

## **SQA Advanced Unit specification**

### **General information**

**Unit title:** Public Health Engineering (SCQF level 8)

**Unit code:** HR5L 48

**Superclass:** TL

**Publication date:** August 2017

**Source:** Scottish Qualifications Authority

**Version:** 01

### **Unit purpose**

The purpose of the Unit is to develop learner knowledge and skills in the principles and practice of wastewater treatment and management incorporating sustainable systems throughout.

### **Outcomes**

On successful completion of the Unit the learner will be able to:

- 1 Apply hydrological and sustainable principles to the design of surface water drainage systems.
- 2 Explain the design of foul and combined sewerage systems.
- 3 Describe and explain the requirements for the control of discharges to rivers and coastal waters.
- 4 Explain the functions and designs of wastewater treatment elements.

### **Credit points and level**

1 SQA Advanced Unit credit at SCQF level 8: (8 SCQF credit points at SCQF level 8)

### Recommended entry to the Unit

Learners should be following a Civil Engineering programme or have at least attained the Unit: *Civil Engineering Specialisms*.

### Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

### Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (<http://www.sqa.org.uk/sqa/46233.2769.html>).

### Equality and inclusion

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements).

## **SQA Advanced Unit specification: Statement of standards**

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

### **Outcome 1**

Apply hydrological and sustainable principles to the design of surface water drainage systems.

#### **Knowledge and/or Skills**

- ◆ Rainfall characteristics
- ◆ Catchment characteristics
- ◆ Design methods
- ◆ System storage
- ◆ Sustainable drainage systems

### **Outcome 2**

Explain the design of foul and combined sewerage systems.

#### **Knowledge and/or Skills**

- ◆ System types
- ◆ Pipe design flows
- ◆ Pipe sizing
- ◆ Storage and overflow
- ◆ Construction
- ◆ Maintenance

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### Outcome 3

Describe and explain the requirements for the control of discharges to rivers and coastal waters.

#### Knowledge and/or Skills

- ◆ Pollutants
- ◆ Regulation
- ◆ Discharge standards
- ◆ Standard tests
- ◆ Dilution/dispersion

### Outcome 4

Explain the functions and designs of wastewater treatment elements.

#### Knowledge and/or Skills

- ◆ Performance requirements
- ◆ Preliminary treatment elements
- ◆ Primary treatment elements
- ◆ Secondary treatment elements
- ◆ Tertiary treatment elements
- ◆ Biochemical processes
- ◆ Sludge control

#### Evidence Requirements for this Unit

Assessment for each Outcome may be carried out on an individual basis or assessment of all four Outcomes could be carried out in a single assessment event. In either circumstance, total assessment time should not exceed three hours. Assessment events should be carried out in open-book, supervised and controlled conditions.

#### Outcome 1

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills across all Outcomes by showing that they can:

- ◆ specify and analyse problems in surface water drainage
- ◆ apply appropriate design criteria to determine suitable elements in surface water drainage
- ◆ provide sustainable solutions to surface water drainage problems

Evidence for the Knowledge and/or Skills for this Outcome will be provided on a sample basis. In any assessment for this Outcome, a minimum of **three out of five** Knowledge and/or Skills items should be sampled. Learners must provide a satisfactory response in regard to all three Knowledge and/or Skills items.

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### Outcome 2

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ identify appropriate design, construction and maintenance criteria for foul and combined sewerage
- ◆ specify and analyse problems in foul and/or combined sewerage
- ◆ explain the use of sustainable materials in construction and maintenance

Evidence for the Knowledge and/or Skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome, a minimum of **four out of six** Knowledge and/or Skills items should be sampled. Learners must provide a satisfactory response in regard to all four Knowledge and/or Skills items.

### Outcome 3

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ identify the regulatory framework controlling wastewater discharges
- ◆ explain the processes involved in pollutant reduction

Evidence for the Knowledge and/or Skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome, a minimum of **three out of five** Knowledge and/or Skills items should be sampled. Learners must provide a satisfactory response in regard to all three Knowledge and/or Skills items.

### Outcome 4

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ explain sewage treatment processes
- ◆ apply appropriate criteria to assess and/or design sewage treatment elements including sustainable options and solutions

Evidence for the Knowledge and/or Skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome, a minimum of **five out of seven** Knowledge and/or Skills items should be sampled. Learners must provide a satisfactory response in regard to all five Knowledge and/or Skills items.

### SQA Advanced Unit Support Notes

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Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

#### Guidance on the content and context for this Unit

This Unit provides the learner with the knowledge and skills to carry out basic designs of surface water drainage elements and sewage treatment elements. It introduces some key features of foul and combined sewerage systems and the control of discharges to receiving waters. It seeks to provide the learner with a basic environmental awareness in relation to public health engineering. Attention should be paid in the delivery of this Unit to the content of other related Units in the programme. In particular, it should be noted that some introductory material is featured in the Unit entitled *Civil Engineering Specialisms*. There is also a related Unit in *Water Supply Engineering* and *Hydrological Engineering*.

Recommended class time allocations to each Outcome are given as guidance towards the depth of treatment that might be applied to each topic. This guidance has been used in the design of the assessment exemplar material for this Unit.

#### 1 Hydrological and sustainable principles in the design of surface water drainage systems (10 Hours).

**Rainfall characteristics:** intensity/duration relationships; factors affecting intensity; standard methods of estimating design rainfall.

**Catchment characteristics:** area; soil type; wetness; permeability; shape; slope; routeing.

**Design methods:** modified rational and other methods; network checks by manual and/or computer based procedures.

**System storage:** headwater, on-line, off-line, and exit storage.

**Sustainable drainage systems:** storage ponds; swales; permeable areas; filter systems; quality issues.

#### 2 Design of foul and combined sewerage systems (10 Hours)

**System types:** large and small scale systems; combined, separate and partially separate systems.

**Pipe design flows:** gradient/depth/discharge/velocity relationships; dry weather flow; peak flow; self-cleansing velocity; infiltration; industrial flows; domestic flows; design charts and software; application to networks.

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**Pipe sizing:** rule-of-thumb methods; tables, charts and software for pipe sizing; network principles.

**Storage and overflow:** on-line storage; combined sewer overflows — types, requirements and pollution control.

**Construction:** manhole types and construction; pipe materials and bedding.

**Maintenance:** access; manual and automatic inspection techniques; health and safety issues.

### 3 Control of discharges to rivers and coastal waters (10 Hours).

**Pollutants:** sources, nature and extent of common wastewater borne pollutants and diseases.

**Regulation:** appropriate European and national statutory requirements for wastewater treatments and discharge; role of protection agencies.

**Discharge standards:** definitions of biochemical oxygen demand (BOD) and suspended solids (SS); appropriate standards; control of other specific pollutants.

**Standard tests:** sampling and testing for discharge and performance monitoring.

**Dilution/dispersion:** introduction to principles of interaction between discharge and receiving water; decay curves.

### 4 Function and design of wastewater treatment elements (10 hours).

**Performance requirements:** small and large scale works; principles of treatment; historical development; process reductions in BOD and SS; relationship to receiving water requirements.

**Preliminary treatment elements:** inlet works; screening; grit removal; comminution; grease removal; disposal of screenings; odour control.

**Primary treatment elements:** storm tanks; sedimentation processes; types and sizes of tank; sludge and scum removal.

**Secondary treatment elements:** oxidation ponds; activated sludge; percolating filters; reed beds.

**Tertiary treatment elements:** phosphate removal; filtration; ultraviolet disinfection; metallic element removal.

**Sludge control:** thickening; digestion; dewatering; disposal.

**Biochemical processes:** introduction to aerobic and anaerobic processes.

### Guidance on approaches to delivery of this Unit

Since this Unit relies in part on the learner's knowledge from a previously completed Unit, the Unit should be studied in the second year of a two-year programme. Case studies could usefully be employed to illustrate the practical working context of the material delivered. This might involve practitioners to deal with some aspects of the content or site visits where these are possible. In addition, where the centre has access to appropriate laboratories and /or design software, this might be used to allow a broader application of the concepts.

### Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Learners would normally work individually but should be encouraged to participate in group work and discussion in relation to their own studies or experiences. Assessment may be formative and summative and both may feature as part of the process. Although assessment must be focussed on the individual achievement of each learner, group work may contribute as appropriate. Integrative project work might assist in linking this Unit with other related Units. Appropriate attention must be given to health and safety arrangements in relation to the topics covered.

The volume of evidence required for each Outcome should take into account the overall number of assessments being contemplated within this Unit and the design of the overall delivery programme. In designing the assessment instrument(s) opportunities should be taken to generate appropriate evidence to contribute to the development of Core Skills elements.

Where available, evidence from the workplace can also be incorporated to enhance the learning Outcomes, provided that such evidence is appropriate and authenticated as the learner's own work.

### Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at [www.sqa.org.uk/e-assessment](http://www.sqa.org.uk/e-assessment).

### Opportunities for developing Core and other essential skills

There are opportunities to develop Core Skills in *Numeracy* and *Problem Solving* throughout this Unit.

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### History of changes to Unit

Version	Description of change	Date

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

**FURTHER INFORMATION:** Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our [Centre Feedback Form](#).

## **General information for learners**

**Unit title:** Public Health Engineering (SCQF level 8)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

On completion of the Unit you should be able to:

- 1 Apply hydrological and sustainable principles to the design of surface water drainage systems.
- 2 Explain the design of foul and combined sewerage systems.
- 3 Describe and explain the requirements for the control of discharges to rivers and coastal waters.
- 4 Explain the functions and designs of wastewater treatment elements.

There are opportunities to develop Core Skills in *Numeracy* and *Problem Solving* throughout this Unit.