



## **National Unit specification: general information**

**Unit title:** Using a Geographical Information System

**Unit code:** FN4W 12

**Superclass:** RF

**Publication date:** August 2011

**Source:** Scottish Qualifications Authority

**Version:** 02

### **Summary**

The purpose of this Unit is to enable candidates to understand the origins and fundamentals of a Geographical Information System (GIS), how these are applied and by whom. Candidates will develop practical skills in using a GIS to import, edit, manipulate and analyse data and display and present their findings.

This is a mandatory Unit within the National Progression Award in Geographical Information Systems: An Introduction (SCQF level 6), but can also be taken as a free-standing Unit.

This Unit is suitable for candidates who:

- ◆ are using GIS for the first time
- ◆ wish to obtain knowledge of GIS theory and associated practical skills
- ◆ are considering further study or employment in a field which requires a basic knowledge of GIS

### **Outcomes**

- 1 Investigate the development, definitions and components of a GIS.
- 2 Explain the functions and operations of a GIS.
- 3 Investigate a range of GIS users and applications.
- 4 Apply basic GIS skills to produce outputs.

## National Unit specification: general information (cont)

**Unit title:** Using a Geographical Information System

### Recommended entry

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

- ◆ English at Standard Grade (Credit) or equivalent
- ◆ Mathematics at Standard Grade (Credit) or equivalent
- ◆ Geographical Information Systems: Managing Data (SCQF Level 6)
- ◆ Basic IT skills, which could be evidenced by attainment of Intermediate 1 ICT Core Skill or equivalent qualification or comparable level of skill obtained through experience

### Credit points and level

1 National Unit credit at SCQF level 6: (6 SCQF credit points at SCQF level 6\*)

*\*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.*

### Core Skills

Achievement of this Unit gives automatic certification of the following Core Skills component:

- ◆ Critical Thinking at SCQF level 6

There are also opportunities to develop aspects of Core Skills which are highlighted in the Support Notes of this Unit specification.

## **National Unit specification: statement of standards**

**Unit title:** Using a Geographical Information System

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.

### **Outcome 1**

Investigate the development, definitions and components of GIS.

#### **Performance Criteria**

- (a) Investigate the origins and evolution of GIS.
- (b) Research and evaluate a range of GIS definitions.
- (c) Identify and describe the components of a GIS.

### **Outcome 2**

Explain the functions and operations of a GIS.

#### **Performance Criteria**

- (a) Identify the functions of a GIS.
- (b) Explain how the various functions work.

### **Outcome 3**

Investigate a range of GIS users and applications.

#### **Performance Criteria**

- (a) Identify a range of sectors where GIS is used.
- (b) Describe a range of applications of GIS in different sectors.
- (c) Describe the benefits to an organisation of use of a GIS.

### **Outcome 4**

Apply basic GIS skills to produce outputs.

#### **Performance Criteria**

- (a) Import data into a GIS.
- (b) Edit and manipulate data in preparation for analysis.
- (c) Formulate queries for interrogation of the data.
- (d) Produce outputs in a range of visual formats appropriate to the data.
- (e) Interpret patterns and trends suggested by the produced outputs.

## National Unit specification: statement of standards (cont)

**Unit title:** Using a Geographical Information System

### Evidence Requirements for this Unit

Written and/or oral recorded evidence is required to demonstrate that the candidate has achieved all of the Outcomes and Performance Criteria.

The evidence should be produced under open-book supervised conditions. Assessment for this Unit may be generated holistically.

**Outcomes 1–4** written and or oral recorded evidence is required consisting of:

- ◆ an accurate description of how GIS developed
- ◆ an evaluation of at least **two** definitions of GIS
- ◆ identification and description of **five** basic components of a GIS
- ◆ identification of **five** basic functions of a GIS and an explanation of how these functions work
- ◆ identification of at least **two** sectors in which GIS is used
- ◆ description of **two** applications of GIS in these sectors and their benefits to an organisation
- ◆ at least **four** outputs to demonstrate that the candidate has achieved all of the Performance Criteria

## National Unit specification: support notes

### Unit title: Using a Geographical Information System

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

This is a mandatory Unit within the National Progression Award in Geographical Information Systems: An Introduction (SCQF level 6), but can also be taken as a free-standing Unit.

The purpose of this Unit is to enable candidates to understand the origins and fundamentals of Geographical Information Systems (GIS), how these are applied and by whom. Candidates will develop practical skills in using a GIS to import, edit, manipulate and analyse data and in display and presentation of their findings. Where candidates are studying this Unit as part of the National Progression Award in Geographical Information Systems: An Introduction, Outcome 3 in particular may provide ideas for the GIS Project Unit.

Content of the Unit to be covered should include:

#### Outcome 1

- (a) The origins and history of GIS.
- (b) A range of GIS definitions, with a focus on the capture, storage, management, analysis and display of spatial data.
- (c) The components of a GIS: spatial and other types of data, hardware, software, people and applications.

#### Outcome 2

The functions of a GIS:

- ◆ collection
- ◆ capture: digitisation and scanning
- ◆ storage: raster and vector
- ◆ manipulation: coordinate systems, map projections, map overlays, measurements, buffer zones
- ◆ analysis: database interrogation
- ◆ outputs: maps, tables, reports

## National Unit specification: support notes (cont)

**Unit title:** Using a Geographical Information System

### Outcome 3

- ◆ Sectors where GIS is used e.g. environment, crime, education, health, politics, planning, agriculture, civil engineering, mining, marketing, business
- ◆ How GIS is used in areas mentioned above. Individual users could include:
  - local/Scottish/UK governments
  - statutory agencies (SEPA, SNH, Historic Scotland, Forestry Commission)
  - NASA
  - NHS
  - police forces and insurance companies, eg in relation to crime mapping and analysis
- ◆ The benefits GIS use can bring to an organisation

### Outcome 4

This Outcome builds on knowledge developed in Outcomes 1–3 and on candidates' understanding of the theory underpinning the practical use of a GIS. It involves completion of a range of practical tasks including:

- ◆ importing data into a GIS
- ◆ formulating spatial queries for interrogation of the data
- ◆ exploring the range of visual outputs which could be used to display interrogation results
- ◆ interpreting patterns and trends suggested by these outputs

Outputs from these tasks could contribute to a folio of evidence which could be presented as part of the assessment requirements for the Unit.

Outcome 4 is based on the use of generic GIS software rather than any specific software package. If GIS software is not already accessible in a Centre, there are a number of free packages which can be downloaded from the Internet. At the time of writing these include:

- ◆ Mapmaker <http://www.mapmaker.com>
- ◆ MapWindow <http://www.mapwindow.org>
- ◆ DIVA-GIS <http://www.diva-gis.org>
- ◆ Quantum GIS <http://www.qgis.org>
- ◆ Arc Explorer <http://www.esri.com/software/arcgis/explorer/index.html>
- ◆ ILWIS <http://www.ilwis.org>
- ◆ IDRISI <http://www.clarklabs.org>

## National Unit specification: support notes (cont)

**Unit title:** Using a Geographical Information System

### National Occupational Standards

This Unit is aligned to the following National Occupational Standards for IT Users (NOS)

#### Using IT Systems: IT User Fundamentals

- ◆ IUF:B2 Manage information storage and retrieval appropriately

#### Using IT Systems: IT software fundamentals

- ◆ ISF:B1 Select and use appropriate software applications to meet needs and solve problems
- ◆ ISF:B2 Enter, develop, combine and format different types of information to suit its meaning and purpose
- ◆ ISF:B3 Present information in ways that are fit for purpose and audience

#### Using IT to find and exchange information: Communication fundamentals

- ◆ ICF:B1 Select and use a variety of sources of information to meet needs
- ◆ ICF:B2 Access, search for, select and use internet-based information and assess its fitness for purpose

#### Using IT productivity tools and applications: Bespoke or specialist software:

- ◆ BS:C3 Exploit the functions of the software effectively to process and present information
- ◆ BS:B3 Use the functions of the software effectively to process and present information

#### Using IT productivity tools and applications Database Software:

- ◆ DB:B2 Enter, edit and organise structured information in a database
- ◆ DB:C3 Use database software tools to create, edit and run data queries and produce reports
- ◆ ISF:B2 Enter, develop, combine and format software applications to meet needs and solve problems
- ◆ ISF:B3 Exploit the functions of software effectively to process and present information

#### Using IT productivity tools and applications: Spreadsheet software

- ◆ SS:A1 Use a spreadsheet to enter, edit and organize numerical and other data
- ◆ SS:A2 Use appropriate formulas and tools to summarise and display spreadsheet information
- ◆ SS:A3 Select and use appropriate tools and techniques to present spreadsheet information effectively

Source <http://www.e-skills.com>

## National Unit specification: support notes (cont)

**Unit title:** Using a Geographical Information System

### Guidance on learning and teaching approaches for this Unit

Delivery should be as practical as possible. This Unit is designed to encourage a practical and interactive approach to teaching and learning, with candidates gaining maximum benefit through a range of individual and group-based investigations and classroom discussions. A candidate-centred approach should be encouraged wherever possible in order that candidates' knowledge, understanding and practical skills are developed through personal discovery.

The Outcomes of this Unit are best taught in sequence as Outcomes 1–3 develop the theory underpinning use of a GIS, an understanding of which should be in place before candidates proceed to the practical elements of the Unit. Outcome 4 will require candidates to work independently. Candidates are likely to require guidance when developing practical GIS skills, and progress in using these skills may not coincide with delivery of theory. It is therefore recommended that this Outcome is taught after, and not concurrently with, the other Outcomes.

Because differing individual IT aptitude means that candidates are unlikely to all progress at the same rate, it is also suggested that they are provided with tutorial materials and allowed to work independently at their own pace, albeit within the allotted timeframe for the Unit, and with tutor guidance. Software providers typically provide such tutorial materials free of charge and these could be adapted for classroom use. Some software providers also provide sample data sets to accompany the tutorials. Data sets are also freely available from many Government departments via the internet. Where candidates are studying this Unit as part of the NPA in Geographical Information Systems: An Introduction, data collected for Outcome 4 in the Handling Data Unit could be used for this Outcome if suitable.

Further suggested learning and teaching approaches include:

- ◆ working in small research groups
- ◆ presenting findings to the class, either individually or as a group
- ◆ class discussions of the findings
- ◆ working individually to evaluate advantages and disadvantages of the topics
- ◆ delivery which encourages self-discovery, eg in exploring functions of the GIS software; learning through, creative and innovative approaches and applications e.g. a satellite navigation system, mobile phones and watches with in-built GPS, etc
- ◆ visiting, or having visits from, agencies where GIS is used on a regular basis. Many employers look for a working knowledge of GIS as a desirable skill and consequently the range of users and applications is very diverse
- ◆ making use of the internet to investigate users and research up-to-date applications



## **National Unit specification: support notes (cont)**

**Unit title:** Using a Geographical Information System

Using the above approaches, candidates may also develop essential skills for life, learning and work, including:

- ◆ Time Management
- ◆ Creativity and Innovation
- ◆ Analytical and Interpretative Skills
- ◆ Presentation Skills
- ◆ Independent Learning Resilience
- ◆ Responsibility
- ◆ Confidence

### **Guidance on approaches to assessment for this Unit**

Evidence for this Unit may be produced holistically. Candidates could produce one piece of evidence for assessment in a folio which would include:

- ◆ a report prepared under supervised conditions to an agreed brief
- ◆ evidence of the practical Outputs of the Unit developed and collated during the course of the Unit

If candidates have varied data interests, opportunities may exist for the assessment brief to be tailored to meet individual areas of interest. Alternatively, candidates could work on a single theme determined by the centre.

Information could be gathered by a range of methods, and may involve a mix of individual, small group or class work. Centres must be satisfied however that the final evidence submitted is the work of the individual candidate and that the candidate has participated actively in all group activities.

Time should be allowed for re-assessment. Where the Unit is assessed holistically candidates need only be re-assessed on those elements that have not met the Performance Criteria.

## National Unit specification: support notes (cont)

**Unit title:** Using a Geographical Information System

### Opportunities for the use of 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 e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

### Opportunities for developing Core Skills

In this Unit candidates will apply knowledge, understanding of how a GIS works and how it can be used.

Candidates will:

- ◆ research and describe the development of GIS
- ◆ identify and explain the functions and components of a GIS
- ◆ research applications of GIS in a variety of industry sectors
- ◆ apply skills to GIS to complete a series of practical tasks
- ◆ use GIS software to edit and manipulate data
- ◆ interpret findings and evaluate GIS outputs
- ◆ report/present findings in a variety of formats including graphical

This Unit has the Problem Solving component of Critical Thinking embedded in it, so when candidates achieve this Unit their Core Skills profile will be updated to show they have achieved Critical Thinking at SCQF Level 6.

Further development of all the above Core Skills may be achieved by adopting the learning and teaching approaches suggested in these support notes, eg Oral Communication through active participation in class discussions; oral presentation of findings and also Working with Others through working in small research groups.

### 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](http://www.sqa.org.uk/assessmentarrangements)

## History of changes to Unit

Version	Description of change	Date
02	Core Skills Component Critical Thinking at SCQF level 6 embedded.	08/08/2011

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