



Higher National Unit specification

General information for centres

Unit title: Reclamation of Degraded Land

Unit code: F6CS 35

Unit purpose: Reclamation of degraded land is an increasingly important issue. This Unit will highlight the problems caused by degraded land and allow candidates to explore methods of improving the land and how it can be brought back into use. Legal, environmental and social issues in relation to degraded land will be described, and appropriate survey techniques and reclamation techniques will be explored in relation to one or more case study sites. At the end of this Unit, candidates should be able to identify issues relevant to degraded land, and be able to recommend appropriate reclamation techniques.

On completion of the Unit the candidate will be able to:

- 1 Evaluate the problems associated with degraded land.
- 2 Explain a range of reclamation techniques used to improve degraded land.
- 3 Evaluate an area of degraded land for reclamation.

Credit points and level: 1 HN credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Recommended prior knowledge and skills: There are no mandatory prior knowledge requirements, however it would be beneficial if the candidate had competence relating to basic environmental science, soil science, laboratory and field monitoring techniques. This may be evidenced by possession of one or more of the following HN Units: *Pollution and Waste Management: An Introduction, Soil Management, Monitoring and Analytical Methods for Environmental Science.*

Core Skills: There are opportunities to develop the Core Skills of *Communication* and *Problem Solving* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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.

General information for centres (cont)

Assessment: The Unit could be assessed by individual assessments for each Outcome, or a single report based on one or more study sites, which could cover all Outcomes.

Higher National Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

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. Candidates 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

Evaluate the problems associated with degraded land

Knowledge and/or Skills

- ◆ Types of degraded land
- ◆ Environmental issues
- ◆ Socio-economic issues
- ◆ Legal issues

Evidence Requirements

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

- ◆ explain three types of degraded land, including one from each of the following categories: derelict, disturbed, contaminated, or a combination of these
- ◆ explain at least three relevant legal issues associated with degraded land
- ◆ evaluate at least three environmental and socio-economic issues associated with degraded land

Assessment Guidelines

This Outcome may be assessed by means of an extended-answer open-book test, with a suggested word limit of 500 words or equivalent. Alternatively, the assessment for this Outcome could be combined with Outcomes 2 and 3 as part of a single report based on a case study (see Outcome 3).

Higher National Unit specification: statement of standards (cont)

Unit title: Reclamation of Degraded Land

Outcome 2

Explain a range of reclamation techniques used to improve degraded land

Knowledge and/or Skills

- ◆ Remediation of contamination
- ◆ Site stabilisation
- ◆ Revegetation
- ◆ Aftercare

Evidence Requirements

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

- ◆ for a specific example of contaminated land, evaluate the appropriateness of two examples from each of the above reclamation techniques

Assessment Guidelines

This Outcome may be assessed by means of extended-response questions, formatted and submitted in report format, with a word limit of 1000 words or equivalent. Alternatively, the assessment for this Outcome may be combined with those for Outcomes 1 and 3, as part of a report based on a case-study (see Outcome 3 for details).

Higher National Unit specification: statement of standards (cont)

Unit title: Reclamation of Degraded Land

Outcome 3

Evaluate an area of degraded land for reclamation

Knowledge and/or Skills

- ◆ Site survey methodology
- ◆ Reclamation techniques
- ◆ End-use of land

Evidence Requirements

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

- ◆ for one degraded land example site, evaluate possible site survey methodology, including appropriate soil analysis techniques, and recommend appropriate survey techniques to use
- ◆ interpret the results of surveys and soil analyses to identify and justify appropriate land reclamation techniques (two techniques from each of: remediation of contamination, site stabilisation, revegetation, aftercare)
- ◆ evaluate the most appropriate end-use of land

Assessment Guidelines

This Outcome may be assessed by means of extended-answer questions, based on one study site, which may be formatted and submitted in report format, with a word limit of 1,000 words or equivalent. Alternatively, the assessment for this Outcome may be combined with assessments for Outcomes 1 and 2, and take the form of a structured series of extended-answer open-book questions, all based on one degraded land example, which may be formatted and submitted in report format, with a word limit of 2,000 words or equivalent.

Administrative Information

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Higher National Unit specification: support notes

Unit title: Reclamation of Degraded Land

This part of the Unit specification is offered as guidance. The support notes 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

Outcome 1: Degraded land includes derelict land, disturbed land (temporarily degraded) and contaminated land (as defined by Part IIA of the EPA 1990). It also includes agricultural land that has been badly mismanaged (eg through over-irrigation (causing salinisation), desertification, exhaustion of nutrients, erosion, compaction, or acidification).

The term ‘Brownfield land’ is often used in this context, meaning ‘*Previously Developed Land*’. Such land can consist of vacant land (land which has stood idle for a significant length of time. Vacant land is not necessarily ‘degraded’); derelict land and buildings; other land or buildings currently in use for which re-development is planned.

Derelict land is land which requires investment in order to bring it back into productive use. Derelict land includes post-industrial sites (eg abandoned gas works, processing plants, manufacturing sites, harbours) and urban clearance sites (eg demolition sites). It does **not** include abandoned agricultural land. Derelict land is not necessarily ‘contaminated’.

Disturbed land includes open cast mines, quarries, landfills and construction sites (eg new roads, pipelines, housing). Contamination is not normally a problem, but it can be (eg through spillage of oil). Compaction often occurs. Problems also result from the incorrect storage and management of topsoil that has been stripped off the site prior to working. Potential serious off-site problems of erosion and run-off (causing water pollution) can occur.

Contaminated land is land which contains substances that pose a significant risk of significant harm to components of the environment (eg humans, water courses, buildings, livestock, terrestrial ecosystems). Contaminants include inorganic compounds (eg heavy metals, sulphides, acids, alkalis) and organic compounds (eg solvents, PCBs, PAHs, benzene, tars and oils). They can be solids, dissolved substances, liquids (miscible and immiscible), and gases (eg methane). Typical contaminated sites include those post-industrial sites listed above (see Derelict Land), plus accidental spillages or emissions (eg Cs-137 radionuclide fall-out from Chernobyl).

The problems presented to the reclamation of these sites and the restoration to a usable or safe state are many and diverse and include: contamination (with zootoxic or phytotoxic elements or compounds), poor edaphic conditions (eg nutrient deficiencies, extreme pH, waterlogging, droughtiness, compaction, low soil organic matter content), and low inherent soil biological activity. Site stability might also be an issue as this can cause mass movements (eg landslides) and erosion.

Higher National Unit specification: support notes (cont)

Unit title: Reclamation of Degraded Land

Such problems affect humans directly (eg through the presence of asbestos) and indirectly (eg via the ingestion of toxins by grazing livestock), and they also seriously affect the re-vegetation (or other end-uses) of the sites. Much legislation exists controlling reclamation and which defines the responsibilities of persons and groups. This Unit should describe the relevant Acts and Regulations and state the function of the relevant regulatory bodies (eg SEPA and Unitary Authorities). Legal issues involve statute law (as laid down by the Acts and Regulations), and common law (eg Nuisance). Liability (and the Polluter Pays Principle) is also often a legal issue.

Outcome 2. Reclamation of contaminated land involves identifying the pollutant linkages present on a site and then addressing either the source of the contaminant(s) (eg heavy metals), the pathway (eg leaching or root uptake), the target (eg homes or groundwater), or a combination of all three. Techniques in **remediation of contamination** include reducing the mobility of the contaminant (eg through liming soils), removing contaminants (eg soil washing), constructing barriers (eg cover systems), or changing the proposed end-use of the site (eg industrial estates are far less sensitive than allotments).

Site stabilisation mainly involves preventing landslides or erosion. Techniques include hydro-seeding, construction of gabions, gradient reduction (eg terracing), using geo-textiles, mulching, or installing drainage systems.

Revegetation of degraded sites often requires over-coming problems of soil fertility. Soil management operations include liming, nutrient application, drainage, compaction removal (and avoidance), increasing soil organic matter levels, de-stoning, and improving soil biological activity (perhaps by seeding with earthworms or inoculating with diazotrophs or mycorrhizae). Other revegetation techniques might include the use of nurse crops, sowing of legumes, tree-planting methods (eg choice of whips, feathers or standards), or decisions made on plant species or habitats.

Aftercare involves monitoring (eg monitoring the potential migration of contaminants into water courses), maintenance (maintaining the status quo, ensuring that the scheme retains its integrity) and management (operations designed to direct the development of the site in a particular direction (eg the succession of grassland through scrub to oak woodland)). Methods include pest control (eg culling of rabbits to prevent unearthing of cover systems), controlling erosion, thinning of trees, sampling of water courses / dip-wells, appropriate grazing by livestock, mowing of grass, maintaining revetments etc.

Outcome 3. Site survey includes desk-top surveys (eg maps, archive information), preliminary ground surveys (walking the site), and intensive soil, geological and ecological surveying. Methods include invasive techniques (eg taking soil samples) and non-invasive techniques (eg the use of ground-penetrating radar). Consideration should be given to pattern of sampling (random, stratified random, grid etc), intensity of sampling (ie number per hectare), depth of samples, media to be sampled (gases, soils, water), repeat and / or targeted sampling, and timing of sampling. Results of soil analysis indicate the presence or absence of contamination or soil fertility problems. Candidates should refer to interpretation tables in order to evaluate the results.

The end-use of the land is greatly affected by the available budget and the problems presented by the site as this can affect suitability of reclamation methods (which might not be available, might be too costly or might be too slow). Candidates should be able to discuss these issues in the context of the case study. Given the nature of the site and the proposed end-use, appropriate reclamation techniques should be recommended.

Higher National Unit specification: support notes (cont)

Unit title: Reclamation of Degraded Land

Guidance on the delivery and assessment of this Unit

Outcome 1: Outcome 1 could be taught by a combination of in-class lectures and talks from practitioners / consultants.

Outcome 2: Outcome 2 could be taught mainly by in-class lectures.

Outcome 3: This Outcome could be taught as a series of case studies (or a single detailed case study) alongside lectures describing and explaining the principles of reclamation. This Unit could be well served by co-ordinating the delivery with other Units such as Soil Management, Monitoring and Analytical Techniques for Environmental Science, and Scottish Rural Development. For example, alongside the site survey and sampling, candidates could undertake laboratory analysis to establish P, K, Mg and heavy metal levels, as well as pH, EC and organic matter status.

The Outcomes for this Unit may be assessed by individual assessments, as described for each Outcome. However, it may be beneficial for the students to gain a more holistic view of land reclamation issues through the combination of assessments for all three Outcomes into one assessment. To guide students, this may take the form of a structured series of extended-response questions, covering all Evidence Requirements. When taken together, these questions should take the candidate through consideration of necessary issues to address in land reclamation (including legal, environmental and social), as well as going through an appropriate sequence of events necessary to evaluate degraded land, and then finally recommending appropriate reclamation techniques and appropriate land end-use.

Opportunities for developing Core Skills

There are opportunities to develop the Core Skills of *Communication* and *Problem Solving* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components. The Core Skill of *Problem Solving* may be developed in particular in relation to Outcomes 2 and 3, where candidates may have to critically assess a range of techniques in relation to site remediation. The Core Skill of *Communication* may be developed in all Outcomes, through the production of written answers and reports.

Open learning

It would be difficult to deliver this Unit via Distance Learning solely. Much of the theory (eg reclamation methods, legal issues, environmental problems) *is* amenable to candidates learning through workbooks etc., but the Unit (especially Outcome 3) is essentially about experiencing degraded sites *in situ*. Study weekends could be organised to compliment electronic or paper-based formats however.

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements

General information for candidates

Unit title: Reclamation of Degraded Land

Land degradation is a serious issue facing most of the world. There are an estimated 300,000 ha of contaminated land in England and Wales. Some people estimate that up to 60% of, for example, Glasgow lies on contaminated land. In Scotland there are around 11,000 ha of vacant and derelict land. Land is constantly being disturbed by construction of new road networks, new housing estates, and pipelines being installed for gas, water, electricity, and telecommunications. Agricultural land in parts of the world is going out of production (due to poor soil management practices) faster than new land is being reclaimed.

The Unit is designed to highlight the problems caused by degraded land: problems to the environment such as water pollution and human health hazards; problems to habitats and conservation sites; and problems of redevelopment (eg social and economic blight), liability, and costs of remediation.

There are many techniques now available to remediate such land. Some of these are simple and cheap (such as removing compaction or liming soils, or ‘dig-and-dump’ contaminated material); others are more technical and innovative (such as the use of bioreactors). Methods can be based on complex engineering principles (such as the use of sophisticated barriers to prevent the movement of contaminants), electro-chemical or chemical processes (eg electro-kinetic removal of heavy metals, or soil washing techniques), or bioremediation (eg using trees to decontaminate soils — phytoremediation).

This Unit will concentrate on methods of reclaiming land with the aim of returning soils to productive *vegetative* use, whether that’s for agriculture or landscaping or conservation. Surveying techniques will be explained in the context of an existing site (or sites). Candidates will be required to interpret the information and, combined with data from soil analyses, evaluate the problems presented by the site. Candidates will propose a suitable end-use and, given this and the site data, recommend appropriate remediation methods.

There are opportunities to develop the Core Skills of *Communication* and *Problem Solving* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.