency: The competency for a Professional Category defined in terms of outcomes, including the expected level of performance that can be demonstrated in a range of occupational contexts.

Initial professional development: Systematic participation in the activities typical of Continuing Professional Development but carried out prior to professional registration.

Integrated Performance: An overall satisfactory outcome of an activity requires several outcomes to be satisfactorily attained; for example, a design requires analysis, synthesis, analysis of impacts, checking of regulatory conformance and judgement in decisions.

Level descriptor: A measure of performance demands at which outcomes must be demonstrated.

Knowledge area: An important subject area that forms part of the overall knowledge base needed for a certain competency.

Management of engineering works or activities: The coordinated activities required to:


- direct and control all that is constructed or results from construction or manufacturing operations
- operate engineering works safely and in the manner intended
- return engineering works, plant and equipment to an acceptable condition by the renewal, replacement or mending of worn, damaged or decayed parts
- direct and control engineering processes and systems in addition to the commissioning, operation and decommissioning of equipment
- maintain equipment or engineering works in a state in which it can perform its required function.

Mentor: A professionally registered person who guides the competence development of an applicant in an appropriate category.

Outcome: A statement of the performance that a person must demonstrate to be judged competent at the specified category level.

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Practice area: A distinctive area of knowledge and expertise developed by an Engineering Specialist through the path of education, training and experience followed by competent and responsible application in practice.

Prescribed standards: The Competency Standards (outcomes) for the category and the discipline-specific requirements (if any) that must be satisfied by an applicant for registration.

Professional Review: An integrative assessment of the applicant's competence, including professional attributes specified in the standard and subdiscipline specific requirements for the category and the subdiscipline via a comprehensive review of the applicant's evidence and an interview.

Range statement: The required extent of or limitations on expected performance stated in terms of situations and circumstances in which outcomes are to be demonstrated in a particular competency area.

Referee: A registered person who is willing to testify in writing about the character or ability of someone undergoing the application process.

Specified Category: A category created for registered persons other than Professional and Candidate Engineers, Certificated Engineers, Engineering Technologists and Engineering Technicians who have specific training and experience pertaining to a specialised field that must be regulated. It is a category of registration created for persons who must be registered through the Engineering Profession Act, 46 of 2000 (EPA) or a combination of the EPA and external legislation as having specific competencies related to an identified need to protect the safety, health and interest of the environment in relation to engineering activity.


Standards: Statements of outcomes to be demonstrated and the levels of performance and content baseline requirements in the context of engineering educational programmes.

Substantial equivalence (applied to educational programmes): Two programmes while not meeting a single set of criteria are both acceptable for preparing their respective graduates to gain training and experience towards professional registration.

Supervisor: A person who directs and oversees the work activities.

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Task: Includes a task relating to designing, constructing, altering, repairing, impounding water in, operating, evaluating the safety of, maintaining, monitoring or abandoning a dam with a safety risk.

Undertaking: Refers to the expressed resolve of employers and mentors to fulfil their commitment to the best of their ability.

Virtual Panel Member: A VPM is an ECSA registered professional in good standing with Council who is trained to perform the work of an assessor, reviewer and/or moderator in the peer-review model and registration process of a candidate who applies for registration.

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ABBREVIATIONS

APP	Approved Professional Person
BDEA	Broadly defined engineering problem
BIFSA	Building Industries Federation South Africa
C&U	Commitment and Undertaking
CESA	Consulting Engineers South Africa
CPD	Continuing Professional Development
DSRR	Discipline-specific Requirements Report
DSTG	Discipline-specific Training Guide
DWS	Department of water and Sanitation
EA	Experience Appraisal
ECSA	Engineering Council of South Africa
EPA	Engineering Profession Act, 46 of 2000
NWA	National Water Act, 36 of 1998
PE	Professional Engineer
PN	Professional Engineering Technician
PR	Professional Review
Pr Cert Eng	Professional Certificated Engineer
Pr Eng	Professional Engineer
Pr Tech Eng	Professional Engineering Technologist
Pr Techni Eng	Professional Engineering Technician
SC	Specified Category
TER	Training and Experience Report
TES	Training and Experience Summary
VA	Voluntary Association

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BACKGROUND

The illustration below defines the documents that comprise the Engineering Council of South Africa (ECSA) system for registration in Specified Categories. The illustration also locates the current document.

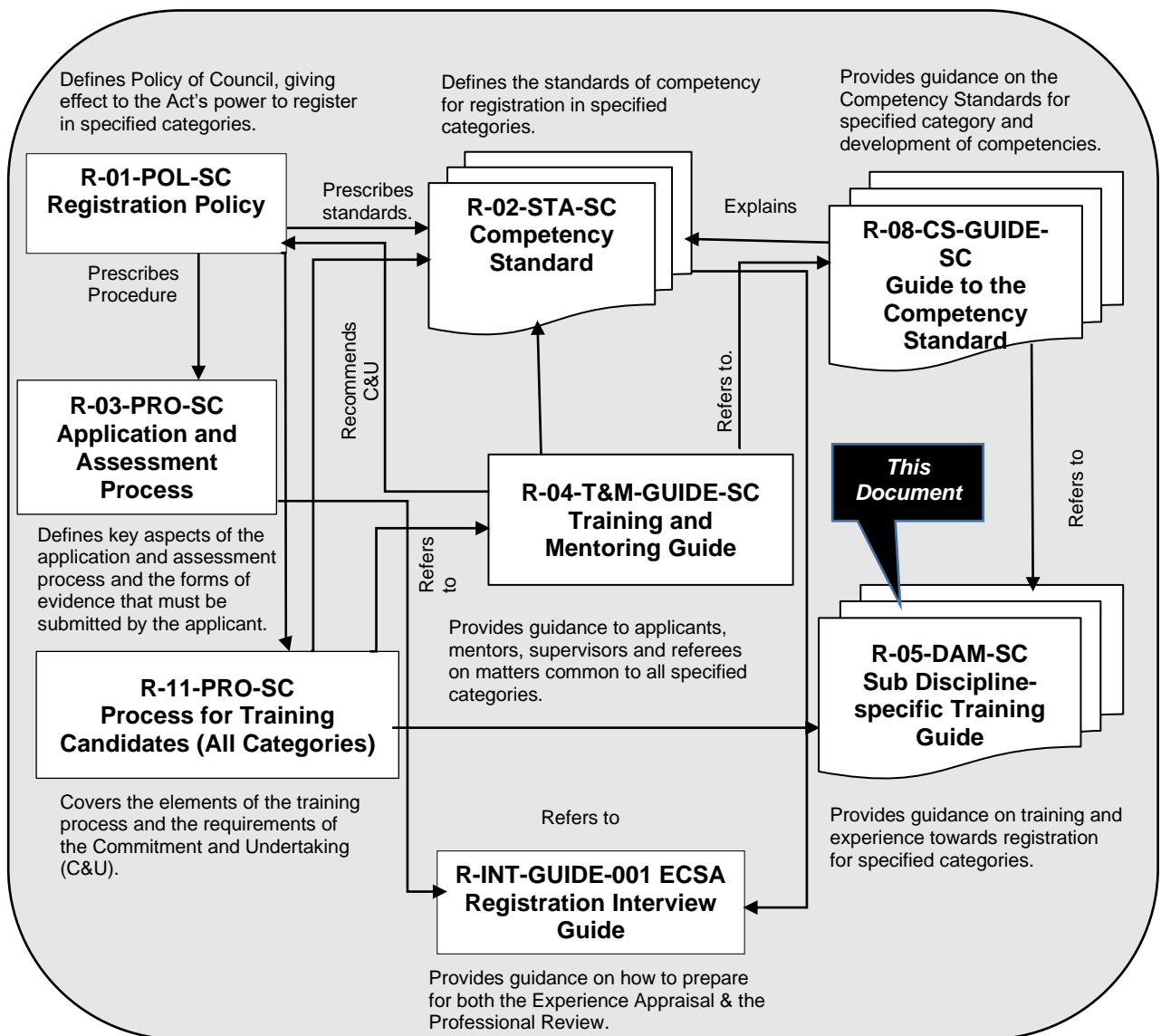



Figure 1: Documents defining the ECSCA registration system

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 QM-TEM-001 Rev 2 – ECSCA Policy/Procedure

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1. PURPOSE OF THIS DOCUMENT

All persons applying for registration in the Specified Category of Dam Specialist are expected to demonstrate the competencies specified in document **R-02-STA-SC** through work performed at the prescribed level of responsibility.

This training requirements document supplements the generic *Training and Mentoring Guide* (document **R-04-T&M-GUIDE-SC**), the *Guide to the Competency Standards for Registered Specialists* (document **R-08-CS-GUIDE-SC**) and the *Process for Training Engineering Candidates towards Specified Category Registration* (document **R-11-PRO-SC**).

In document **R-04-T&M-GUIDE-SC**, attention is drawn to the following sections:

- Duration of training and period working at level required for registration
- Principles of planning training and experience
- Progression of training programme
- Documenting training and experience
- Demonstrating responsibility.


The second document (document **R-08-CS-GUIDE-SC**) is applicable to Alternative Route applicants. It provides both a high-level and an outcome-by-outcome understanding of the Competency Standards as an essential basis for this discipline-specific training requirements document.

The third document (document **R-11-PRO-SC**) elaborates on the elements of the training process and the requirements of the Commitment and Undertaking (C&U).

This training requirements document and documents **R-04-T&M-GUIDE-SC**, **R-08-CS-GUIDE-SC** and **R-11-PRO-SC** are subordinate to the *Policy on Registration* (document **R-01-POL-SC**), the *Competency Standards* (document **R-02-STA-SC**) and the application process definition (document **R-03-PRO-SC**).

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2. AUDIENCE

This guide is for candidates and their supervisors and mentors in the subdiscipline of Dam Specialist. The requirements are intended to support a programme of training for a Dam Specialist to gain experience incorporating good practice elements.


The requirements are for the members of the engineering team as listed in Table 1. The table presents the different categories for the engineering team of registered practitioners who accept full responsibility for their area of work and adhere to the ECSA Code of Conduct and the Engineering Professions Act, 46 of 2000 (EPA).

Table 1: Different categories of professional registration

Category	Authority	Underpinning knowledge	Area of responsibility
Professional Engineer – EPA Section 18(1)(a)(i)	Educated, trained and experienced to carry out complex, defined engineering work.	Graduate attributes acquired in education at NQF 8 level (560 credits).	Complex interaction between professions and disciplines; justify work outside codes, standards and procedures.
Professional Certificated Engineer – EPA Section 18(1)(a)(iii)	Educated, trained and experienced to carry out broadly defined engineering work.	Graduate attributes acquired in education at NQF 7 level (420 credits) and Government Certificate of Competency.	Interaction with other professions and disciplines; authorisation required to work outside codes, standards and procedures after conducting research and investigation; legal responsibility (OHS Act).
Professional Engineering Technologist – EPA Section 18(1)(a)(ii)	Educated, trained and experienced to carry out broadly defined engineering work	Graduate attributes acquired in education at NQF 7 level (420 credits).	Interaction with other professions and disciplines; authorisation required to work outside codes, standards and procedures after conducting research and investigation.
Professional Engineering Technician – EPA Section 18(1)(a)(iv)	Educated, trained and experienced to carry out well-defined engineering work	Graduate attributes acquired in education at NQF 6 level (280 to 360 credits).	Mainly working within a single discipline; strict adherence to codes, standards and procedures; repetitive work.
Specified Category Specialist – EPA Section 18(1)(c)	Educated, trained and experienced to carry out specifically defined engineering work	Graduate attributes acquired in education at NQF 5 level (140 credits).	Working within a single discipline in a specific field; may be legally responsible for work.

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Finally, this guide applies to persons who:

- have completed the educational requirements for registration as either a Professional Engineer or a Professional Engineering Technologist, Professional Engineering Technician or Specified Category and who are registered with the ECSA as such; or
- have completed recognised foreign equivalent educational requirements for registration as either a Professional Engineer or a Professional Engineering Technologist but are not registered with the ECSA (**Alternative Route Applicants**);
- are registered as a Candidate Specified Category Dam Specialist;
- have embarked on a process of acceptable training under a registered **C&U** with a Mentor guiding the professional development process at each stage; and
- intend to adhere to the ECSA Code of Conduct, prohibiting the undertaking of engineering work for which the registered person is not qualified, trained or experienced.

3. PERSONS NOT REGISTERED AS CANDIDATE OR BEING TRAINED UNDER A COMMITMENT AND UNDERTAKING


All applicants for registration must present the same evidence of competence and be assessed against the same standards and requirements, irrespective of the development path followed. Application for registration as a Dam Specialist is permitted without being registered as a Candidate Specified Category or without training under a C&U. Mentorship and adequate supervision are, however, key factors in effective development to the level required for registration. A C&U indicates that the company is committed to mentorship and supervision.

If the trainee's employer has no C&U, the trainee should establish the level of mentorship and supervision that the employer is able to provide. In the absence of an internal mentor, the services of an external mentor should be secured. The recognised Voluntary Association (VA) for the subdiscipline should be consulted for assistance in locating an external mentor. A mentor should be in place at all stages of the development process.

These requirements are written for the registered Professional Engineer (Pr Eng), Professional Engineering Technologist (Pr Tech Eng), Professional Certificated Engineer (Pr Cert Eng) and Professional Engineering Technician (Pr Techni Eng) who is training and gaining experience

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towards Dam Specialist registration. Mature applicants for Dam Specialist registration may apply the requirements retrospectively to identify possible gaps in their development.

Applicants who have not enjoyed mentorship are advised to request an experienced mentor (internal or external) to act as an application adviser while they prepare their applications for Dam Specialist registration.

This training requirements document may be applied in the case of a person moving into a candidacy programme at a later stage that is at a level below that required for registration.

4. TRAINING OBJECTIVE

The scope of a Dam Specialist is to typically undertake the planning, feasibility, design and construction of dams of all sizes and types (e.g. earth fill, rockfill, concrete, etc.). It also includes the generation of appropriate engineering specifications, drawings and undertaking of dam safety inspections and evaluations, remedial works to existing dams, etc., to prevent dam failure and determine causes and remedies when there is a dam failure. During the training, the Dam Specialist should carry out engineering activities with care towards the State and the general public, and must:


- ensure that the activities are conducted according to acceptable dam engineering practice
- keep the prescribed records
- compile the prescribed reports
- where the activity includes constructing, altering or repairing a dam, issue a completion certificate to the owner of the dam to the effect that activity on the dam has been carried out according to the applicable design, drawings and specifications.

Furthermore, the Dam Specialist appointed to carry out a dam safety evaluation must consider whether the safety norms pertaining to the design, construction, monitoring operation, performance and maintenance of the dam satisfy acceptable dam engineering practice.

The training and experiential learning should be designed to enable the Dam Specialists to demonstrate competence in line with the ECSA prescribed standards and the training should incorporate an increasing level of responsibility to enable applicants to submit evidence in the Training and Experience reports of achieving the duration and the level detailed in Appendix A

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of this document (Degrees of Responsibility). For this reason, it is necessary that the applicant has a wide experience of and exposure to those aspects that are important to the relevant activity. It is a further requirement that an applicant has a sound engineering judgment in line with ECSA's 11 competency outcomes and level of performance for demonstrating competence for each professional category and the ability to take responsible decisions. (See **Appendix C**)

5. AREAS OF PRACTICE

Dam Specialists form a collective group of designers who plan, design, evaluate and oversee the construction, operation, maintenance and management of a new dam with a safety risk or who enlarge, alter or repair an existing dam with a safety risk. The area of practice, among others, includes the following dam components:


- Concrete dam
- Fill dam (earth or rockfill)
- Inspection of materials
- Structural analysis
- Foundations
- Monitoring system
- Hydrology
- Spillways
- Mechanical equipment
- Outlet works.

Typical activities that Dam Specialists may undertake within the dam's components include the following:

- **Research:** Conduct research and develop specifically defined new or improved theories and methods related to the performance of dam materials, dam components and their structural safety.
- **Design:** This includes the investigation of alternative solutions, selection of materials, determination of geometry, execution of appropriate analyses, compilation of detailed building plans, specifications and manuals for operations.

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- **Procurement:** This involves developing a specification on the performance and aesthetic requirements of dam to include bills of quantity, as well as advising on the merits of completing tender submissions on compliance or deficiencies to the technical specification
- **Quality control:** This includes the execution of control over the erection of a structure or component thereof according to plans and specifications
- **Evaluation:** This includes the determination of which current standards and practice are complied with in respect of:
 - provision to fulfil the intended function (e.g., adequacy of spillway capacity, stability)
 - laid down procedures and methods for the use of a component, the condition of or performance of a component that has been observed or can be observed, or
 - the method, assumptions and norms that were used for structural analysis or hydrological analysis.
- **Construction:** Construction monitoring of the execution of the design elements according to the specifications and approved construction drawings.
- **Safety and environment:** Assisting in establishing control systems to ensure efficient functioning of infrastructure as well as safety and environmental protection.
- **Operation:** This includes the use of a component or components of a dam from completion of construction, as well as the continuous maintenance thereof to ensure serviceability, including regular inspections to determine the condition and serviceability, as well as assessment of measurements to determine performance.


6. DAM SYSTEMS

Within the National Water Act, 36 of 1998 and the regulations pertaining to dam safety, a variety of activities relating to dams have been identified for which approval is required. These activities include:

- design of new dams or alterations to existing dams
- exercise of quality control during the construction of dams or large maintenance works
- undertaking of dam safety inspections and dam safety studies.

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Further details in this connection appear on the Dam Safety Office's application form. The evaluation of the task requirements considers the complexity of the task in relation to aspects such as:

- wall height
- type of wall
- nature of the foundation material
- size and location of catchment area
- type of spillway and magnitude of design flood
- type of river outlet
- hazard potential of the dam
- age of the structure, and
- any known or expected problems (such as alkali aggregate reaction or soil with dispersive characteristics).


The task requirements for the inspection of an existing dam may in fact be higher than the requirements for the design of a new dam so this fact is considered in assessing the applicant's appropriate design experience. An applicant's experience with risk analysis is also considered when assessing the appropriateness of his or her design and evaluation experience.

For evaluation, expertise requirements are classified as either *desirable* or *essential*. For example, for the inspection of a large earth fill dam, it is an indispensable requirement that the applicant has appropriate design experience of earth fill dams.

For the inspection of a medium size dam, it would be a desirable requirement that the applicant has experience of systems for monitoring the behaviour of dams. However, the specific circumstances applicable to each dam are considered on their own merits

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7. TRAINING IMPLICATIONS ON THE NATURE AND ORGANISATION OF THE INDUSTRY

7.1 Nature of training

The following are particular aspects of importance in relation to the recognition of experience:

- Experience in a direction closely related to dam engineering may also be brought into account to a maximum of 6 months
- Post registration experience of over 6 years' involvement in small dams may be considered when the applicant wishes to undertake a task in relation to a medium size dam but has limited experience with dams of that size.
- The quality of the experience acquired is often the critical element. Experience acquired in one-man projects carries less weight than experience obtained with projects where a variety of experts is involved. In addition, excessive durations indicated for a dam of a particular size are not necessarily fully recognised. Experience obtained from feasibility studies carries less weight than actual design and construction experience.

Dam Specialists must be experienced with structural analysis and evaluation of the safety of dams as part of dam safety inspections; dam safety investigations may also be considered as experience for the relevant types of structures.

7.2 Process design

Dam Specialists must demonstrate the ability to define, investigate and analyse specifically defined engineering problems (activities), typified by the following performances:


7.2.1 Understand the activity as agreed to with the client

Dam Specialists must be able to do the following:

- Use personal experience and knowledge and an understanding of the employer's commercial position and available dam components to identify potential projects or opportunities and consider their technical viability.
- Demonstrate ability to define rational dam safety design and to use this capability together with related expertise of other specialists to provide a total solution.

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- Analyse and clarify information, drawings, codes and procedures.
- Demonstrate the ability to select the type of dam materials that will not deteriorate under normal circumstances.
- Demonstrate the ability to interpret the engineering designs and drawings.

7.2.2 Be conversant with latest developments in the dam field

Carry out initial professional development to remain abreast of key developments in the field of dams, such as changes in regulations or in dam practice, and be aware of key research/experimental programmes that are likely to have an influence in the field. Changes in regulations or industry practices will have an impact on the Regulations Regarding the Safety of Dams in Terms of Section 123(1) of the National Water Act, 36 of 1998.

7.2.3 Engage in creative and innovative development of engineering technology

Engage in creative and innovative development of engineering technology and continuous improvement systems to design an optimised dam's rational design that will perform equally well or better than pure code-related rules.

7.2.4 Develop and analyse alternative approaches to the solution

Develop and analyse alternative approaches to do the work and check impacts and sustainability of solutions.

7.3 Risk and impact mitigation


The requirements to be complied with relating to a dam with a safety risk in respect of design, construction, putting into operation, maintenance, monitoring, dam safety inspections, dam safety evaluations and decommissioning of the dam must be determined in accordance with the category classification.

No person without possession of a Dam Safety relevant licence can construct a dam with a safety risk or enlarge, alter or repair an existing dam with a safety risk, or begin any construction work, including:

- any preparation of the foundations
- storage of construction materials, including aggregate, earth and rock

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- development of quarries or borrow areas
- diversion of the watercourse concerned or any works incidental thereto, and in the case of the enlargement, alteration or repair of an existing dam, steps to change the existing structure or equipment.

In a case of urgent emergency repair work to prevent failure of the dam or its components, the work may be constructed without a Dam Safety relevant licence on condition that the application is made within seven days.

7.4 Selection of save and sustainable material

Dam Specialists must undertake engineering activities in a way that contributes to sustainable development and exercise sound judgement during complex engineering activities:

- Promote the considerations and actions required in engineering practice to improve, sustain and restore the environment.
- Encourage the wise use of non-renewable resources through waste minimisation, recycling and the development of alternatives, where possible.
- Strive to achieve the beneficial objectives of dam design through minimising the consumption of raw materials and energy and designing sustainable management procedures.
- Account for life-cycle implications with respect to how dam designs affect the environment.
- Understand and secure stakeholder involvement in sustainable development.
- Use resources efficiently and effectively.


7.5 Engineering project management

Dam Specialists must plan for effective project implementation, meet all legal and regulatory requirements and protect the health and safety of persons during their specified engineering activities through:

- identifying the factors affecting project implementation
- preparing and developing project proposals and negotiating contractual arrangements with customers, suppliers and partners to secure the employer's commercial position
- analysing and organising the provision of resources required to execute the work

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- recognising and addressing the reasonably foreseeable social, cultural and environmental effects of specified engineering activities
- complying with international, national and local laws, regulations, by-laws and standards relating to dam safety and emergency services to ensure end-to-end sustainable dam safety solutions.

Dam Specialists must demonstrate the ability to plan, budget, organise, direct and control tasks, people and resources by:

- setting work objectives and priorities, including milestone outputs, project deadlines, quality standards and budgets
- organising project teams and exercising leadership over other engineers and technical and other personnel as appropriate
- monitoring and/or auditing tasks to ensure that work is executed as planned and determine appropriate corrective actions.

Dam Specialists must demonstrate the ability to lead teams and develop staff to meet changing technical and managerial needs through:

- agreeing on objectives and work plans with teams and individuals
- contributing to the identification of the training needs of teams and individuals to respond to changing technical and managerial requirements and to further their professional progression
- developing external and work experience-related training plans for teams and individuals and identify and procure appropriate training activities and resources.


7.6 Undertake reviews of training effectiveness

Dam Specialists must demonstrate the ability to manage implementation of design solutions and evaluate their effectiveness through:

- preparing documented proposals that clearly identify and describe the dam solutions that have been engineered to satisfy the functional objectives of the project

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- ensuring that any testing or proving requirements are discussed and that any potential problem areas are highlighted, with options for modifications or adaptations identified as necessary
- taking corrective action to overcome the shortcomings or omissions identified with the proposals
- determining the impact on dam design solutions of factors in relation to a dam with a safety risk in respect of design, construction, putting into operation, maintenance, monitoring, dam safety inspections, dam safety evaluations and decommissioning of the dam
- in consultation with affected parties, evaluating the issues that affect them and how resolution of these issues will influence the design.

7.7 Continuing professional development

Dam Specialists registered by ECSA are able to further their education, development and training regarding dam safety practice to ensure competency and the acceptance of work responsibility. Participating in ECSA's candidacy scheme with the associated C&U, adhering to ECSA's continuing professional development (CPD) requirements and complying with the ECSA Code of Conduct promote the standing of Dam Specialists.

8. DEVELOPING COMPETENCY


8.1 Classification of dam with safety risk

Dam Specialists must comprehend and understand the type or types of dams and their classifications with safety risk during the training and experience period which include, among others, the following:

- Every dam with a safety risk must be classified on the basis of its size and hazard potential to determine the level of control over the safety of the structure that is applicable in accordance with the regulations.
- The size classification of a dam with a safety risk is based on the maximum wall height in accordance with Table 3 in Annexure B.
- The hazard potential classification of a dam with a safety risk must be effected as set out in Table 4 in Annexure B and in accordance with the following parameters:

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- When the potential adverse impact on resource quality due to failure of a dam with a safety risk is assessed, the quality of water stored in the reservoir as well as the estimated volume of sediment and water that can be released from the reservoir must be considered.
- If the water stored in the reservoir contains polluted water or hazardous substances, the potential adverse impact on resource quality must be regarded as significant or severe, respectively.
- The hazard potential rating for a given dam as set out in **Table 4** of Annexure C must be the highest level as determined by the separate consideration of the potential loss of life, potential economic loss and potential adverse impact on resource quality downstream of the dam.

8.2 Minimum duration of involvement with dams

Dam Specialists must demonstrate competence in line with the prescribed standards for the specified categories. It is unlikely that this competence can be developed and demonstrated at the required level in less than the duration of involvement in Dams.


Both pre- and post-registration experience will be recognised for meeting the duration of involvement in Dams. During this time, the applicant's competency will develop and must be demonstrated at the required level over a certain period. Mentors, candidates and employers must plan for a period of not less than the duration of involvement for the dam size class. The duration of the activities on which the applicant is working at the level Responsibility E: Performing (see Annexure A) must not be shorter than 52 weeks.

Table 2: Classification of dams with a safety risk

Duration of involvement in dams	Dam size	Maximum wall height in metres
Three to five years	Small dams	Lower than 12 metres
Six to seven years	Medium dams	12 metres to 30 metres
Eight years and more	Large dams	30 metres and higher

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8.3 Contextual knowledge

Candidates are expected to be aware of the requirements of the engineering profession. Among the functions and services of the recognised VAs applicable to Dam Specialists is the provision of a broad range of contextual knowledge not only for Candidate Dam Specialists but also through the full career path of Registered Dam Specialists.

The practice area of Dam Specialists has identified specific contextual activities that are considered essential in the competence development of Dam Specialists.

The Virtual Panel Members of ECSA, with its discipline-specific assessing team, perform a review of the portfolio of evidence of Candidate Dam Specialists at the completion of the training period.

8.4 Functions performed


Special considerations must be given to the competencies specified in the following groups as described in the Degree of Responsibility Scale presented in document **R-04-T&M-GUIDE-SC**:

- Responsibility Level A: Knowledge-based problem-solving
- Responsibility Level B: Management and communication
- Responsibility Level C: Identifying and mitigating the impacts of the engineering activity
- Responsibility Level D: Judgement and responsibility
- Responsibility Level E: Independent learning.

The progression of a candidate's competency can be measured as indicated in **Appendix A**, which was developed to align the progression of Candidate Dam Specialists with the Degree of Responsibility Scale. It should be noted that Candidate Dam Specialists working at **Responsibility Level E** carry the responsibility for work performed that is appropriate to that of a Registered Person, except that supervisor of a Candidate Dam Specialist is accountable for that candidate's recommendations and decisions.

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8.5 Statutory

Candidates are expected to have a working knowledge of the following laws and regulations, as well as standards, and how they affect the safety of dams:

- Occupation Health and Safety Act, 85 of 1993, as amended by Act 181 of 1993
- Environment Conservation Act, 73 of 1989, as amended by Act 52 of 1994 and Act 50 of 2003
- Labour Relations Act, 66 of 1995
- Building Regulations – National Building Regulations and Building Standards Act, 103 of 1977, as amended by Act, 49 of 1995
- Regulations Regarding the Safety of Dams in Terms of Section 123(1) of the National Water Act, 36 of 1998.

8.6 Recommended formal learning activities

The following list of formal learning activities is a sample of useful courses:


- CPD courses on specific disciplines and equipment types
- Elementary project management
- Negotiation skills
- Risk analysis
- Quality systems
- Occupational health and safety
- Maintenance engineering
- Environmental impacts
- Report writing and communication
- Planning methods
- Facilities management, etc.

8.7 Best practice

The training programme for each Candidate Dam Specialist depends on the work opportunities available at the time for the employer to assign to the candidate. It is suggested that Candidate Dam Specialists work with their mentors to develop expertise in relation to a dam with a safety

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risk in respect of design, construction, putting into operation, maintenance, monitoring, dam safety inspections, dam safety evaluations, and decommissioning of the dam.

The training programme should be such that Candidate Dam Specialists progress through the levels of work capability described in document **R-04-T&M-GUIDE-SC**, so that by the end of the training period, Dam Specialists can perform individually and as team members, meeting the discipline-specific requirements (and the engineering outcomes for Alternative Route applicants) at the level required for registration of the **Degree of Responsibility E**.

The nature of work and the degrees of responsibility defined in document **R-04-T&M-GUIDE-SC** are indicated in **Appendix A**.

Mentors and Dam Specialist candidates must identify the level of responsibility at which an activity is compliant and demonstrate the various requirements and, if applicable, the outcomes. Evidence of a candidate's activities must be recorded on the appropriate system such that it meets the requirements and, if applicable, the Training Elements indicated in **Appendix C**. ECSA will specify the applicable recording system in the Application for Registration form.

8.8 Realities


Each candidate effectively undertakes a unique programme in which the various activities carried out at the discipline-specific level that are to be met during the candidacy are linked to the generic competency requirements presented in document **R-08-CS-GUIDE-SC** and this *Subdiscipline-Specific Training Guide*.

8.9 Moving into candidacy programmes

This guide assumes that Candidate Dam Specialists enter a programme after graduation and continue with the programme until ready to apply for registration. The guide also assumes that Candidate Dam Specialists are supervised and mentored by persons who meet the requirements stated in document **R-04-T&M-GUIDE-SC**. In the case of a person changing from one candidacy programme to another or moving into a candidacy programme from a less structured environment, it is essential that the following steps are completed:

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- Candidate Dam Specialists must complete the Training and Experience Summary (TES) and the Training and Experience Report (TERs) for the previous programme or unstructured experience. In the latter case, it is important to reconstruct the experience as accurately as possible. The TERs must be signed off.
- Alternative Route Dam Specialists candidates must complete the TES and the TERs for the previous programme or unstructured experience. In the latter case, it is important to reconstruct the experience as accurately as possible. The TERs must be signed off.
- On entering the new programme, the mentor and supervisor should review the candidate's development while considering past experience and opportunities and the requirements of the new programme.
- The next phase of the candidate's programme must be planned.
- The candidate must complete the **Discipline-specific Requirements Report (DSRR)** on elements already covered during the initial part of the candidacy.

Professionally registered persons who want to register as a Dam Specialist do not need to register as candidates.

8.10 Programme structure and sequencing

8.10.1 Consideration for generalists, specialists, researchers and academics

The ECSA **R-08-CS-GUIDE-SC** documents adequately describe what is expected of persons whose formative development has not followed a conventional path, for example, academics, researchers, specialists and those who have not followed a candidate training programme.


The overriding consideration is that irrespective of the route followed, the applicant must provide evidence of competence against the **Subdiscipline-specific Requirements** and in the case of Alternative Route applicants, against the Standards.

8.10.2 Compulsory Subdiscipline-specific Requirements to be met during candidacy

The industry has a critical need to identify people who have expertise in relation to a dam with a safety risk in respect of design, construction, putting into operation, maintenance, monitoring, dam safety inspections, dam safety evaluations and decommissioning of the dam.

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During candidacy, all candidates assisted by mentors and supervisors must ensure that they are conversant with the practical knowledge set out in form **APP-REG-SC-DS** (part of the *Application for Registration* form) and submit evidence as such in the form of a Subdiscipline-specific Requirements Report **APP-REG-SC-DS**.

During candidacy, **Alternative Route Candidates** must ensure they are conversant with the practical knowledge set out in form **ER-SC** (part of the *Application for Registration* form) and submit evidence as such in the form of an Engineering Report (**ER-SC**).

8.11 Dam Specialist in line with the Approved Professional Person Registration

ECSA will register the Dam Specialists in accordance with the Dam size as defined in the Department of Water and Sanitation (DWS), regulations regarding the safety of dams in terms of section 123(1) of the National Water Act, 36 of 1998. A list of registered dam specialists can be verified on the ECSA website to check registration status.


ECSA will assess the applicant's competencies as described in the Competency Standard for Registration in a Specified Category (**R-02-STA-SC**) together with the Degree of Responsibility Scale presented in document **R-04-T&M-GUIDE-SC** and will be benchmarked with DWS, level of involvement in a task.

ECSA will register the applicant under the Specified category of Dam Specialists in line with the relevant Code of Practice for the registered person and with the nature of the task undertaken and presented for registration. The ECSA Code of Conduct for a registered person already regulates the registered person's conduct, stating that he/she may only undertake work that he/she is competent in.

A registered Dam Specialist who has acquired experience for registration in the relevant dam size, as specified in Table 2 above, may come to ECSA to add the scope.

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REVISION HISTORY

Revision number	Revision date	Revision details	Approved by
Rev. 0 Draft A	28 Sept 2023	First draft submitted	Working group
Rev. 0 Draft B	19 Oct 2023	First draft Reviewed	RDDR and Registration
Rev. 0 Draft C	21 Nov 2023	First draft Reviewed inputs and changes incorporated	RDDR and Working group
Rev. 0 Draft D	29 July 2024	Final Draft Reviewed by the BU	RIDR BU
Rev. 0 Draft E	01 Aug 2024	Document submitted to Steering Committee for inputs and comments	RIDR Business Unit
Rev. 0 Draft F	20 August 2024	Document sent to the identified stakeholders for comments and inputs	RIDR Business Unit
Rev. 0 Draft G	01 October 2024	Webinar and inputs (Definition and dams sizes revised)	RIDR Business Unit & Working Group
Rev. 0 Draft H	09 October 2024	Recommendation for approval by the RPSC	ERSIR
Rev. 0	23 October 2024	Recommendation for approval	RPSC

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The Subdiscipline-Specific Training Guide for

Registration as a Dam Specialist in Specified Category

Revision 0 dated 23 October 2024 and consisting of 30 pages has been reviewed for adequacy by the Business Unit Manager and is approved by the Executive: Regulatory Services & International Relations (**ERSIR**).



Business Unit Manager

2 December 2024

Date



Executive: RPS


2024/12/02

Date

This definitive version of this policy is available on our website.

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APPENDIX A: PROGRESSION THROUGHOUT THE CANDIDACY PERIOD

Degree of responsibility	Nature of work: Candidate	Responsibility of candidate to supervisor	Extent of supervisor/mentor support
A: Being Exposed	Undergoes induction, observes processes, work of competent practitioners.	No responsibility.	Mentor explains challenges and forms of solution.
B: Assisting	Performs specific processes under close supervision.	Limited responsibility for work output.	Supervisor/Mentor coaches, offers feedback.
C: Participating	Performs specific processes as directed with limited supervision.	Full responsibility for supervised work.	Supervisor progressively reduces support but monitors outputs.
D: Contributing	Performs specific work with detailed approval of work outputs.	Full responsibility to supervisor for immediate quality of work.	Candidate articulates own reasoning and compares it with that of supervisor
E: Performing	Works in team without supervision, recommends work outputs, responsible but not accountable.	Level of responsibility to supervisor is appropriate to a registered person; supervisor is accountable for candidate's decisions.	Candidate takes on problem solving without support – at most, limited guidance.

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APPENDIX B: THE CLASSIFICATION OF DAMS WITH A SAFETY RISK

Table 3: Size classification

Size class	Maximum wall height in metres (m)
Small	Less than 12m
Medium	Equal to or more than 12m but less than 30m
Large	Equal to or more than 30m.

Table 4: Hazard potential classification


Hazard potential rating	Potential loss of life	Potential economic loss	Potential adverse impact on resource quality
Low	None	Minimal	Low
Significant	Not more than ten	Significant	Significant
High	More than ten	Great	Severe

Table 5: Category classification of dams with a safety risk

Size class	Hazard potential rating		
	Low	Significant	High
Small	Category I	Category II	Category II
Medium	Category II	Category II	Category III
Large	Category III	Category III	Category III

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APPENDIX C: TRAINING ELEMENTS

This training requirements document is written for the recent graduate who has completed recognised foreign equivalent educational requirements for registration as either a Professional Engineer or a Professional Engineering Technologist but who is not registered with the Engineering Council of South Africa but is training and gaining experience towards registration (Alternative Route). Mature applicants for registration may apply these requirements retrospectively to identify possible gaps in their development.


Synopsis: Candidate Dam Specialists should achieve specific competencies at the prescribed level during their development towards registration and at the same time accept more and more responsibility as experience is gained. The outcomes achieved and established during the Candidacy phase should form the template for all engineering work performed after registration, regardless of the level of responsibility at any particular stage of an engineering career.

1. Confirm understanding of instructions received and clarify if necessary.
2. Use theoretical training to develop possible approaches to the work and thereafter select the best and present to the recipient.
3. Apply theoretical knowledge to justify decisions taken and processes used.
4. Understand one's role in the work team and plan and schedule work accordingly.
5. Issue complete and clear instructions and report comprehensively on work completed.
6. Be sensitive to the impact of the engineering activity and take action to mitigate this impact.
7. Consider and adhere to legislation applicable to the task and the associated risk identification and management.
8. Adhere strictly to high ethical behavioural standards and the ECSA Code of Conduct.
9. Display sound judgement by considering all factors and their interrelationship, consequences and evaluation when not all evidence is available.
10. Accept responsibility for own work by using theory to support decisions, seeking advice when uncertain and evaluating shortcomings.
11. Become conversant with employer's training and development programme and develop lifelong development programme within this framework.

Responsibility Levels: A = Being Exposed; B = Assisting; C = Participating; D = Contributing; E = Performing

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Competency Standards for registration as a Specified Category Rational Designer	Explanation and responsibility level
<p>1. Purpose</p> <p>This standard defines the competence required for registration as a Specified Category Rational Designer. Definitions of terms having particular meaning within this standard are given in the text, at the beginning of the document.</p>	<p>Discipline-specific Training Guides (DSTGs) give context to the purpose of the Competency Standards. Registered Dam Specialists operate within the nine disciplines recognised by the ECSA. Each discipline can be further divided into subdisciplines and finally into specific workplaces or competency areas. The DSTGs are used to facilitate experiential development towards ECSA registration and assist in compiling the required portfolio of evidence (specifically the Engineering Report in the application form).</p> <p>Note: The training period must be used to develop the competence of the trainee towards achieving the standards presented below at the responsibility level indicated (mainly Level E: Performing). (Refer to Table 4 in document R-04-SC).</p>
<p>2. Demonstration of competence</p> <p>Competence must be demonstrated within complex / broadly defined / well-defined engineering problems by integrated performance of the outcomes defined in Section 3 below at the level defined for each outcome. Required contexts and functions may be specified in the applicable Subdiscipline-specific Training Requirements.</p> <p>Activities include planning; investigation and problem resolution; improvement of materials, components, systems or processes, engineering operations, maintenance, project management, development and commercialisation.</p>	<p>Engineering activities can be approximately divided into the following:</p> <ul style="list-style-type: none"> • 5% Complex (Professional Engineers) • 5% Broadly defined (Professional Engineering Technologists) • 10% Well-defined (Professional Engineering Technicians) • 15% Specifically defined (Registered Specified Categories including Dam Specialists) • 20% Skilled Worker (Engineering Artisan) • 45% Unskilled Worker (Artisan Assistant) <p>The activities can be in-house or contracted out; evidence of integrated performance can be submitted irrespective of the situation.</p> <p>For Candidate Dam Specialists, research, development and commercialisation happen frequently in some work areas and are seldom encountered in others.</p>

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Competency Standards for registration as a Specified Category Rational Designer	Explanation and responsibility level
3. Outcomes to be satisfied	Explanation and Responsibility Level
Group A: Engineering problem-solving	
Outcome 1: Define, investigate and analyse <i>complex / broadly defined / well-defined</i> engineering problems (tasks).	Responsibility Level E Analysis of an engineering problem means the 'separation into parts possibly with comment and judgement'.
Competency indicators: A structured analysis of specifically defined rational design problems typified by the following performances within the competency area is expected: 1.1 State how <u>you</u> interpreted the work instruction received, checking with your client or supervisor if your interpretation is correct. 1.2 Describe how <u>you</u> analysed, obtained and evaluated further clarifying information and if the instruction was revised as a result.	To perform an engineering task, a Dam Specialist will typically receive an instruction from a senior person (customer) to do the task and must conduct the following: 1.1 Ensure that the instruction is complete, clear and within his/her capability and that the person who issued the instruction agrees with his/her interpretation. 1.2 Ensure that the instruction and information to do the work is fully understood and complete, including the engineering theory needed to understand the task and to carry out and/or check calculations and the acceptance criteria. If needed, supplementary information must be gathered, studied and understood.
Range Statement: The problem (task) may be part of a larger engineering activity or may be stand alone. The design problem is amenable to solution by specific techniques practised regularly. This outcome is concerned with the understanding of a problem: Outcome 2 is concerned with the solution.	Please refer to section 6 to 9 of the Subdiscipline-specific Training Requirements document above.

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Competency Standards for registration as a Specified Category Rational Designer	Explanation and responsibility level
Outcome 2: Design or develop (plan) sustainable solutions to <i>complex / broadly defined / well-defined</i> engineering problems (tasks).	Responsibility Level C Design means 'drawing or outline from which something can be made'. Develop means 'come or bring into a state in which it is active or visible'.
Competency indicators: This outcome is normally demonstrated after a problem analysis, as defined in Outcome 1. Working systematically to synthesise a solution to a <i>complex / broadly defined / well-defined</i> problem typified by the following performances is expected: 2.1 Describe how <u>you</u> designed or developed and analysed alternative approaches to do the work. (Impacts and sustainability checked. Calculations attached). 2.2 State <u>your</u> final solution to perform the work, client or supervisor in agreement.	The task given must be fully understood and interpreted and solutions developed (designed) to execute. Synthesis of a solution means 'the combination of separate parts, elements, substances, etc. into a whole or into a system' by the following: 2.1 More than one way to conduct an engineering task or to solve a problem should always be developed (designed), and a costing and impact assessment for each alternative must be included. All the alternatives must meet the requirements set out by the instruction received, and the theoretical calculations to support each alternative must be done and submitted as an attachment. The alternatives must be within the imposed legal boundaries. 2.2 In some cases, Candidate Dam Specialists will not be able to support proposals with the complete theoretical calculation to substantiate every aspect and in these cases, they must refer their alternatives to a Professional for scrutiny and support. The alternatives and the recommended alternative must be convincingly detailed to win customer support for the alternative that is recommended. Selection of alternatives may be based on tenders submitted, with the submitted alternatives deviating from those specified.
Range statement: The solution conforms to specific established methods, techniques or procedures within the <i>complex / broadly defined / well-defined</i> competency area. Engineering should not only look to decrease impacts but also to restore and regenerate through design.	Applying theory to <i>complex / broadly defined/ well-defined engineering work</i> is done in a way that has been used before, probably developed by experienced Professionals in the past and documented in written procedures, specifications, drawings, models, examples, etc. Candidate Dam Specialists must seek approval and engineering verification for any deviation from these established methods.

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<p>Outcome 3: Comprehend and apply knowledge embodied in established specific engineering practices and knowledge specific to the field in which he/she practises.</p>	<p>Responsibility Level E Comprehend means 'to understand fully'. The jurisdiction in which a Dam Specialists practises is given in section 6 to 9 of the applicable Subdiscipline-specific Training Guide above.</p>
<p>Competency indicators: This outcome is normally demonstrated in the course of the design, investigation or operations confined to the competency area.</p> <p>3.1 State which high-level engineering standard procedures and systems <u>you</u> used to execute the work and how high-level theory was applied to understand and/or verify these procedures.</p> <p>3.2 Give <u>your</u> theoretical calculations and/or reasoning on why the application of this theory is considered correct (actual examples).</p>	<p>Design (development) work for Candidate Dam Specialists is mainly to utilise, configure, certify, test, verify, etc. manufactured components or proven engineering or management systems, and to design (develop) work using an existing design (development) as an example. Candidate Dam Specialists apply existing codes, policies and procedures in their design (developmental) work. Investigations are on specifically defined incidents, and condition monitoring and operations are mainly on controlling, maintaining and improving engineering systems and operations.</p> <p>3.1 The understanding of specifically defined procedures and techniques must be based on fundamental mathematical, scientific and engineering knowledge. Specific procedures and techniques applied to do the work accompanied by the underpinning theory must be given.</p> <p>3.2 Calculations confirming the correct application and utilisation of equipment and/or systems listed in the Subdiscipline-Specific Training Guide above must be done on practical complex / broadly-defined/ well-defined activities. Reference must be made to standards and procedures used and how they were derived from theory.</p>
<p>Range statement: Applicable knowledge includes the following:</p> <p>a) Technical knowledge that is applicable to the practice area irrespective of location and supplemented by locally relevant knowledge, for example, established properties of local materials.</p>	<p>a) The specific location of the task to be executed is the most important determining factor in the layout, design and utilisation of equipment and/or systems. A combination of educational knowledge and practical experience must be used to substantiate decisions taken, including a</p>

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b) A working knowledge of interacting disciplines confined to the competency area. Codified knowledge in related areas such as finance, statutory, safety, management and sustainability. c) Jurisdictional knowledge includes legal and regulatory requirements together with prescribed codes of practice.	comprehensive study of the laws, policies, procedures, standards, environment, manpower, materials, components and projected customer requirements and expectations. b) Despite having a working knowledge of interacting disciplines, Candidate Dam Specialists must appreciate the importance of working with specialists such as civil engineers on structures and roads, mechanical engineers on fire protection equipment, architects on buildings and electrical engineers on communication equipment. The codified knowledge in the related areas means understanding and working to the requirements set out by specialists in areas such as those mentioned. c) Jurisdictional in this instance means ‘having the authority’ and Candidate Dam Specialists must adhere to the terms and conditions associated with each task undertaken. They may even be appointed as the ‘responsible person’ for specific duties in terms of the OHS Act.
Outcome 4: Manage part or all of one or more <i>complex / broadly defined / well-defined</i> engineering activities.	Responsibility Level E Manage means ‘control’.
Competency indicators: The display of personal and work process management abilities within the competency area is expected: 4.1 State how <u>you</u> managed yourself, priorities, processes and resources in doing the work (e.g., bar chart) 4.2 Describe <u>your</u> role and contribution in the work team.	In engineering operations and projects, Candidate Dam Specialists will typically be given the responsibility to carry out specific tasks and/or complete projects. 4.1 Resources are usually subdivided based on availability and are controlled by a work breakdown structure and scheduling to meet deadlines. Quality, safety and environmental management are important aspects. 4.2 Depending on the task, the Candidate Dam Specialists can be the manager, team leader or a team member and can supervise appointed contractors.

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Competency Standards for registration as a Specified Category Rational Designer	Explanation and responsibility level
Outcome 5: Communicate clearly with others in the course of his/her <i>complex / broadly defined / well-defined</i> engineering activities.	Responsibility Level E
Competency indicators: Demonstrates effective communication by the following: 5.1 State how <u>you</u> presented your point of view and compiled reports after completion of the work. 5.2 State how <u>you</u> compiled and issued instructions to entities working on the same task.	5.1 Refer to Range Statement for Outcomes 4 and 5. Presentation of point of view mostly occurs in meetings and discussions with the immediate supervisor. 5.2 Refer to Range Statement for Outcomes 4 and 5.
Range statement for outcomes 4 and 5: Management and communication in <i>complex / broadly defined / well-defined engineering</i> involves the following: a) Planning activities b) Organising activities c) Leading activities d) Implementing activities e) Controlling activities Communication relates to technical aspects and wider impacts of professional work. Audiences include peers, other disciplines, clients and stakeholders. Appropriate modes of communication must be selected. The Specified Category	a) Planning means ‘the arrangement for doing or using something, considered in advance’. b) Organising means ‘put into working order; arrange in a system; make preparations for’. c) Leading means to ‘guide the actions and opinions of; influence; persuade’. d) Implementing means to ‘carry an undertaking, agreement or promise into effect’. e) Controlling means the ‘means of regulating, restraining, keeping in order; check’. Candidate dam specialist participate in writing or adhere to specifications for the purchase of materials and/or work to be done, make recommendations on tenders received, place orders and variation orders, write work instructions, report back on work done, draw, correct and revise drawings, compile test reports, use operation and maintenance manuals to write or apply work procedures, write inspection and audit reports, write commissioning reports, prepare and present motivations for new projects, compile budgets, report on studies done and calculations carried out, report on customer requirements, report on safety incidents and risk analysis, report on equipment failure, report on

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Specialist is expected to perform the communication functions confined to the competency area reliably and repeatedly.	proposed system improvement and new techniques, report back on cost control, report on environmental impact and sustainability, etc.
Group C: Risk and impact mitigation	Explanation and responsibility Level
Outcome 6: Recognise the reasonably foreseeable social, cultural, environmental and sustainability effects of <i>complex / broadly defined / well-defined</i> engineering activities.	Responsibility Level D Social means ‘people living in communities; of relations between persons and communities’. Cultural means ‘all the arts, beliefs, social institutions, etc. characteristic of a community’. Environmental means ‘surroundings, circumstances, influences’. Sustainable is defined in the definitions below.
Competency indicators: This outcome is normally displayed in the course of analysis and the solution of problems within the competency area: 6.1 Describe the social, cultural, environmental impact and long-term sustainability of the engineering activity 6.2 State how you communicated mitigating measures to affected parties and acquired stakeholder engagement.	6.1 Engineering significantly affects the environment (e.g., servitudes, expropriation of land, excavation of trenches with associated inconvenience, borrow pits, dust and obstruction, street and other crossings, power dips and interruptions, visual and noise pollution, malfunctions, oil and other leaks, electrocution of human beings, detrimental effect on animals and wild life, dangerous rotating and other machines and demolishing of structures). 6.2 Mitigating measures taken may include environmental impact studies, environmental impact management, community involvement and communication, barricading and warning signs, temporary crossings, alternative supplies (ring feeders and bypass roads), press releases and compensation paid.

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Outcome 7: Meet all legal and regulatory requirements, protect the health and safety of persons and adhere to sustainable practices in the course of his/her <i>complex / broadly defined / well-defined</i> engineering activities.	Responsibility Level E
Competency indicators: 7.1 List the major laws and regulations applicable to this particular activity and how sustainability practices and health and safety matters were handled. 7.2 State how <u>you</u> obtained advice regarding risk management for the work and elaborate on the risk management system applied.	7.1 The OHS Act is supplemented by a variety of parliamentary Acts, regulations, local authority by-laws, standards and codes of practice. Places of work may have standard procedures, instructions, drawings and operation and maintenance manuals available. Depending on the situation (emergency, breakdown, etc.), these documents are consulted before work is commenced and during the activity. 7.2 It is advisable to attend a Risk Management (Assessment) course and to investigate and study the materials, components and systems used in the workplace. Candidate Dam Specialists must seek advice from knowledgeable and experienced specialists if any doubt exist that safety and sustainability cannot be guaranteed.
Range statement for outcomes 6 and 7: Impacts and regulatory requirements include the following: a) Impacts to be considered are generally those identified within the established methods, techniques or procedures used in the specific practice area. b) Regulatory requirements are prescribed. c) Apply prescribed risk management strategies. d) Consider effects to be and define methods used.	a) The impacts will vary substantially with the location of the task (e.g., the impact of laying a cable or pipe in the main street of town will be entirely different to the impact of construction in a rural area.) The methods, techniques and procedures will differ accordingly and are identified and studied by the Candidate Dam Specialists before starting the work. b) The Safety Officer and/or the Responsible Person appointed in accordance with the OHS Act usually confirms or checks that the instructions are in line with regulations. Candidate Dam Specialists are responsible for making certain that this is done and if not, to establish which

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e) Prescribe safe and sustainable materials, components and systems. f) Prescribe maintenance protocols. g) Persons' health and safety are to be protected both inside and outside the workplace.	regulations apply and ensure that they are observed. Usually, the people working on site are strictly controlled w.r.t. health and safety, but Candidate Dam Specialists check that this is done. Tasks and projects are mainly carried out where contact with the public cannot be avoided, and safety measures such as barricading and warning signs must be used and maintained. c) Risks are mostly associated with elevated structures, subsidence of soil, electrocution of human beings, moving parts on machinery, fraud and corruption, and theft. Risk-management strategies are usually designed by more senior staff but are understood and applied by the Candidate Dam Specialists. d) Effects associated with risk management are mostly well known if not obvious, and the methods used to address, these effects are clearly defined. e) Usually, the safe and sustainable materials, components and systems are prescribed by Registered Professionals or other specialists. It is the responsibility of Candidate Dam Specialists to use their knowledge and experience to check and interpret what is prescribed and to report anything with which they are not satisfied. f) Draw up maintenance systems and procedures from the Codes of Practice and the Manufacturer's Instructions. g) Staff working on the task or project and persons affected by the engineering work being carried out.
Group D: Act ethically, Exercise judgement and Take responsibility and	Explanation and Responsibility Level
Outcome 8: Conduct engineering activities ethically.	Responsibility Level E Ethically means 'science of morals; moral soundness'. Moral means 'moral habits; standards of behaviour; principles of right and wrong'.

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	Systematic means 'methodical; based on a system'.
<p>Competency indicators: Sensitivity to ethical issues and the adoption of a systematic approach to resolving these issues is expected:</p> <p>8.1 State how <u>you</u> identified ethical issues and affected parties and their interests and indicate the actions you took when a problem arose.</p> <p>8.2 Confirm <u>you</u> are conversant and in compliance with the ECSA Code of Conduct and why this is important in <u>your</u> work.</p>	<p>8.1 Ethical problems that can occur include tender fraud, payment bribery, alcohol abuse, sexual harassment, absenteeism, favouritism, defamation, fraudulent overtime claims, fraudulent expenses claimed, fraudulent qualifications and misrepresentation of facts.</p> <p>8.2 The ECSA Code of Conduct as per the ECSA website is known and observed. Give applicable examples.</p>
<p>Outcome 9: Exercise sound judgement in the course of <i>complex / broadly defined / well-defined</i> engineering activities.</p>	<p>Responsibility Level E Judgement means 'good sense: ability to judge'.</p>
<p>Competency indicators: Exhibition of judgement is expected by the following:</p> <p>9.1 State the factors applicable to the work, their interrelationship and how <u>you</u> applied the most important factors.</p> <p>9.2 Describe how <u>you</u> foresaw work consequences and evaluated situations in the absence of full evidence.</p>	<p>9.1 The extent of a project or task given to a Candidate Dam Specialist is characterised by the number of factors and their resulting interdependence. Candidate Dam Specialists must seek advice if educational and/or experiential limitations are exceeded. Examples of the main engineering factors applied must be given.</p> <p>9.2 Taking risky decisions will lead to equipment failure, excessive installation and maintenance costs, damage to persons and property, bankruptcy, poor service delivery, etc. Give examples.</p>
<p>Range statement for outcomes 8 and 9: Judgement is expected both within the application of the candidate's category, specific methods and techniques and specific</p>	<p>In engineering, about 15% of the activities can be classified as specifically defined. In such activities, Candidate Dam Specialists use standard procedures, codes of practice, specifications, etc. Judgment</p>

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<p>procedures and in assessing their immediate impacts. Judgement in decision-making involves:</p> <p>a) taking limited risk factors into account, some of which may be ill-defined;</p> <p>b) taking consequences in the immediate work contexts into account; or</p> <p>c) taking the identified set of interested and affected parties with defined needs into account.</p>	<p>must be displayed to identify any activity falling outside the range of the Dam Specialists as defined above:</p> <p>a) Seeking advice when risk factors exceed their capability.</p> <p>b) Consequences outside the immediate work contexts (e.g. long-term) not normally handled.</p> <p>c) Interested and affected parties with defined needs outside the parameters of Candidate Dam Specialists to be taken into account.</p>
<p>Outcome 10:</p> <p>Be responsible for making decisions on part or all of one or more complex/broadly defined/well-defined engineering activities.</p>	<p>Responsibility Level E</p> <p>Responsible means 'legally or morally liable for carrying out a duty; for the care of something or somebody in a position where one may be blamed for loss, failure, etc.'</p>
<p>Competency indicators: Responsibility is displayed by the following performance:</p> <p>10.1 Show how <u>you</u> used high-level theoretical calculations to justify decisions taken in doing engineering work. (Attach actual calculations).</p> <p>10.2 State how <u>you</u> sought responsible advice on any matter falling outside your own education and experience.</p> <p>10.3 Describe how <u>you</u> took responsibility for <u>your</u> own work and evaluated any shortcomings in <u>your</u> output</p>	<p>10.1 The calculations, for example, fault levels, load calculations, losses, and return on investment are done to ensure that the correct material and components are used</p> <p>10.2 Candidate Dam Specialists do not operate on tasks outside the Dam Specialist's range; they consult professionals if elements of the tasks to be done are beyond their education and experience (e.g., power system stability, legal actions).</p> <p>10.3 This continuous self-evaluation is to ascertain that the task given is done correctly, on time and within budget. Continuous feedback to the originator of the task instruction and corrective action, if necessary, form an important element.</p>

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Range statement: Responsibility must be discharged for significant parts of one or more <i>complex / broadly defined / well-defined</i> engineering activities.	The responsibility is mostly allocated within a team environment, with increasing designation as experience is gathered.
Note 1: Responsibility for the evaluation of work in a supervisory capacity.	
Group E: Initial Professional Development (IPD)	Explanation and Responsibility Level
Outcome 11: Undertake sufficient independent learning activities to maintain and extend competence.	Responsibility Level D
Competency indicators: Self-development typically managed by the following: 11.1 Provide the strategy that you adopted independently to enhance the professional development (IPD report). 11.2 Be aware of the philosophy of the employer regarding professional development.	11.1 If possible, a specific field of the subdiscipline is chosen, available developmental alternatives are established, a programme is drawn up (in consultation with employer if costs are involved), and available options are investigated to expand knowledge into additional fields. 11.2 Record keeping must not be left to the employer or to any other person. The trainee must manage his/her own training independently, taking initiative and being in charge of experiential development towards Dam Specialists) registration. Knowledge of the employer's policy and procedures on training is essential.
Range statement: Professional development involves the following: a) Taking ownership of own professional development. b) Planning own professional development strategy. c) Selecting appropriate professional development activities.	a) This is your professional development, not that of the organisation for which you work. b) In most places of work, training is seldom organised by a training department. It is the responsibility of Candidate Dam Specialists to manage their own experiential development. Candidate Dam Specialists frequently find themselves at a standstill and are left doing repetitive work. If self-development is not self-driven, success is unlikely. c) Preference must be given to engineering development rather than developing soft skills.

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d) Recording professional development strategy and activities while displaying independent learning ability.	d) Developing a learning culture in the workplace environment of Candidate Dam Specialists is vital to their success. Information is readily available and most senior personnel in the workplace are willing to mentor if approached.

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