

City & Guilds Level 3 Advanced Technical Extended Diploma in Horticulture (1080) (0174-37)

April 2025 Version 2.7

(For delivery from September 2024)

Qualification Handbook

Qualification at a glance

Industry area	Horticulture and Forestry
City & Guilds qualification number	0174-37
Age group	16-19 (Key Stage 5), 19+
Entry requirements	Centres must ensure that any pre-requisites stated in the <i>What is this qualification about?</i> section are met.
Assessment	<p>To gain this qualification, candidates must successfully achieve the following assessments:</p> <ul style="list-style-type: none"> • Two externally set, internally marked, externally moderated synoptic assignments • Three externally set, externally marked exams, sat under examination conditions • One portfolio of evidence • One externally set, internally marked, externally moderated assignment (<i>Professional horticulture only</i>) • Optional unit assessments, externally set, internally marked, externally verified
Additional requirements to gain this qualification	Employer involvement in the delivery and/or assessment of this qualification is essential for all candidates and will be externally quality assured.
Grading	<p>This qualification is graded.</p> <p>For more information on grading, please see Section 7: Grading.</p>
Approvals	These qualifications require full centre and qualification approval
Support materials	<p>Sample assessments</p> <p>Guidance for delivery</p> <p>Guidance on use of marking grids</p>
Registration and certification	Registration and certification of this qualification is through the Walled Garden, and is subject to end dates.
External quality assurance	This qualification is externally quality assured by City & Guilds, and its internally marked synoptic assignments are subject to external moderation. Additional internally assessed units / optional assessments are subject to external verification. There is no direct claim status available for this qualification.

Title and level	Size (GLH)	TQT	City & Guilds qualification number	Ofqual accreditation number
City & Guilds Level 3 Advanced Technical Extended Diploma in Horticulture (1080)	1080	1800	0174-37	601/7454/7

Version and date	Change detail	Section
1.0 September 2017	New handbook	
1.1 September 2017	Exam length changed for 010/510	Exam specifications
2.0 August 2018	Update to grading details	Section 7
2.1 November 2018	Assessment method for unit 301 amended	1. Introduction 5. Assessment
2.2 January 2019	Typographical and formatting amendments made	Throughout
2.3 May 2019	Wording changed regarding retakes	5. Assessment – Summary of assessment methods and conditions 8. Administration – Re-sits and shelf-life of assessment results
2.4 May 2023	Amended assessment method for unit 301 Component number for assessment component changed from 301 to 300 Clarified moderation and external verification processes Updated website links and references	5 Assessment 5 Assessment 6 Moderation and standardisation of assessment 3 Delivering Technicals qualifications - Support materials 8 Administration
2.5 September 2023	Revision to the exam specification for the health and safety test component (300)	5 Exam specification
2.6 September 2024	Removal of evolve onscreen exam option (002, 008, 010)	1 Assessment Requirements and employer involvement
2.7 April 2025	Removal of Bradley, S., Hebron, L and Woods, A. 2001. S/NVQ 3 Customer Service Candidate Handbook. Oxford Butterworth Heinemann.	P264

Contents

1	Introduction	8
	What is this qualification about?	8
	Qualification structure	11
	Total qualification time (TQT)	13
	Assessment and employer involvement	14
2	Centre requirements	17
	Approval	17
	Resource requirements	17
	Learner entry requirements	17
3	Delivering technical qualifications	18
	Initial assessment and induction	18
	Employer involvement	18
	Support materials	18
4	Employer involvement	19
	Qualification approval	19
	Monitoring and reporting learner engagement	19
	Types of involvement	20
	Types of evidence	21
	Quality assurance process	21
	Sufficiency of involvement for each learner	22
	Live involvement	22
	Timing	22
5	Assessment	23
	Summary of assessment methods and conditions	23
	What is synoptic assessment?	24
	How the assignment is synoptic for this qualification	25
	External exam for stretch, challenge and integration	25
	Optional unit assessments and integration into the synoptic qualification content	25
	Assessment objectives for synoptic assignments	25
	Exam specifications	28
6	Moderation and standardisation of assessment	31
	Supervision and authentication of internally assessed work	31
	Internal standardisation	32
	Internal appeal	32
	Post-quality assurance procedures	32
	Centres retaining evidence	32
7	Grading	33
	Awarding individual assessments	33
	Grade descriptors	33
	Awarding grades and reporting results	34

8	Administration	36
	External quality assurance	36
	Enquiries about results	37
	Re-sits and shelf-life of assessment results	37
	Factors affecting individual learners	37
	Malpractice	37
	Access arrangements	37
	Special consideration	38
Unit 301	Principles of Health and Safety	39
Unit 302	Undertake and review work related experience in the Land-based Industries	46
Unit 303	Identification, selection and planting of plants	51
Unit 304	Maintain turf in parks and gardens	55
Unit 305	Land based industry machinery operations	60
Unit 306	Principles of plant health and protection	66
Unit 307	Plant and soil science	73
Unit 308	Tree and shrub maintenance	80
Unit 309	Undertake estate skills	86
Unit 310	Business management in the Land based sector	92
Unit 311	Undertake a specialist project in the Land based sector	98
Unit 312	Principles of advanced horticultural science	104
Unit 313	Identification and use of ornamental plants	110
Unit 314	Principles of sustainable management of turf	114
Unit 315	Sustainable development	120
Unit 316	Manage plant propagation activities	126
Unit 317	Construct horizontal landscape surfaces	133
Unit 318	Establish and manage exterior plant displays	138
Unit 319	Principles and practices of garden design	143
Unit 320	Construct and maintain timber landscape features	149
Unit 321	Horticultural production techniques – protected environments	153
Unit 322	Horticultural production techniques - outdoors	158
Unit 323	Construct and restore walls	164
Unit 324	Construct and establish sports and amenity turf areas	168
Unit 325	Manage winter and summer sports turf surfaces	174
Unit 326	Manage sports turf surfaces - golf	181

Unit 327	Principles of sports turf maintenance	188
Unit 328	Manage sports turf surfaces - association football	195
Unit 329	Manage sports turf surfaces - cricket	201
Unit 330	Construct and maintain decorative landscape features	207
Unit 331	Site surveying, levelling and setting out	213
Unit 332	Historical influences on the development of gardens	218
Unit 333	Computer-aided design in horticulture	222
Unit 334	Prepare landscape and garden design briefs	226
Unit 335	Specification, programming and monitoring of landscape projects	234
Unit 336	Establish and manage interior plant displays	239
Unit 337	Manage advanced nursery stock production	245
Unit 338	Principles of organic crop production	253
Unit 339	Customer care and retail merchandising	260
Unit 340	Water management	265
Appendix 1	Sources of general information	272

1 Introduction

What is this qualification about?

The following purpose is for the **City & Guilds Level 3 Advanced Technical Extended Diploma in Horticulture (1080) 601/7454/7**

Area	Description
OVERVIEW	
Who is this qualification for?	<p>This qualification is for you if you are aged 16-19, and want to work in horticulture. It is designed to provide you with a very wide range of specialist technical practical skills and detailed knowledge and understanding which will equip you to seek a diverse range of employment opportunities, or to further learning and training within the horticultural industry.</p> <p>On successful completion of the qualification, you will be awarded one of the following:</p> <p>City & Guilds Level 3 Advanced Technical Extended Diploma in Horticulture (Professional Horticulture) (1080)</p> <p>Or</p> <p>City & Guilds Level 3 Advanced Technical Extended Diploma in Horticulture (Sports Turf) (1080)</p>
What does this qualification cover?	<p>This qualification gives you the opportunity to learn about and build on the essentials of working in horticulture such as safe working, using equipment and machinery, plant identification, maintaining turf, plant health, pests and diseases and pruning and maintaining trees and shrubs. You will also learn about plant and soil science and business skills. You will then choose to specialise in one of the following areas; professional horticulture or sports turf.</p> <p>Students choosing the professional horticulture option will also learn about estate maintenance skills and constructing landscape features. You can choose to study topics from a very wide range which could be those relating to landscaping such as planning and producing landscape and garden designs, site surveying, levelling and setting out, using computer aided design, undertaking landscape projects and constructing and maintaining decorative landscape features (rock, alpine, water and climbing and wall plants). You may be more interested in production horticulture and could study areas such as plant propagation, protected and outdoor crop production, organic crop production and managing advanced nursery stock</p>

production. There are also units relating to retail and garden centres and you could choose to study skills relating to managing internal and external plant displays, retail management and customer service.

If you wish to study the sports turf specialism, then you will learn about the construction and establishment of sports and amenity turf areas, winter and summer sports turf surface management, sports turf maintenance and management of specialist sports turf surfaces such as golf courses.

Centres and providers work with local employers who will contribute to the knowledge and delivery of training. Employers will provide demonstrations and talks on the industry and where possible work placements will also be provided by the employers. This practically based training is ideal preparation for gaining employment in the horticultural industry or specialist further study.

WHAT COULD THIS QUALIFICATION LEAD TO?

Will the qualification lead to employment, and if so, in which job role and at what level?

This two-year qualification exposes you to the whole industry, and the opportunities within it. On completion, it is likely that you will enter the industry by working within a public or private park or garden, for a landscape company or for a plant nursery. As you will have gained a breadth and depth of skills and knowledge over a wide range of units, you could progress within work to become a:

In the professional horticulture pathway

- Production manager
- Commercial manager
- Landscape site manager/foreman
- Gardener/grounds maintenance manager

In the sports turf pathway

- Golf greenkeeper

You may also wish to become self-employed, and undertake roles such as a freelance gardener or garden designer or set up your own business such as a landscape company.

Why choose this qualification over similar qualifications?

You are likely to take this qualification full-time over 2 years. You have the option of the two separate pathways which will enable you to prepare to enter the many diverse opportunities within horticulture, focussing on a broad basis of skills that employer's value, whilst studying in greater depth the areas that will enable you to seek specialised and more demanding job roles.

City & Guilds offers four sizes of Level 3 qualification in Horticulture: Certificate, Diploma (540), Extended Diploma (720) and Extended Diploma (1080).

You would take the Certificate if you want an introductory qualification to develop some of the core skills and knowledge required by employers in the horticultural industry. The Certificate is likely to be taken alongside other programmes such as GCSEs or AS Levels over a one-year course of study.

You would take the Diploma (540) if you want a qualification to develop some of the skills and knowledge that can lead to specific roles required by employers in the horticultural industry. The Diploma is likely to be taken alongside other programmes such as GCSEs or AS Levels over a one-year course of study.

You would take the Extended Diploma (720) if you want to specialise, to develop most of the skills and knowledge required by employers in the horticultural industry. The Extended Diploma (720) is likely to be taken as part of a full-time two year programme of study, or alongside other qualifications such as AS or A Levels over a longer period of time.

You would take the Extended Diploma (1080) if you want to specialise and develop the skills and knowledge required by employers in the horticultural industry. The Extended Diploma (1080) is likely to be taken as a full-time programme of study over two years. By taking this large qualification, you will be exposed to, and have the opportunity to gain experience in, the wider horticultural sector. This will enable you to progress to a diverse range of employment opportunities, as you will have gained hands-on experience over 2 years, which employers really value.

Will the qualification lead to further learning?

You may wish to progress onto an Advanced Apprenticeship in Horticulture, which allows you to combine working for a Public Garden or Park, a Landscape firm, Nursery or a similar job, and typically attending one day a week at College or with a Training Provider.

You may wish to progress onto further learning within a Higher Education Institution. You could study courses such as:

- FdSc Horticulture
- BSc (Hons) Horticulture
- FdSc Sports Turf
- BSc (Hons) Sports Turf Science & Management

WHO SUPPORTS THIS QUALIFICATION?

Employer/Higher Education Institutions

The British Growers Association (BGA)
The Horticultural Trades Association (HTA)
The Greenkeepers Training Committee (GTC)
The British Association of Landscape Industries (BALI)

Qualification structure

For the **City & Guilds Level 3 Advanced Technical Extended Diploma in Horticulture (Professional Horticulture) (1080)** the teaching programme must cover the content detailed in the structure below.

Unit number	Unit title	GLH
Mandatory		
301	Principles of Health and Safety	30
302	Undertake and review work related experience in the land based industries	30
303	Identification, selection and planting of plants	60
304	Maintain turf in parks and gardens	60
305	Land based industry machinery operations	60
306	Principles of plant health and protection	60
307	Plant and soil science	60
308	Tree and shrub maintenance	60
309	Undertake estate skills	60
310	Business management in the land based sector	60
311	Undertake a specialist project in the land based sector	60
317	Construct horizontal landscape surfaces	60
Optional – Learners must be taught at least 420 GLH from units 312 – 313, 315 – 316, 318 – 323, 330 – 340		
312	Principles of advanced horticultural science	60
313	Identification and use of ornamental plants	60
315	Sustainable development	60
316	Manage plant propagation activities	60
318	Establish and manage exterior plant displays	60
319	Principles and practices of garden design	60
320	Construct and maintain timber landscape features	60
321	Horticultural production techniques - protected environments	60
322	Horticultural production techniques – outdoors	60
323	Construct and restore walls	60
330	Construct and maintain decorative landscape features	60
331	Site surveying, levelling and setting out	60
332	Historical influences on the development of gardens	60
333	Computer-aided design in horticulture	60
334	Prepare landscape and garden design briefs	60

335	Specification, programming and monitoring of landscape projects	60
336	Establish and manage interior plant displays	60
337	Manage advanced nursery stock production	60
338	Principles of organic crop production	60
339	Customer care and retail merchandising	60
340	Water management	60

For the **City & Guilds Level 3 Advanced Technical Extended Diploma in Horticulture (Sports Turf) (1080)** the teaching programme must cover the content detailed in the structure below:

Unit number	Unit title	GLH
Mandatory		
301	Principles of Health and Safety	30
302	Undertake and review work related experience in the land based industries	30
303	Identification, selection and planting of plants	60
304	Maintain turf in parks and gardens	60
305	Land based industry machinery operations	60
306	Principles of plant health and protection	60
307	Plant and soil science	60
308	Tree and shrub maintenance	60
310	Business management in the land based sector	60
314	Principles of sustainable management of turf	60
324	Construct and establish sports and amenity turf areas	60
325	Manage winter and summer sports turf surfaces	60
327	Principles of sports turf maintenance	60
Optional – Learners must be taught at least 360 GLH from units 309, 311 – 313, 317, 326, 328 - 329, 331, 333, 335, 340		
309	Undertake estate skills	60
311	Undertake a specialist project in the land based sector	60
312	Principles of advanced horticultural science	60
313	Identification and use of ornamental plants	60
317	Construct horizontal landscape surfaces	60
326	Manage sports turf surfaces – golf	60
328	Manage sports turf surfaces - association football	60
329	Manage sports turf surfaces - cricket	60

331	Site surveying, levelling and setting out	60
333	Computer-aided design in horticulture	60
335	Specification, programming and monitoring of landscape projects	60
340	Water management	60

Total qualification time (TQT)

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

Title and level	Size (GLH)	TQT
City & Guilds Level 3 Advanced Technical Extended Diploma in Horticulture (Professional Horticulture)	1080	1800

Assessment and employer involvement

To achieve the **City & Guilds Level 3 Advanced Technical Extended Diploma in Horticulture (Professional Horticulture) (1080)** candidates must successfully complete **all** the mandatory assessment components **as well as** the optional assessment components for their chosen optional units.

Component number	Title
Mandatory	
003	Level 3 Horticulture - Synoptic assignment (1)*
502	Level 3 Horticulture - Theory exam (1)*
007	Level 3 Horticulture - Synoptic assignment (2)*
508	Level 3 Horticulture - Theory exam (2)*
300	Level 3 Principles of health and safety – Theory exam (evolve online)
302	Level 3 Undertake and review work related experience in the land-based industries - Portfolio
311	Level 3 Undertake a specialist project in the land based sector - Assignment
Optional	
312	Level 3 Principles of advanced horticultural science - Assignment
313	Level 3 Identification and use of ornamental plants - Assignment
315	Level 3 Sustainable development - Assignment
316	Level 3 Manage plant propagation activities - Assignment
318	Level 3 Establish and manage exterior plant displays - Assignment
319	Level 3 Principles and practices of garden design - Assignment
320	Level 3 Construct and maintain timber landscape features - Assignment
321	Level 3 Horticultural production techniques (protected environments) - Assignment
322	Level 3 Horticultural production techniques (outdoors) - Assignment
323	Level 3 Construct and restore walls - Assignment
330	Level 3 Construct and maintain decorative landscape features - Assignment
331	Level 3 Site surveying, levelling and setting out - Assignment
332	Level 3 Historical influences on the development of gardens - Assignment
333	Level 3 Computer-aided design in horticulture - Assignment
334	Level 3 Prepare landscape and garden design briefs - Assignment
335	Level 3 Specification, programming and monitoring of landscape projects - Assignment
336	Level 3 Establish and manage interior plant displays - Assignment

337	Level 3 Manage advanced nursery stock production - Assignment
338	Level 3 Principles of organic crop production - Assignment
339	Level 3 Customer care and retail merchandising - Assignment
340	Level 3 Water management - Assignment

Note – from 1 September 2023, centres may only enter candidates for the Level 3 Horticulture-Theory exam assessments through the paper-based components (502, 508). There is no option to take this assessment as an onscreen (evolve) exam.

Where candidates have previously successfully achieved an onscreen exam - the result will continue to count towards the Rules of Combination for this qualification.

To achieve the **Level 3 Advanced Technical Extended Diploma in Horticulture (Sports Turf) (1080)** candidates must successfully complete **all** the mandatory assessment components **as well as** the optional assessment components for their chosen optional units.

City & Guilds component number	Title
Mandatory	
003	Level 3 Horticulture - Synoptic assignment (1)*
502	Level 3 Horticulture - Theory exam (1)*
009	Level 3 Horticulture - Synoptic assignment (2)*
510	Level 3 Horticulture - Theory exam (2)*
300	Level 3 Principles of health and safety – Theory exam (evolve online)
302	Level 3 Undertake and review work related experience in the land-based industries - Portfolio
Optional	
309	Level 3 Undertake estate skills - Assignment
311	Level 3 Undertake a specialist project in the land based sector - Assignment
312	Level 3 Principles of advanced horticultural science - Assignment
313	Level 3 Identification and use of ornamental plants - Assignment
317	Level 3 Construct horizontal landscape surfaces - Assignment
326	Level 3 Manage sports turf surfaces (golf) - Assignment
328	Level 3 Manage sports turf surfaces (association football) - Assignment
329	Level 3 Manage sports turf surfaces (cricket) - Assignment
331	Level 3 Site surveying, levelling and setting out - Assignment
333	Level 3 Computer-aided design in horticulture - Assignment

335	Level 3 Specification, programming and monitoring of landscape projects - Assignment
340	Level 3 Water management - Assignment

Note – from 1 September 2023, centres may only enter candidates for the Level 3 Horticulture-Theory exam assessments through the paper-based components (502, 510). There is no option to take this assessment as an onscreen (evolve) exam.

Where candidates have previously successfully achieved an onscreen exam - the result will continue to count towards the Rules of Combination for this qualification.

In addition, candidates **must** complete the mandatory employer involvement requirement for this qualification **before** they can be awarded a qualification grade. For more information, please see guidance in *Section 4: Employer involvement*.

Employer involvement

Component number	Title
Mandatory	
837	Employer involvement

**Number of mandatory assessments per assessment type*

2 Centre requirements

Approval

New centres will need to gain centre approval. Existing centres who wish to offer this qualification must go through City & Guilds' full Qualification Approval Process. There is no fast track approval for this qualification. Please refer to the City & Guilds website for further information on the approval process: www.cityandguilds.com

Resource requirements

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualification before designing a course programme.

Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following requirements:

- be technically competent in the areas in which they are delivering
- be able to deliver across the breadth and depth of the content of the qualification being taught
- have recent relevant teaching and assessment experience in the specific area they will be teaching, or be working towards this
- demonstrate continuing CPD.

Physical resources

Centres must be able to demonstrate that they have access to the equipment and technical resources required to deliver this qualification and its assessment.

Internal Quality Assurance

Internal quality assurance is key to ensuring accuracy and consistency of tutors and markers. Internal Quality Assurers (IQAs) monitor the work of all tutors involved with a qualification to ensure they are applying standards consistently throughout assessment activities. IQAs must have, and maintain, an appropriate level of technical competence and be qualified to make both marking and quality assurance decisions through a teaching qualification or recent, relevant experience.

Learner entry requirements

Centres must ensure that all learners have the opportunity to gain the qualification through appropriate study and training, and that any prerequisites stated in the *What is this qualification about?* section are met when registering on this qualification.

Age restrictions

This qualification is approved for learners aged 16 – 19, 19+.

3 Delivering technical qualifications

Initial assessment and induction

An initial assessment of each learner should be made before the start of their programme to identify:

- if the learner has any specific learning or training needs,
- support and guidance they may need when working towards their qualification,
- the appropriate type and level of qualification.

We recommend that centres provide an introduction so that learners fully understand the requirements of the qualification, their responsibilities as a learner, and the responsibilities of the centre. This information can be recorded on a learning contract.

Employer involvement

Employer involvement is essential to maximise the value of each learner's experience. Centres are required to involve employers in the delivery of technical qualifications at Key Stage 5 and/or their assessment, for every learner. This must be in place or planned before delivery programmes begin in order to gain qualification approval. See *Section 4: Employer involvement* for more detail.

Support materials

The following resources are available for this qualification:

Description	How to access
Sample assessments	Available on the qualification pages on the City & Guilds Website: www.cityandguilds.com
Technical Qualifications: Guide to Teaching, Learning and Assessment	Available on the City and Guilds website: 14-19-teaching-learning-assessment-guide-pdf.ashx (cityandguilds.com)
Quality Assurance Guide for Centres: Technical Qualifications and the Extended Project Qualification (EPQ)	Available on the City and Guilds website: technicals-quality-assurance-guide-for-centres-pdf.ashx (cityandguilds.com)

4 Employer involvement

Employer involvement is a formal component of Key Stage 5 Technical qualifications. It does not contribute to the overall qualification grading, but is a mandatory requirement that all learners must meet. As such it is subject to external quality assurance by City & Guilds.

Department for Education (DfE) requirements state:

Employer involvement in the delivery and/or assessment of technical qualifications provides a clear 'line of sight' to work, enriches learning, raises the credibility of the qualification in the eyes of employers, parents and students and furthers collaboration between the learning and skills sector and industry.

[Technical qualifications] must:

- *require all students to undertake meaningful activity involving employers during their study; and*
- *be governed by quality assurance procedures run by the awarding organisation to confirm that education providers have secured employer involvement for every student.*

Extract from: ***Vocational qualifications for 16 to 19 year olds, 2017 and 2018 performance tables: technical guidance for awarding organisations, paragraphs 89-90***

City & Guilds will provide support, guidance and quality assurance of employer involvement.

Qualification approval

To be approved to offer City & Guilds technicals, centres must provide an Employer Involvement planner and tracker showing how every learner will be able to experience meaningful employer involvement, and from where sufficient and suitable employer representatives are expected to be sourced.

Centres must include in their planner a sufficient range of activities throughout the learning programme that provide a range of employer interactions for learners. Centres must also plan contingencies for learners who may be absent for employer involvement activities, so that they are not disadvantaged.

As part of the approval process, City & Guilds will review this planner and tracker. Centres which cannot show sufficient commitment from employers and/or a credible planner and tracker will be given an action for improvement with a realistic timescale for completion. **Approval will not be given** if employer involvement cannot be assured either at the start of the qualification, or through an appropriate plan of action to address this requirement before the learner is certificated.

Monitoring and reporting learner engagement

Employer involvement is a formal component of this qualification and is subject to quality assurance monitoring. Centres must record evidence that demonstrates that each learner has been involved in

meaningful employer based activities against the mandatory content before claiming the employer involvement component for learners.

Centres must record the range and type of employer involvement each learner has experienced and submit confirmation that all learners have met the requirements to City & Guilds. If a centre cannot provide evidence that learners have met the requirements to achieve the component, then the learner will not be able to achieve the overall Technical Qualification.

Types of involvement

Centres should note that to be eligible, employer involvement activities **must** relate to one or more elements of the mandatory content of this qualification.

As the aim of employer involvement is to enrich learning and to give learners a taste of the expectations of employers in the industry area they are studying, centres are encouraged to work creatively with local employers.

Employers can identify the areas of skills and knowledge in their particular industry that they would wish to see emphasised for learners who may apply to work with them in the future. Centres and employers can then establish the type of input, and which employer representative might be able to best support these aims.

To be of most benefit this must add to, rather than replace the centre's programme of learning. Some examples of meaningful employer involvement are listed below. Employer involvement not related to the mandatory element of the qualification, although valuable in other ways, does not count towards this element of the qualification.

The DfE has provided the following examples of what does and does not count as meaningful employer involvement, as follows^{1,2}:

The following activities meet the requirement for meaningful employer involvement:

- *students undertake structured work-experience or work-placements that develop skills and knowledge relevant to the qualification³;*
- *students undertake project(s), exercises(s) and/or assessments/examination(s) set with input from industry practitioner(s);*
- *students take one or more units delivered or co-delivered by an industry practitioner(s). This could take the form of master classes or guest lectures;*
- *industry practitioners operate as 'expert witnesses' that contribute to the assessment of a student's work or practice, operating within a specified assessment framework. This may be a specific project(s), exercise(s) or examination(s), or all assessments for a qualification.*

In all cases participating industry practitioners and employers must be relevant to the industry sector or occupation/occupational group to which the qualification relates.

¹ As extracted from: Vocational qualifications for 16 to 19 year olds
2017 and 2018 performance tables: technical guidance for awarding organisations

² This list has been informed by a call for examples of good practice in employer involvement in the delivery and assessment of technical qualifications - **Employer involvement in the delivery and assessment of vocational qualifications**

³ **DfE work experience guidance**

The following activities, whilst valuable, do not meet the requirement for meaningful employer involvement:

- *employers' or industry practitioners' input to the initial design and content of a qualification;*
- *employers hosting visits, providing premises, facilities or equipment;*
- *employers or industry practitioners providing talks or contributing to delivery on employability, general careers advice, CV writing, interview training etc;*
- *student attendance at career fairs, events or other networking opportunities;*
- *simulated or provider-based working environments eg hairdressing salons, florists, restaurants, travel agents, small manufacturing units, car servicing facilities;*
- *employers providing students with job references.*

Below is guidance on the type of activities that can be considered employer involvement for this qualification. Further guidance can be found in the *Guidance for delivery* sections of the individual units.

Employers could be employed to aid learner's progress by acting as guest speakers to cohort groups. Guest speaker's experiences and the opportunity for learners to ask questions, linked to assignment tasks, could benefit whole groups of learners.

The use of scenario led tasks are essential in the assessment of this qualification. Work can be set in the context of case studies from local employers. Visits to companies/shows/exhibitions will enhance this aspect of the qualification.

A partnership approach should be adopted where possible with employers with whom the centre has links, and with employers used for work experience placements.

It would be helpful for tutors to develop a method of maintaining contact with a range of employers in the sectors who may be able to help with keeping the examples of legislation, policies and codes of practice used in the taught content up to date.

Types of evidence

For each employer involvement activity, centres are required to provide evidence of which learners undertook it, e.g. a candidate attendance register. The types of additional evidence required to support a claim for this component will vary depending on the nature of the involvement. E.g. for a guest lecture it is expected that a synopsis of the lecture and register would be taken which each learner and the guest speaker will have signed; expert witnesses will be identified and will have signed the relevant assessment paperwork for each learner they have been involved in assessing; evidence of contribution from employers to the development of locally set or adapted assignments.

Quality assurance process

As the employer involvement component is a requirement for achieving the KS5 Technical qualifications, it is subject to external quality assurance by City & Guilds at the approval stage and when centres wish to claim certification for learners.

Evidence will be validated by City & Guilds before learners can achieve the employer involvement component. Where employer involvement is not judged to be sufficient, certificates cannot be claimed for learners.

Sufficiency of involvement for each learner

It is expected that the centre will plan a range of activities that provide sufficient opportunities for each learner to interact directly with a range of individuals employed in the related industry. Centres must also provide contingencies for learners who may be absent for part of their teaching, so they are not disadvantaged. Any absence that results in a learner missing arranged activities must be documented. Where learners are unable to undertake all employer involvement activities due to temporary illness, temporary injury or other indisposition, centres should contact City & Guilds for further guidance.

Live involvement

Learners will gain most benefit from direct interaction with employers and/or their staff; however the use of technology (eg the use of live webinars) is encouraged to maximise the range of interactions. Where learners are able to interact in real time with employers, including through the use of technology, this will be classed as 'live involvement'.

It is considered good practice to record learning activities, where possible, to allow learners to revisit their experience and to provide a contingency for absent learners. This is not classed as live involvement however, and any involvement of this type for a learner must be identified as contingency.

Timing

A learner who has not met the minimum requirements cannot be awarded the component, and will therefore not achieve the qualification. It is therefore important that centres give consideration to scheduling employer involvement activities, and that enough time is allotted throughout delivery and assessment of the qualification to ensure that requirements are fully met.

5 Assessment

Summary of assessment methods and conditions

Component numbers	Assessment method	Description and conditions
003 007 009	Synoptic assignment	<p>The synoptic assignments are externally set, internally marked and externally moderated. The assignments require candidates to identify and use effectively in an integrated way an appropriate selection of skills, techniques, concepts, theories, and knowledge from across the content area. Candidates will be judged against the assessment objectives.</p> <p>Assignments will be released to centres as per dates indicated in the Assessment and Examination timetable published on our website.</p> <p>Where seasonality is a factor in the timing of the assignment the assignment will be released early to ensure that candidates can take the assignment to fit in with the seasonal requirements.</p> <p>Centres will be required to maintain the security of all live assessment materials. Assignments will be password protected and released to centres through a secure method.</p> <p>There will be one opportunity within each academic year to sit the assignment. Candidates who fail the assignment will have one re-sit opportunity. The re-sit opportunity will be in the next academic year, and will be the assignment set for that academic year once released to centres. If the re-sit is failed, the candidate will fail the qualification.</p> <p>Please note that for externally set assignments City & Guilds provides guidance and support to centres on the marking and moderation process.</p>
502 508 510	Externally marked exam	<p>The exams are externally set and externally marked, and will be taken as a paper-based test (502, 508 and 510).</p> <p>The exams are designed to assess the candidate's depth and breadth of understanding across content in the qualification at the end of the period of learning, using a range of question types and will be sat under invigilated examination conditions. See JCQ requirements for details: http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations</p> <p>The exam specification shows the coverage of the exam across the qualification content.</p>

		Candidates who fail the exam at the first sitting will have a maximum of two opportunities to retake. If the candidate fails the exam three times then they will fail the qualification. (Note: the third and final retake opportunity applies to Level 3 only.) For exam dates, please refer to the Assessment and Examination timetable.
300	Evolve online on-demand exam	This exam is externally set and externally marked and will be taken online through City & Guilds' computer-based testing platform under invigilated exam conditions. The exam is available on-demand and can be taken at any time in the year. There is no maximum number of retake attempts for this exam , however, learners should be given sufficient time and tutor support before resitting.
302	Portfolio of evidence	This unit will be evidenced by a portfolio of evidence.
311	Unit assignment	The unit assignments are externally set, internally marked and externally verified . The assignment requires candidates to identify and use effectively skills, knowledge and understanding from across the unit content area. Candidates will be judged against the unit grading criteria Arrangements for release, security and re-sitting assignments are the same as detailed for the synoptic assignment.
<i>Professional Horticulture</i> 312, 313, 315, 316, 318, 319, 320, 321, 322, 323, 330, 331, 332, 333, 334, 335, 339, 340 <i>Sports Turf</i> 309, 312, 313, 317, 326, 328, 329, 331, 333, 335, 340	Unit Assignments	The unit assignments are externally set, internally marked and externally verified . The assignment requires candidates to identify and use effectively skills, knowledge and understanding from across the unit content area. Candidates will be judged against the unit grading criteria. Arrangements for release, security and re-sitting assignments are the same as detailed for the synoptic assignment.

What is synoptic assessment?

Technical qualifications are based around the development of a toolkit of knowledge, understanding and skills that an individual needs in order to have the capability to work in a particular industry or occupational area. Individuals in all technical areas are expected to be able to apply their knowledge, understanding and skills in decision making to solve problems and achieve given outcomes independently and confidently.

City & Guilds technical qualifications require candidates to draw together their learning from across the qualification to solve problems or achieve specific outcomes by explicitly assessing this through the synoptic assignment component.

In this externally set, internally marked and externally moderated assessment the focus is on bringing together, selecting and applying learning from across the qualification rather than demonstrating achievement against units or subsets of the qualification content. The candidate will be given an appropriately levelled, substantial, occupationally relevant problem to solve or outcome to achieve. For example this might be in the form of a briefing from a client, leaving the candidate with the scope to select and carry out the processes required to achieve the client's wishes, as they would in the workplace.

Candidates will be marked against assessment objectives (AOs) such as their breadth and accuracy of knowledge, understanding of concepts, and the quality of their technical skills as well as their ability to use what they have learned in an integrated way to achieve a considered and high quality outcome.

How the assignment is synoptic for this qualification

The typical assignment brief could be to maintain an area (eg a part of a garden, sports turf etc), ensuring all seasonal activities are planned for and performed when necessary. Candidates will be expected to plant and establish plants, monitor for pests and diseases, operate land based machinery and possibly construct landscape features. Candidates might be given a brief to follow, or they might produce their own design and apply it in practice.

External exam for stretch, challenge and integration

The externally set, externally marked exams (502 and 508 or 510) will draw from across the mandatory content of the qualification, using a range of shorter questions to confirm breadth of knowledge and understanding. Extended response questions are included, giving candidates the opportunity to demonstrate higher level understanding and integration through discussion, analysis and evaluation, and ensuring the assessment can differentiate between 'just able' and higher achieving candidates.

Optional unit assessments and integration into the synoptic qualification content

While the mandatory units for this qualification provide the main skills and knowledge required to work in the Horticulture industry, the optional units provided give centres flexibility when devising programmes to meet local employment needs, where the purpose of the qualification demands this.

The assessments for the optional units will require that the candidate has experienced the full breadth of mandatory learning of the qualification in order to better demonstrate the rounded performance expected at higher grades.

Optional unit assessments are externally set, internally marked and externally verified.

Assessment objectives for synoptic assignments

The assessments for this qualification are set against a set of assessment objectives (AOs) which are used across all City & Guilds Technicals to promote consistency among qualifications of a similar purpose. They are designed to allow judgement of the candidate to be made across a number of different categories of performance.

Each assessment for the qualification has been allocated a set number of marks against these AOs based on weightings recommended by stakeholders of the qualification. This mark allocation remains the same for all versions of the assessments, ensuring consistency across assessment versions and over time.

The following table explains all AOs in detail, including weightings for the synoptic assignments. In some cases, due to the nature of a qualification’s content, it is not appropriate to award marks for some AOs. Where this is the case these have been marked as N/A. Weightings for exams (AOs 1, 2 and 4 only) can be found with the exam specification.

Assessment objective	Level 3 Advanced Technical Extended Diploma in Horticulture (1080) (003, year 1) Typical expected evidence of knowledge, understanding and skills	Approximate weighting (Assignment)
AO1 Recalls knowledge from across the breadth of the qualification.	Use of terminology, health and safety considerations, environmental impact, signs of plant health, legislation, routine tasks	20%
AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	Planting specifications, weed, pest and disease control, rates and timings of activities, interpreting data, application of legislation and codes of practices, quality management	20%
AO3 Demonstrates technical skills from across the breadth of the qualification.	Planting, testing, use of equipment and machinery	25%
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	Applying and linking knowledge, understanding and practical skills to a particular situation, justifying decisions/ approaches taken, contingencies, reflection and evaluation.	20%
AO5 Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.	Coherent charts, graphs, measurements, plant identification, correctly used botanical names	15%

Assessment objective	Level 3 Advanced Technical Extended Diploma in Horticulture (1080) (Professional Horticulture) (007, year 2) Typical expected evidence of knowledge, understanding and skills	Approximate weighting (Assignment)
AO1 Recalls knowledge from across the breadth of the qualification.	Use of terminology, health and safety considerations, environmental impact, legislation, routine tasks, legal structure	20%

	and organisation of a business, aim of business plans and financial records, aims and roles of important formal and informal quality management systems, customer base.	
AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	Construction specifications, rates and timings of activities, interpreting data, application of legislation and codes of practices, quality management, suitability of ground profiles, construction and maintenance standards	20%
AO3 Demonstrates technical skills from across the breadth of the qualification.	Reading scale plans, marking out and constructing surfaces and boundaries, use of equipment and machinery, risk assessment	30%
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	Applying and linking knowledge, understanding and practical skills to a particular situation, justifying decisions/ approaches taken, contingencies, reflection and evaluation.	15%
AO5 Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.	Coherent charts, graphs, measurements, plant identification, correctly used terminology	15%

Assessment objective	Level 3 Advanced Technical Extended Diploma in Horticulture (1080) (Sports Turf) (009, year 2) Typical expected evidence of knowledge, understanding and skills	Approximate weighting (Assignment)
AO1 Recalls knowledge from across the breadth of the qualification.	Use of terminology, health and safety considerations, environmental impact, legislation, routine tasks, business legal structure, marketplace and competitors, performance quality standards (PQS), sports surfaces, characteristics of thatch, soil ecosystem, drainage, soil types, site topography	20%
AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	Work specifications, rates and timings of activities, interpreting data, application of legislation and codes of practices, quality management, importance of businesses in the industry, advantages and impact of performance management systems (PQS), sustainability strategies and sports turf management, winter and summer sports	20%

	turf management and maintenance, drainage systems	
AO3 Demonstrates technical skills from across the breadth of the qualification.	Assessing against performance quality standards(PQS), surveying and soil assessment, seeding and turfing, primary and secondary cultivations, maintenance and aftercare, use of equipment and machinery, risk assessment	30%
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	Applying and linking knowledge, understanding and practical skills to a particular situation, justifying decisions/ approaches taken, contingencies, reflection and evaluation.	20%
AO5 Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.	Coherent charts, graphs, measurements, correctly used terminology	10%

Exam specifications

AO weightings per test

AO	Test 502 weighting (approx. %)	Test 508 weighting (approx. %)	Test 510 weighting (approx. %)
AO1 Recalls knowledge from across the breadth of the qualification.	30	30	30
AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	50	50	50
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	20	20	20

The way the exam covers the content of the qualification is laid out in the table below:

Assessment type: Examiner marked, written exam, usually delivered online*

Assessment conditions: Invigilated examination conditions

Grading: X/P/M/D

502		Duration: 2 hours	
Unit	Unit title	Number of marks	%
303	Identification, selection and planting of plants	18	30
305	Land based industry machinery operations	10	17
306	Principles of plant health and protection	20	33
N/A	Integration across the units	12	20
Total		60	100

Assessment type: Examiner marked, written exam, usually delivered online*

Assessment conditions: Invigilated examination conditions

Grading: X/P/M/D

Test 508		Duration: 2 hours	
Unit	Unit title	Number of marks	%
308	Tree and shrub maintenance	13	22
310	Business management in the land based sector	27	45
317	Construct horizontal landscape surfaces	8	13
N/A	Integration across the units	12	20
Total		60	100

Assessment type: Examiner marked, written exam, usually delivered online*

Assessment conditions: Invigilated examination conditions

Grading: X/P/M/D

Test 510		Duration: 2 hours 30 minutes	
Unit	Unit title	Number of marks	%
310	Business management in the land based sector	24	29
314	Principles of sustainable management of turf	8	9
324	Construct and establish sports and amenity turf areas	17	21
327	Principles of sports turf maintenance	16	20
N/A	Integration across the units	15	20
Total		80	100

Assessment type: Multiple-choice exam, delivered online *

Assessment conditions: Invigilated examination conditions

Grading: X/P

Level 3 Principles of health and safety - Theory exam (300)		Duration: 1 hour	
Unit	Learning outcome	Number of marks	%
Level 3 Principles of health and safety (301)	1. Understand health and safety legislation	9	30
	2. Understand the risk assessment process	8	26
	3. Understand first aid requirements	7	23
	4. Understand safe manual handling principles	2	6
	5. Understand the use of fire extinguishers	4	15
Total		30	100

*These exams are sat under invigilated examination conditions, as defined by the JCQ:
<http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations>.

Entry for exams can be made through the City & Guilds Walled Garden.

6 Moderation and standardisation of assessment

City & Guilds' externally set synoptic assignments for technical qualifications are designed to draw from across the qualifications' content, and to contribute a significant proportion towards the learner's final qualification grade. They are subject to a rigorous external quality assurance process known as external moderation.

Moderation is the process where external quality assurers are standardised to a national standard in order to review centre marking of internally marked assessments. These external quality assurers are referred to as 'moderators'. Moderators will review a representative sample of 'candidate work' across the mark range from every centre. Their marks act as a benchmark to inform City & Guilds whether centre marking is in line with City & Guilds' standard.

Where moderation shows that the centre is applying the marking criteria within a reasonable range of mark tolerance, centre marks for the whole cohort will be accepted. Where moderation shows that the centre is either consistently too lenient or consistently too harsh in comparison to the national standard, an appropriate adjustment (up or down) will be made to the marks of the whole cohort, retaining the centre's rank ordering. Due to the nature of the assessment and the marking grid across Assessment Objectives (AOs), it is not expected that the tutors mark and the moderators mark will match exactly.

Where centre application of the marking criteria is inconsistent, an appropriate adjustment for the whole cohort may not be possible on the basis of the sample of candidate work. In these instances a complete remark of the candidate work may be necessary.

Additional unit and optional unit assessments are also subject to external quality assurance through a verification process. This involves external quality assurers scrutinizing IQA records; sampling candidates' work across a range of units and also sampling across the mark/grade range. Centres are then provided with feedback and actions to ensure that results are valid and reliable.

For more detailed information, on the quality assurance process for synoptic assignments and additional unit and optional unit assessments please refer to 'Quality Assurance Guide for Centres: Technical Qualifications and the EPQ available to download on the City & Guilds website.

It is vital that centres familiarise themselves with this process, and how it impacts on their delivery plan within the academic year.

Supervision and authentication of internally assessed work

The Head of Centre is responsible for ensuring that internally assessed work is conducted in accordance with City & Guilds' requirements.

City & Guilds requires both tutors and candidates to sign declarations of authenticity. If the tutor is unable to sign the authentication statement for a particular candidate, then the candidate's work cannot be accepted for assessment.

Internal standardisation

For internally marked work the centre is required to conduct internal standardisation to ensure that all work at the centre has been marked and / or graded to the same standard. It is the Internal Quality Assurer's (IQA's) responsibility to ensure that standardisation has taken place, and that the training includes the use of reference and archive materials such as work from previous years as appropriate.

Internal appeal

Centres must have an internal process in place for candidates to appeal the marking of internally marked components, ie the synoptic assignment and any optional unit assignments. This must take place before the submission of marks or grades for external quality assurance. The internal process must include candidates being informed of the marks (or grades) the centre has given for internally assessed components, as they will need these to make the decision about whether or not to appeal.

Post-quality assurance procedures

Once the external quality assurance processes have been completed, feedback is provided to the centre on the standard of the internal assessment, highlighting areas of good practice, and potential areas for improvement. This will inform future centre assessment, and standardisation activities, as well as external quality assurance and risk management activity.

City & Guilds will then carry out awarding, the process by which grade boundaries are set with reference to the candidate evidence available on the platform.

Centres retaining evidence

Centres must retain assessment records for each candidate for a minimum of three years. To help prevent plagiarism or unfair advantage in future versions, candidate work may not be returned to candidates. Samples may however be retained by the centre as examples for future standardisation of marking.

7 Grading

Awarding individual assessments

Individual assessments will be graded, by City & Guilds, as pass/merit/distinction where relevant. The grade boundaries for pass and distinction for each assessment will be set through a process of professional judgement by technical experts. Merit will usually be set at the midpoint between pass and distinction. The grade descriptors for pass and distinction, and other relevant information (eg archived samples of candidate work and statistical evidence) will be used to determine the mark at which candidate performance in the assessment best aligns with the grade descriptor in the context of the qualification's purpose. Boundaries will be set for each version of each assessment to take into account relative difficulty.

Please note that as the merit grade will usually be set at the arithmetical midpoint between pass and distinction, there are no descriptors for the merit grade for the qualification overall.

Grade descriptors

To achieve a pass, a candidate will be able to

- Demonstrate the knowledge and understanding required to work in the occupational area, its principles, practices and legislation.
- Describe some of the main factors impacting on the occupation to show good understanding of how work tasks are shaped by the broader social, environmental and business environment it operates within.
- Use the technical industry specific terminology used in the industry accurately.
- Demonstrate the application of relevant theory and understanding to solve non-routine problems.
- Interpret a brief for complex work related tasks, identifying the key aspects, and showing a secure understanding of the application of concepts to specific work related tasks.
- Carry out planning which shows an ability to identify and analyse the relevant information in the brief and use knowledge and understanding from across the qualification (including complex technical information) to interpret what a fit for purpose outcome would be and develop a plausible plan to achieve it.
- Achieve an outcome which successfully meets the key requirements of the brief.
- Identify and reflect on the most obvious measures of success for the task and evaluate how successful they have been in meeting the intentions of the plan.
- Work safely throughout, independently carrying out tasks and procedures, and having some confidence in attempting the more complex tasks.

To achieve a distinction, a candidate will be able to

- Demonstrate the excellent knowledge and understanding required to work to a high level in the occupational area, its principles, practices and legislation.
- Analyse the impact of different factors on the occupation to show deep understanding of how work tasks are shaped by the broader social, environmental, and business environment it operates within.
- Demonstrate the application of relevant theory and understanding to provide efficient and effective solutions to complex and non-routine problems.
- Analyse the brief in detail, showing confident understanding of concepts and themes from across the qualification content, bringing these together to develop a clear and stretching plan, that would credibly achieve an outcome that is highly fit for purpose.

- Achieve an outcome which shows an attention to detail in its planning, development and completion, so that it completely meets or exceeds the expectations of the brief to a high standard.
- Carry out an evaluation in a systematic way, focussing on relevant quality points, identifying areas of development/ improvement as well as assessing the fitness for purpose of the outcome.

Awarding grades and reporting results

The overall qualification grade will be calculated based on aggregation of the candidate's achievement in each of the assessments for the mandatory units, taking into account the assessments' weighting. The qualification will be reported on a ten grade scale: Pass Pass Pass, Pass Pass Merit, Pass Merit Merit, Merit Merit Merit, Merit Merit Distinction, Merit Distinction Distinction, Distinction Distinction Distinction, Distinction Distinction Distinction*, Distinction Distinction* Distinction*, Distinction* Distinction* Distinction*.

All assessments **must** be achieved at a minimum of pass for the qualification to be awarded. Candidates who fail to reach the minimum standard for grade pass for an assessment(s) will not have a qualification grade awarded and will not receive a qualification certificate.

The approximate pass grade boundaries for the synoptic assignments in this qualification are:

Synoptic Assignment	Pass Mark (%)
003	40%
007/009	40%

Please note that each synoptic assignment is subject to an awarding process before final grade boundaries are confirmed.

The contribution of assessments towards the overall qualification grade is as follows:

Assessment method	Grade scale	% contribution
Synoptic Assignment 1 (003)	X/P/M/D	30%
Synoptic Assignment 2 (007 or 009)	X/P/M/D	30%
Exam 1 (502)	X/P/M/D	20%
Exam 2 (508 or 510)	X/P/M/D	20%

Both synoptic assignments and exams are awarded (see 'Awarding individual assessments', at the start of Section 7, above), and candidates' grades converted to points. The minimum points available for each assessment grade is listed in the table below. The range of points between the pass, merit and distinction boundaries will be accessible to candidates. For example a candidate that achieves a middle to high pass in an assessment will receive between 8 and 10 points, a candidate that achieves a low to middle merit in an assessment will receive between 12 and 14 points. The points above the minimum for the grade for each assessment are calculated based on the candidate's score in that assessment.

	Pass	Merit	Distinction
Synoptic Assignment 1 (003)	6	12	18
Synoptic Assignment 2 (007 or 009)	6	12	18
Exam 1 (502)	6	12	18
Exam 2 (508 or 510)	6	12	18

The weighted average of candidate's points for each assessment is calculated, and the overall grade of the qualification will then be determined using the following criteria.

Qualification Grade	Minimum points
Distinction*, Distinction*, Distinction*	20.5
Distinction, Distinction*, Distinction*	19.3
Distinction, Distinction, Distinction*	18.2
Distinction, Distinction, Distinction	17
Merit, Distinction, Distinction	15
Merit, Merit, Distinction	13
Merit, Merit, Merit	11
Pass, Merit, Merit	9.3
Pass, Pass, Merit	7.7
Pass, Pass, Pass	6

Candidates achieving Distinction*, Distinction*, Distinction* will be the highest achieving of the Distinction candidates.

8 Administration

Approved centres must have effective quality assurance systems to ensure valid and reliable delivery and assessment of qualifications. Quality assurance includes initial centre registration by City & Guilds and the centre's own internal procedures for monitoring quality assurance procedures.

Consistent quality assurance requires City & Guilds and its associated centres to work together closely; our Quality Assurance Model encompasses both internal quality assurance (activities and processes undertaken within centres) and external quality assurance (activities and processes undertaken by City & Guilds).

For this qualification, standards and rigorous quality assurance are maintained by the use of:

- internal quality assurance
- City & Guilds external moderation (synoptic assessments)
- City & Guilds external verification (additional unit / optional assessments).

In order to carry out the quality assurance role, Internal Quality Assurers (IQAs) must have and maintain an appropriate level of technical competence and have recent relevant assessment experience. For more information on the requirements, refer to *Section 2: Centre requirements* in this handbook.

To meet the quality assurance criteria for this qualification, the centre must ensure that the following procedures are followed:

- suitable training of staff involved in the assessment of the qualification to ensure they understand the process of marking and standardisation
- completion by the person responsible for internal standardisation of the Centre Declaration Sheet to confirm that internal standardisation has taken place
- the completion by candidates and supervisors/tutors of the record form for each candidate's work.

External quality assurance

City & Guilds will undertake external moderation and verification activities to ensure that the quality assurance criteria for this qualification are being met. Centres must ensure that they co-operate with City & Guilds staff and representatives when undertaking these activities.

City & Guilds requires the Head of Centre to

- facilitate any inspection of the centre which is undertaken on behalf of City & Guilds
- make secure arrangements to receive, check and keep assessment material secure at all times,
- maintain the security of City & Guilds confidential material from receipt to the time when it is no longer confidential and
- keep completed assignment work and examination scripts secure from the time they are collected from the candidates to their dispatch to City & Guilds.

Enquiries about results

The services available for enquiries about results include a review of marking for exam results and review of moderation for synoptic assignments. Requests must be submitted within the specified period after the publication of results for individual assessments. Please see the **City & Guilds website** for more information.

Re-sits and shelf-life of assessment results

Re-sits and shelf-life of assessment results Candidates who have failed an exam or wish to re-take it in an attempt to improve their grade, can do so **twice**. The best result will count towards the final qualification. See guidance on individual assessment types in Section 5.

Factors affecting individual learners

If work is lost, City & Guilds should be notified immediately of the date of the loss, how it occurred, and who was responsible for the loss. Centres should use the JCQ form, JCQ/LCW, to inform City & Guilds Customer Services of the circumstances.

Learners who move from one centre to another during the course may require individual attention. Possible courses of action depend on the stage at which the move takes place. Centres should contact City & Guilds at the earliest possible stage for advice about appropriate arrangements in individual cases.

Malpractice

Please refer to the City & Guilds guidance notes *Managing cases of suspected malpractice in examinations and assessments*. This document sets out the procedures to be followed in identifying and reporting malpractice by candidates and/or centre staff and the actions which City & Guilds may subsequently take. The document includes examples of candidate and centre malpractice and explains the responsibilities of centre staff to report actual or suspected malpractice. Centres can access this document on the City & Guilds website.

Examples of candidate malpractice are detailed below (please note that this is not an exhaustive list):

- falsification of assessment evidence or results documentation
- plagiarism of any nature
- collusion with others
- copying from another candidate (including the use of ICT to aid copying), or allowing work to be copied
- deliberate destruction of another's work
- false declaration of authenticity in relation to assessments
- impersonation.

These actions constitute malpractice, for which a penalty (eg disqualification from the assessment) will be applied.

Where suspected malpractice is identified by a centre after the candidate has signed the declaration of authentication, the Head of Centre must submit full details of the case to City & Guilds at the earliest opportunity. Please refer to the form in the document *Managing cases of suspected malpractice in examinations and assessments*.

Access arrangements

Access arrangements are adjustments that allow candidates with disabilities, special educational needs and temporary injuries to access the assessment and demonstrate their skills and knowledge

without changing the demands of the assessment. These arrangements must be made before assessment takes place.

It is the responsibility of the centre to ensure at the start of a programme of learning that candidates will be able to access the requirements of the qualification.

Please refer to the JCQ access arrangements and reasonable adjustments and Access arrangements - when and how applications need to be made to City & Guilds for more information. Both are available on the **City & Guilds website**.

Special consideration

We can give special consideration to candidates who have had a temporary illness, injury or indisposition at the time of the examination. Where we do this, it is given after the examination.

Applications for either access arrangements or special consideration should be submitted to City & Guilds by the Examinations Officer at the centre. For more information please consult the current version of the JCQ document, A guide to the special consideration process. This document is available on the **City & Guilds website**

UAN:	A/507/4634
Level:	3
GLH:	30

What is this unit about?

This unit aims to provide learners with an understanding of the principles of health and safety and identify how these can be applied in practice within land-based or related industries. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learners will be able to recognise common health and safety practices and processes which they will encounter within the workplace. The land-based sector has one of the worst fatal accident records of any major industrial sector and a lack of basic training and/or competency is often a contributory factor. There is a need for new entrants to these industries to gain essential health and safety knowledge in order to minimise harm to themselves and to improve attitudes and behaviour in the workplace. In addition, the learners have the opportunity to consider factors which are specific to their workplace.

This unit must be taught alongside **all** technical units within the qualification ensuring learners gain an appreciation of its importance and so that they are equipped with knowledge and understanding to protect themselves and others when working in the industry.

Learning outcomes:

In this unit, learners will be able to

1. Understand health and safety legislation
2. Understand the risk assessment process
3. Understand first aid requirements
4. Understand principles of safe manual handling
5. Understand the use of fire extinguishers

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand health and safety legislation

Topics

- 1.1 Impact of good and bad practice upon individuals and businesses
- 1.2 Key legislation relating to health, safety and welfare
- 1.3 Statutory duties of employers, employees and the self-employed
- 1.4 Consequences of not complying with statutory duties
- 1.5 How individuals can contribute to establishing a good health and safety culture

Topic 1.1

Learners will know direct and indirect consequences of poor standards of workplace health and safety practice on both businesses and individuals, to include:

Financial eg:

- prosecution fines and legal fees
- compensation claims
- repairs/replacement of equipment
- recruit and train new staff
- increased insurance premiums

Emotional eg:

- guilt and grief
- stress

Reputation eg:

- loss of reputation
- bad publicity

Employees eg:

- reduced staff morale and productivity
- increased staff turnover and sickness

Social eg:

- loss of independence
- reduced social activity

Topic 1.2

Learners will know key legislation relating to health, safety and welfare within the workplace, for example, Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999. Learners will understand the importance of accident and incident reporting in accordance with the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013. Learners will understand the legal status and practical implications of approved codes of practice and industry specific best practice guidance.

Topic 1.3

Learners will know the statutory duties of employers, employees and the self-employed, to include:

Employers:

- provide a safe working environment
- provide safe equipment and systems of work.
- provide information, instruction, training and supervision.
- arrange for the safe storage, transport and use of articles and substances.
- provide adequate welfare facilities.

Employees:

- take reasonable care of their own health and safety.
- take reasonable care of other people who may be affected by what they do or don't do at work.
- cooperate with their employer on health and safety.
- not interfere with or misuse anything provided for their health, safety or welfare

Topic 1.4

Learners will know the powers of health and safety enforcement officers (eg inspection, investigation and guidance) and identify the range of enforcement actions and penalties that may be imposed (eg prohibition and improvement notices, intervention fee and prosecutions).

Topic 1.5

Learners will understand how individuals can contribute to establishing a good health and safety culture within their workplace, for example:

- prompt reporting of defective safety equipment or other matters of concern
- always use control measures and personal protective equipment (PPE) as instructed
- help others to work safely by sharing knowledge and good practice
- set a good example to others by always working safely
- follow instructions and safe working procedures

Learning outcome:

2. Understand the risk assessment process

Topics

2.1 Principles of risk assessment

2.2 Workplace hazards

2.3 Risk assessment

Learning outcome 2 provides learners with the knowledge on the requirements and importance of carrying out risk assessments. Learners will be expected to carry out risk assessments in practice when performing their industry specific activities as required.

Topic 2.1

Learners will understand the legal requirement to carry out suitable and sufficient risk assessments. They will understand the responsibilities of the employer, self-employed and employee within the risk assessment process and identify when expert advice and guidance may be required (eg lack of experience or knowledge).

Topic 2.2

Learners will know common hazards associated with a workplace which could result in serious harm to themselves or others (eg visitors, colleagues, members of the public).

Topic 2.3

Learners will understand how to undertake a detailed risk assessment within the context of their workplace, following the Health and Safety Executive 'Five Steps to Risk Assessment', to include:

- identification of the hazards
- identification of who might be harmed and how they might be harmed
- evaluation of the risks and decide how the level of risk may be controlled
- recording and implementation of the results, as well as communication to others who may be affected
- reviewing risk assessments and suggesting when risk assessments should be reviewed.

Learners will also know the hierarchy of risk control:

- elimination
- substitution
- safe working procedures
- training, instruction and supervision
- personal and respiratory protective equipment (PPE/RPE).

Learning outcome:

3. Understand first aid requirements

Topics

- 3.1 Planning for emergencies and first aid provision in the workplace
- 3.2 Procedures when encountering an accident or medical emergency
- 3.3 First aid for common emergencies

In this outcome learners will explore the importance of planning to and subsequently how to manage common first aid emergencies which may arise in the workplace, with emphasis upon their workplace. Learners should be aware of the aims of first aid (ie, preserve life, prevent injuries worsening and promote recovery) Evidence towards this outcome could come from a current first aid training qualification (ie, appointed persons or first aid at work).

Topic 3.1

Learners will understand the importance of emergency planning, especially for lone or isolated working, and the responsibilities of a first aider. Learners will also know the minimum requirements for first aid at work and identify supplementary arrangements which may be appropriate for their workplace.

Topic 3.2

Learners will know the procedures to follow when encountering an accident or medical emergency. Learners will know how to check the incident site to minimize risk to themselves, assess the situation, and how and when to contact the emergency services and identify prioritisation of activities (eg, 'DRABC').

Topic 3.3

Learners will know how to manage the following common situations as well as other significant situations appropriate to their workplace:

- wounds and burns
- choking
- severe bleeding
- shock
- concussion
- unconscious casualties
- falls from height
- suspected broken limbs and dislocations
- heart attacks.

Learners will know how to recognise their own limitations and explain how to monitor the condition of the casualty and prevent an injury from worsening.

Learning outcome:

4. Understand safe manual handling principles

Topics

4.1 Principles of safe manual handling

4.2 Safe manual handling of common items

In this outcome learners will need to investigate the principles of risk assessment relevant to manual handling in order to plan for and safely move a range of common items associated with their workplace. Learners should have access to a range of common mechanical aids and these should be used as appropriate.

Topic 4.1

Learners will understand how manual handling at work should be minimised and identify appropriate alternatives and mechanical aids. They will know the common causes of injuries associated with poor manual handling within the workplace.

Topic 4.2

Learners will understand how to safely move a range of common items within their workplace. They will know appropriate mechanical aids for a range of common manual handling activities within their workplace.

Learning outcome:

5. Understand the use of fire extinguishers

Topics

5.1 Use of fire extinguishers

Topic 5.1

Learners will know the types, use and colours of portable fire extinguishers, to include:

- water
- dry powder
- foam
- CO₂.

Learners will know how to recognise their own limitations in managing fires in the workplace.

Guidance for delivery

On completion of this unit, the learner will have developed an understanding of some of the key underlying principles and practices of health and safety to help prepare them to enter the workplace. It will be important that delivery relates to example situations that are vocationally relevant to the learners.

Visiting speakers eg paramedics, health and safety consultants or inspectors could enhance the relevance of the subject to learners.

Suggested learning resources

Books

Farmwise - Your Essential Guide to Health and Safety in Agriculture Health and Safety Executive
Published by: Health and Safety Executive Books, 2013
ISBN: 0717665097

Health & Safety at Work Essentials Chadder, P & Duncan, M
Published by: Lawpack Publishing Ltd., 8th Edition, 2014
ISBN: 1910143006

Health and Safety at Work: An Essential Guide for Managers Stranks, J
Published by: Kogan Page, 9th edition, 2010
ISBN: 0749461195

Websites

Health and Safety Executive (HSE) [http:// www.hsegov.uk](http://www.hsegov.uk)

The Royal Society for the Prevention of Accidents (ROSPA) <http://www.rosipa.com/>

Unit 302

Undertake and review work related experience in the Land-based Industries

UAN:	F/507/4635
Level:	3
GLH:	30

What is this unit about?

The aim of this unit is to give learners the skills needed to identify, participate in and review work experience in the environmental and land-based sector. The unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learning outcomes

In this unit, learners will be able to

1. Determine employment opportunities in the environmental and land-based industries
2. Prepare for a work-based experience in the environmental and land-based industry
3. Understand the importance of effective interpersonal skills in the workplace
4. Review a work-based experience in the environmental and land-based sector

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Determine employment opportunities in the environmental and land-based industries

Topics

1.1 Career and progression opportunities within an environmental and land-based industry

In this outcome, learners will explore the different job roles and responsibilities, and the job titles commonly associated with them in their specialist sector. This background understanding is likely to require some formal classroom teaching. Learners should be encouraged to explore the range of employment opportunities and career paths within their specialist sector. Learners will then consider the skills and qualifications that are required for appropriate jobs for themselves and should be encouraged to think about skills and qualifications that they may need to acquire to achieve their employment and careers ambitions. This should help them to identify suitable work experience.

Topic 1.1

Learners will know the job roles relevant to the land based sector, to include:

- managerial
- supervisory
- team worker
- trainee
- volunteer
- common job titles within the relevant sector,
- main duties and responsibilities.

Learners will also know the skills, qualifications and experience needed to fulfil duties and responsibilities of appropriate jobs, to include:

- job specific
- vocational
- personal.

Learning outcome:

2. Prepare for a work-based experience in the environmental and land-based industry

Topics

2.1 Appropriate work-based experience and the application process

2.2 Interview skills

This outcome involves learners going through the process of applying for work experience. They will need to locate suitable job adverts or work experience opportunities, but can be supported by centres suggesting suitable placements. When applying for work experience learners should produce, as a minimum, a detailed curriculum vitae and letter of application using a computer. It will be beneficial for learners to attend a real or simulated interview, and reflect on their performance outlining how they could improve their effectiveness.

Topic 2.1

Learners will find a suitable job opportunity based on existing skills, experience, qualifications, development of skills and experience to achieve future employment goals. They will use a range of sources of information about work opportunities eg trade magazines, websites Learners will , complete an application form (if applicable), curriculum vitae and letter of application.

Topic 2.2

Learners will know how to prepare for an interview eg research the business and job role, suitable dress and personal presentation, information to find out and suitable questions to ask.

Learners will also know how to behave in an interview, eg:

- attend punctually
- dressed appropriately
- answering questions
- completion of other tests (eg practical, aptitude)
- reflection on interview performance.

Learning outcome:

3. Understand the importance of effective interpersonal skills in the workplace

Topics

3.1 The importance of effective interpersonal skills in the workplace

It would be appropriate for employers to be invited to outline to learners their expectations in the workplace.

Topic 3.1

Learners will understand the importance of effective interpersonal skills in the workplace when dealing with customers and colleagues, to include:

- effective communication (eg addressing others face to face, appropriate telephone manner, effective written communication, use of social media)
- courtesy and helpfulness
- appropriate dress and body language
- product knowledge
- use of technical terms.

Learning outcome:

4. Review a work- based experience in the environmental and land-based sector

Topics

4.1 Present evidence of activities and achievements during a work-based experience

4.2 Review a work-based experience, identifying strengths and areas for improvement

4.3 Evaluate future career aspirations

In this outcome, learners will use evidence from their work experience to present a report (eg written or visual), on their work experience business, job role, learning and achievements. They will then review the effectiveness of the workplace, making realistic and justified suggestions for improvement. Review of their own workplace performance and achievements should include all of the content identified, with reference to relevant evidence, eg reports, progress reviews, and the extent to which their aims, objectives/targets have been achieved. Learners should consider further training and experience that will help them to achieve their career ambitions.

Topic 4.1

Learners will present evidence of activities and achievements during a work-based experience to include, as appropriate: name of work experience provider, nature of the organisation (type of business, products or services, customers), organisation structure chart, main duties and responsibilities, regular daily working routine, evidence of safe working practices (eg PPE, risk assessments).

Topic 4.2

Learners will review their work-based experience, identifying strengths and areas for improvement, to include:

- work rate
- work quality and effectiveness
- punctuality
- attendance
- reliability
- dress and personal presentation
- working relationships with others work experience aims
- objectives and targets.

Topic 4.3

Learners will evaluate career aspirations, to include:

- advantages and disadvantages of identified pathways
- suitability to personal interests
- skills and qualifications.

Guidance for delivery

Learners on vocational courses should have experience of the type of work that they hope to do, and of the expectations of potential future employers.

Ideally this unit should be undertaken in a real business environment relevant to the subject interest of the learner, but actual work experience may be gained by a number of routes, eg as part of an industrial placement whilst within the programme, whilst working on a planned daily or weekly basis on the centre's commercial and/or educational facilities, whilst undertaking voluntary work within the industry, as previous relevant and current work experience in the industry or as a member of a group of learners invited to carry out practical work on a suitable business.

Throughout the unit, the emphasis should be on safe working. It is expected that learners will be aware of safe working practices and familiar with accepted practices and behaviours within the context in which they are working.

Learners should complete a minimum of 150 hours of work experience to achieve this unit. If work experience is in the industry, centres should be mindful of their responsibilities for ensuring that work placements have appropriate supervision, insurance and health and safety policies in place.

It is recommended that a summary report is completed by the employer at the end of the work placement.

UAN:	R/507/4347
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to undertake identification, selection and use of plants, and how this can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learners will be able to identify plants by botanic name, and use botanical and morphological features and keys in the identification of plants. In addition, learners will understand how to plant a range of plant types and provide immediate aftercare. Plant knowledge is the foundation of all good horticultural practice and is an essential tool for those with technical and supervisory roles in garden centres, parks, gardens and related areas.

Learning outcomes

In this unit, learners will be able to:

1. Identify plants
2. Understand the factors that affect the selection of plants
3. Plant and provide aftercare to plants

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome

1. Identify plants

Topics

1.1 Plant classification from kingdom to variety and cultivar

1.2 Use botanical and morphological features and keys in the identification of plants

1.3 Identify plants by botanical names

Topic 1.1

Learners will understand how plants are classified from kingdom to variety and cultivar, including inter-specific and bi-generic hybrids.

Learners will understand how plant taxonomy groups plants with shared characteristics such as:

- Gymnosperms
- Angiosperms
- Monocotyledons and dicotyledons
- How this can aid in the identification of plants.

They will understand the naming conventions and relevance of the bi-nominal system, and will be able to write plant names using the correct botanic spelling.

Topic 1.2

Learners will be able to recognise botanical and morphological features of plants that aid identification, including

- Habit (eg prostrate, horizontal, fastigiata, columnar, weeping, round, irregular)
- Size
- Leaf (shape, apex, margins, colour and arrangement)
- Bud (shape, size and arrangement)
- Stem (colour and texture)
- Stem and leaf modifications
- Flowers and fruit (colour, shape, size, flower morphology, type of inflorescence, scent and fruit).

Learners must be able to determine the family and genera of a plant using *Flora*, keys and other sources for identification, including nursery catalogues and brochures, illustrated and specialist text books and Internet images.

Topic 1.3

Learners must be able to identify a minimum of fifty (50) plants as appropriate to industry setting. Live specimens, either growing or as classroom samples, are preferred, but high quality images may be used to assist out-of-season identification.

Learners will need access to live specimens and reference material to practise identification. Specimens for identification must show the typical characteristics of the plant.

Learning outcome:

2 Understand factors that affect selection of plants

Topics

2.1 Plant factors that influence selection

2.2 Site factors that affect the selection of plants

Topic 2.1

Learners will understand plant characteristics and adaptations that allow certain plants to tolerate conditions such as shade, maritime conditions and polluted sites.

Learners will also understand how plant factors such as size, habit, growth rate, possible seasonal nuisance (leaves, fruit, brittle branches), maintenance requirements and pest and disease susceptibility would affect a plants suitability for different sites.

Topic 2.2

Learners will understand factors affecting site suitability and requirements, taking into account the following:

- Climate and microclimate conditions: aspect, slope, exposure, altitude, latitude, shade pockets and sun spots, frost pockets, rainfall and temperature variations, maritime exposure.
- Soil: drainage, texture, structure, pH, nutrient status, anchorage, wet/dry, compaction
- Environmental conditions: pollution, planning restrictions and protected areas designations.
- Feasibility and cost-effectiveness: size, access, freedom from pernicious weeds, pests and diseases, cost of plants and subsequent maintenance, requirement for mature plant specimen

Learning outcome

3 Plant and provide aftercare to plants

Topics

3.1 Plant plants

3.2 Provide appropriate support and immediate aftercare to plants

In this outcome learners will carry out planting, support and protection of stock. Learners will complete a specified project that should include the planting of a range of nursery stock, use of differing planting techniques, the application of support, protection and immediate aftercare. Learners will need to meet the requirements of a specification, and should have an awareness of industry best practice requirements, commercial pressure and implications of poor working practices

Topic 3.1

Learners will plant their industry specific plants using appropriate methods.

Topic 3.2

Learners will apply immediate aftercare of the planted material:

- Apply appropriate aftercare as specified: fertilisers, irrigation, pruning, pesticides, mulch, protection, support

Guidance for delivery

The learner will be able to identify plants by botanic name and specify and design ornamental plant displays that are suitable for the site and situation. In addition, learners will understand how to plant a range of plant types and provide immediate aftercare. Plant knowledge is the foundation of all good horticultural practice and is an essential tool for those with technical and supervisory roles in garden centres, parks, gardens and related areas.

Suggested learning resources

Books

- Alexander, R. 2009. The Essential Garden Design Workbook 2nd Ed. London: Timber Press.
- Brickell, C. 2012. RHS Encyclopaedia of Gardening. Harlow: Dorling Kindersley.
- British Standards Institution. 1989. BS 3936-7: 1989 Nursery stock. Specification for bedding plants. London: BSI
- British Standards Institution. 1990. BS 3936-2: 1990 Nursery stock. Specification for roses. London: BSI
- British Standards Institution. 1990. BS 3936-10: 1990 Nursery stock. Specification for ground cover plants. London: BSI
- British Standards Institution. 1992. BS 3936-1: 1992: Nursery stock. Specification for trees and shrubs. London: BSI
- British Standards Institution. 2014. BS 8545: 2014: Trees: from nursery to independence in the landscape. Recommendations. London: BSI
- Hillier Nurseries. 1998. The Hillier Manual of Trees and Shrubs. Devon: David and Charles Plc.
- Thomas, G.S. 2004. Perennial garden plants. London: Frances Lincoln.
- Phillips, R. et al. 1978. Trees in Britain, Europe and North America. New York: Pan Books.
- Phillips, R., Rix, M. 1993. Perennials: Early Perennials v.1: Early Perennials Vol 1. New York: Pan Books.
- Phillips, R., Rix, M. 1993. Perennials: Late Perennials v.2: Late Perennials Vol 2. New York: Pan Books.
- Stace, C. 2010. New Flora of the British Isles. 3rd ed. Cambridge: Cambridge University Press.
- Young, C (Ed). 2013. RHS Encyclopaedia of Garden Design. London: Dorling Kindersley

Brochures from hardy plant nurseries in UK and Europe are also useful

Websites

www.rhs.org.uk

The Royal Horticultural Society

Unit 304

Maintain turf in parks and gardens

UAN:	A/507/4679
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to maintain turf in parks and gardens and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

The learner will be able to develop the skills and knowledge involved in the maintenance of turf surfaces in parks and gardens. They will also cover the planning and management of an annual maintenance plan for high quality turf.

Learning outcomes

In this unit, learners will be able to:

1. Understand the maintenance of established turf
2. Carry out maintenance and repair of established amenity turf
3. Prepare an annual maintenance programme for a high quality turf area
4. Understand the use, establishment and maintenance of wildflower meadows /low maintenance swards

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the maintenance of established turf

Topics

1.1 Factors affecting maintenance operations on amenity turf

1.2 The effect of maintenance on the growth and development of turf

1.3 Grass species selection for amenity turf

In this outcome learners will explore the relationship between soil, environmental and biological factors on the maintenance of turf. The importance of correct and timely application of turf maintenance operations must be stressed and the consequences of poor maintenance procedures need to be fully understood. Learners need to develop an awareness of how maintenance varies between sites as a result of lawn function, usage and the grass species found. The links between maintenance and the avoidance, limitation and control of lawn pests, diseases and weeds must be fully understood. The understanding gained in learning outcome 1 will support students as they develop the practical skills required for learning outcomes 2 and 3.

Topic 1.1

Learners will understand the effects of the following on turf maintenance needs, methods and timing:

- Soil conditions (texture, compaction, pH, nutrition, soil organisms, surface and sub drainage),
- Environmental factors (rainfall, drought, light levels/shade, temperature, aspect, topography)
- Biological factors (turf pests, diseases, disorders and weeds)
- Function and usage

Topic 1.2

Learners will know the potential positive and negative consequences of lawn maintenance operations over the short and long term.

Lawn maintenance operations will include:

- Mowing (rotary and cylinder)
- Edging (shears and half-moon)
- Irrigation
- Fertiliser application
- Aeration (hollow and solid tine)
- Scarification
- Bulky topdressing
- Leaf clearing.

Topic 1.3

Learners will be able to recognise the following grasses, and be able to list their characteristics:

- *Festuca sp.*
- *Lolium perenne*
- *Holcus lanatus*

- *Poa annua*
- *Agrostis sp.*

Learners must be able to recommend grasses for fine quality, hard wearing and shade situations.

Learning outcome:

2 Carry out maintenance and repair of established amenity turf

Topics

2.1 Carry out turf maintenance operations

2.2 Carry out turf repairs

In this outcome learners will safely carry out a range of maintenance and repair operations on turf in a variety of situations such as fine quality and hard wearing lawns. Learners must be able to demonstrate:

- Selection use, cleaning and storage of appropriate tools, equipment, materials and Personal Protective Equipment (PPE)
- Appraisal of site
- Critical evaluation and professional standards of finish work.

Topic 2.1

Learners will demonstrate the safe use of the following turf maintenance operations by hand and using machinery where appropriate:

- Mowing (rotary and cylinder)
- Edging turf (shears and half-moon)
- Aeration
- Scarification
- Application of bulky top-dressings
- Accurate calibrating of a fertiliser distributor

Topic 2.2

Learners will be able to demonstrate

- Lifting turf and turning around edges
- Lifting turf and relaying to adjust levels
- Patching and over-seeding with appropriate seed mixture.

Learning outcome:

3 Prepare an annual maintenance programme for a high quality turf area

Topics

3.1 Produce a turf maintenance plan

3.2 Estimate annual maintenance costs

In this outcome, learners will develop a turf maintenance plan for a stipulated area of high quality turf. The plan will need to be succinct, clear and suitable for a work situation. It should be assumed that for the purposes of this exercise the learners are working on behalf of a company that already

owns the required machinery although the running costs of this machinery should be taken into account when estimating the costs involved.

Topic 3.1

Learners will produce a turf maintenance plan detailing timing and frequency of lawn maintenance operations to include:

- Mowing
- Edging (shears and half-moon)
- Irrigation
- Fertiliser application
- Aeration
- Scarification
- Bulky topdressing
- Leaf clearing.

Specifications must be given in regards to weather conditions, machinery and tools and their setting and adjustments, materials used and rates of application.

Topic 3.2

Learners will give a full breakdown of the estimated costs involved in carrying out the maintenance plan, to include:

- labour (and time taken to carry out each operation)
- materials (consumables).

Learning outcome:

4 Understand the use, establishment and maintenance of wildflower meadows /low maintenance swards

Topics

4.1 Establishment and maintenance of wildflower meadows/ low maintenance swards

4.2 Advantages, disadvantages and uses of wildflower meadows/ low maintenance swards

Topic 4.1

Learners will understand the establishment and maintenance needs of wildflowers/low maintenance swards:

Establishment:

- Soil conditions
- pH and nutrient levels required
- Ways to reduce the fertility of the soil
- Establishment from seed
- Turf and plants
- Suitable species for spring meadows and summer meadows

Maintenance:

- Spring meadows and summer meadows
- Suitable equipment

- Height of cut
- Timing of operations
- Seed dispersal
- Removal of hay.

Investigations into establishment and maintenance of the meadows should highlight any differences that occur relating to the species of wildflower present.

Topic 4.2

Learners will understand the advantages and disadvantages of the use of wildflower meadows/low maintenance swards in horticultural situations such as parks, gardens and road side verges as an alternative to short mown turf.

Learners will know the use of wildflower meadows/low maintenance swards, for environmental, economic, social, and maintenance implications.

Guidance for delivery

The learner will be able to develop the skills and knowledge involved in the maintenance of turf surfaces in parks and gardens. They will also cover the planning and management of an annual maintenance plan for high quality turf.

This unit should be delivered as practically as possible, but a wide range of techniques can be used, including lectures, supervised practical work (in a centre or the work-place), discussions, site visits and research could be used. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities and learners should not be asked to undertake physical tasks beyond their physical capabilities. Learners should have appropriate access to suitable fine and coarse amenity turf areas for practical lessons and assessment. Where resources at the centre are limited, visits to parks and gardens would be useful to complement lessons at the centre. However, the learners should have regular access for practical work on amenity surfaces over at least one full season in order to develop their skills to the required level. All unit tasks must be undertaken at the correct time of year and in appropriate weather conditions.

Suggested learning resources

Books

- Brickell, C. 2007. The RHS Encyclopaedia of Gardening. Essex: Dorling Kindersley Publishers.
- Brown, S. 2005. Sports Turf and Amenity Grassland Management. Wiltshire: The Crowood Press Limited.
- Hope, F. 1990. Turf Culture: A Complete Manual for the Groundsman. London: Cassell Illustrated.
- Hubbard, C.E. 1992. Grasses: v. 1: A Guide to Their Structure, Identification, Uses and Distribution. 3rd ed. Essex: Penguin Books

Unit 305

Land based industry machinery operations

UAN:	J/507/4636
Level:	3
GLH:	60

What is this unit about?

This unit aims to provide learners with an understanding of the principles of land based machinery operations and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

The learners will study the purpose and operation of land based machines including machine operating and working principles. They will explore routine maintenance and appropriate Personal Protective Equipment. They will also develop knowledge of the legal requirements and industry best practice guidance for land based machinery. They will learn how to safely operate and maintain machinery and consider the different conditions in which machinery might need to operate.

Learning outcomes

In this unit, learners will be able to

1. Understand the purpose and operation of land based industry machinery
2. Prepare land based industry machinery for work
3. Operate land based industry machinery

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the purpose and operation of land based industry machinery

Topics

1.1 Current legislation and industry guidance for land based industry machinery operation

1.2 Purpose and operation of land based machines

In Learning outcome 1 learners must understand the significance of current legislation and industry best practice guidance to the machinery they operate. Learners must also demonstrate understanding of the construction and working principles of a selection of machines commonly used in their specific land based industry, and knowledge of their work and performance parameters.

Topic 1.1

Learners will understand the significance of current legislation and industry best practice guidance to the machinery they operate, to include:

- Legislation: eg Provision and Use of Work Equipment Regulations 1998 (PUWER), Health and Safety at Work Act 1974, Management of Health and Safety at Work Regulations 1999, Control of Substances Hazardous to Health Regulations 2002 (COSHH), Manual Handling Operations Regulations 1992, Personal Protective Equipment (PPE) at Work Regulations 1992, Environmental Protection Act 1990, Wildlife and Countryside Act 1981, Control of Noise at Work Regulations 2005, Control of Vibration at Work Regulations 2005, Lifting Operations and Lifting Equipment Regulations 1998
- Industry best practice guidance.

Topic 1.2

Learners will understand the purpose, operating and working principles and limitations of land based industry machinery. For example:

- Purpose built, trailed, tractor mounted, self-propelled or pedestrian ,
- Power source (eg electric, battery, spark ignition, compression ignition, PTO and hydraulic)
- Drive and transmission systems
- Cutting mechanisms
- Cutting/loading capacity or range
- Input and output ranges and levels
- Terrain suitability
- Safety features.

Learning outcome:

2. Prepare land based industry machinery for work

Topics

2.1 Machinery preparation

2.2 Carry out pre-use checks

2.3 Identify common faults and suggest appropriate remedial action

2.4 Check and report on safety requirements

In Learning outcome 2 learners will demonstrate the ability to prepare machines for work. Machines will be specific to learners' area of study. It is essential that manufacturers' recommendations, user's manuals and machinery handbooks are available to the learner. It is expected that learners do this for three different machines.

Topic 2.1

Learners will prepare selected land based industry machinery for work in accordance with the manufacturers' recommendations, user's manual or machinery handbook.

Topic 2.2

Learners will carry out pre-use checks for selected land based industry machinery in accordance with the manufacturers' recommendations, user's manual or machinery handbook.

Topic 2.3

Learners will identify common faults and suggest appropriate remedial action to the machinery available to them. Common faults may include:

- Incorrect, polluted or lack of fuel
- blocked filters (air, fuel, oils)
- poor oil pressure
- damaged sprockets and fouled drive systems
- damaged or blunt blades
- fouled or incorrectly set gap of spark plugs
- starter recoil tension
- blocked mechanisms.

Topic 2.4

Learner will be able to check and report on the safety requirements for selected land based industry machinery in accordance with the manufacturers' recommendations, user's manual or machinery handbook.

Learning outcome:

3. Operate land based industry machinery

Topics

3.1 Carry out risk assessments

3.2 Ways to minimise possible environmental impacts of using selected land based industry machinery

3.3 Operate land based industry machinery

3.4 Carry out post operating procedures

In outcome 3 learners will be required to operate land based industry machinery. It is anticipated that the delivery of this outcome will be through supervised practical training and the learners will be able to consolidate operational skills within realistic working environments. As a minimum, it is expected

that the learner will be able to operate three powered machines appropriate to their area of study in a realistic industrial environment where possible. The learner should be given appropriate time in order to develop operational skills before assessment. The learner is not required to transport machinery, but should be aware of transport requirements.

Topic 3.1

Learners will carry out risk assessments for the machines they are to operate in accordance with The Management of Health and Safety at Work Regulations 1999.

Topic 3.2

Learners will know how to minimise possible environmental impacts of land based industry machinery, eg:

- Oil and fuel spillage and storage
- Emissions
- Soil stability and erosion
- Protected species
- Waste disposal
- Watercourses.

Topic 3.3

Learners will demonstrate safe and efficient operation of specialist land based industry machinery, to include as appropriate:

- Risk assessment
- Adherence to industry safety guidance and operator's manual,
- Safe start and stop,
- Monitoring of machine performance and output
- Effective communications
- Clearance of blockages,
- Conversion between work and transport positions
- Economic operation
- Safe and efficient operation.

Topic 3.4

Learners will carry out post operating procedures appropriate to machinery operated, to include:

- Cleaning
- Inspecting for and reporting of damage or defects
- Lubrication
- Storage.

Guidance for delivery

This unit is designed to give learners knowledge, understanding and practical skills to enable them to recognise and understand the working principles of land based industry machinery typically used in their area of study.

Learners will be able to demonstrate pre use checks and fault finding of a range of selected machines. They will be able to prepare machines for work and operate them safely and efficiently. An emphasis will be put on the use of manufacturers' recommended procedures, health and safety issues and safe working practices.

Learners must show awareness and consideration of hazards and risks at all times, particularly during operational situations where levels of risk may vary at any given time.

Where possible, tasks should be undertaken in a real working environment. Following operations, learners will demonstrate simple inspection and maintenance and pre storage tasks to minimise degeneration of the machine, and to ensure it is in a useable condition for subsequent operations.

Employer engagement

Employer engagement is essential in order to maximise the value of learners' experience. A partnership approach should be adopted where possible with employers with whom the consortium has links.

Suggested learning resources

Arboricultural Association. 2005. *Arboricultural Association Health and Safety Package*. Cheltenham: Arboricultural Association. ISBN 0900978406.

Ireland, D. 2004. *Winching Operations in Forestry: Tree Takedown and Vehicle Debogging*. Norwich: Stationary Office Books. ISBN 085538638X.

Hathaway, L. 1994. *Tractors Fundamentals of Machine Operation*. Davenport: John Deere Publishing. ISBN 0866912126.

Kestel, B. 2009. *Chainsaw Operator's Manual: The Safe Use of Chainsaws*. Australia: Landlinks Press. ISBN 0643090282.

Southorn, N. 1999. *Tractor Operation and Maintenance*. Sydney: Inkata Press. ISBN 0750689145.

Williams, M. 2000. *Tractor Power*. Ipswich: Farming Press. ISBN 0852365144.

Bell B. 2005. *Farm Machinery*. Old Pond Publishing. ISBN 1903366682

Culpin C. 1992. *Farm Machinery, 12th edition*. Blackwell Scientific. ISBN 063203159X

Manufacturers publications and manuals

Journals and magazines

Horticultural Weekly

Profi International

Farmers Weekly

Arboricultural Association newsletter

Forestry and British Timber

Arboriculture and Forestry Advisory Group (AFAG) Safety Guides

Forest Industry Safety Accord (FISA) Safety Guides

Websites

www.bagma.com	British Agricultural and Garden Machinery Association
www.defra.gov.uk	Dept for Environment, Food and Rural Affairs
www.wales.gov.uk	Welsh Assembly Government
www.scotland.gov.uk	Scottish Executive Environment and Rural Affairs Department
www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)
www.hse.gov.uk	Health and Safety Executive
http://www.trees.org.uk	The Arboricultural Association
http://www.ukfisa.com	The Forest Industry Safety Accord
http://www.gorestry.gov.uk	The Forestry Commission
http://www.hse.gov.uk	The Health and Safety Executive

Unit 306

Principles of plant health and protection

UAN:	M/507/4680
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of the principles of plant health and protection and how this can be applied in practice.

The learner will be able to identify a range of weeds, pests, diseases and disorders within a specific sector of the industry. They will also be able to review the viable control measures and specify an integrated plan of control to ensure plant health and protection within the sector. Learners will also learn about and develop the skills required to apply pesticides safely.

Learning outcomes

In this unit, learners will be able to:

1. Identify and classify pests, diseases, disorders and weeds
2. Understand the biology of pests, diseases, disorders and weeds and the problems they cause
3. Understand methods of controlling pests, diseases, disorders and weeds
4. Understand the safe use of pesticides

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome

1. Identify and classify pests, diseases, disorders and weeds

Topics

Identify and classify pests relating to a specific horticultural situation

Identify and classify diseases and disorders relating to a specific horticultural situation

Identify and classify weeds relating to a specific horticultural situation

In this outcome learners will identify (using the binomial system) and classify a range of pests, diseases, disorders and weeds of importance to their specialist sector. They will be able to identify 40 types (a minimum of 10 weeds, 10 pests, 10 diseases/disorders). This outcome develops the identification of plant problems, correct identification being the basis of control strategy. Live specimens, either growing in the field or as classroom samples are to be preferred, but high quality images may also be used, particularly to assist learning out of the season, or for problems that are not so common. Where appropriate, some pest and diseases are best identified from the damage caused.

Topic 1.1

Learners will identify and classify common pests covering the following groups:

- Vertebrates (birds and mammals)
- Invertebrates, these may include:
 - Molluscs
 - Nematodes
 - Mites
 - Insects (to include relevant orders of insects eg *Hemiptera*, *Coleoptera*, *Lepidoptera* and *Hymenoptera*)

Topic 1.2

Learners will identify and classify common diseases and disorders covering the following groups:

- Diseases (such as viruses, bacteria and fungi)
- Disorders (environmental disorders such as weather, light availability, drought and nutrient deficiencies)

Topic 1.3

Learners will identify and classify common weeds covering the following groups:

- Annual and ephemeral weeds
- Perennial weeds

Learning outcome

2 Understand the biology of pests, diseases, disorders and weeds and the problems they cause

Topics

2.1 Biology of pests and the problems they cause

2.2 Biology of diseases and the problems they cause

2.3 Disorders and the problems they cause

Biology of weeds and the problems they cause

In this outcome learners will explore the biology of pests, diseases, disorders and weeds and the problems they cause , to include:

- Causes (conditions that encourage the pest, disease, disorder or weed),
- Life cycle, where relevant (eg duration and timing of each stage, reproduction methods and rates, life expectancy, effects of season, temperature, day length and other relevant environmental factors, dormant period, host plants),
- Symptoms and damage caused
- Spread, where relevant (eg vectors, airborne, rain splash, walking, swimming, flying, seed, rhizomes, offsets, stolons, runners, bulbs, corms).

Topic 2.1

Learners will understand the biology of pests and recognise the problems they cause. Pests include:

- Mammals
- Birds
- Molluscs
- Nematodes
- Insects

Topic 2.2

Learners will understand the occurrence of the disease in relation to the disease triangle (pathogen, host and environment). Learners will be able to recognise the pathogen, host, and environmental factors required for specific examples of the following disease types to occur:

- Viral and bacterial diseases
- Fungal diseases

Topic 2.3

Learners will understand the causes and symptoms of disorders in relation to environmental factors.

Topic 2.4

Learners will understand the biology of weeds and recognise the problems they cause. Weeds include

- Annual and ephemeral weeds
- Perennial weeds

Learning outcome

3 Understand methods of controlling pests, diseases, disorders and weeds

Topics

- 3.1 Control of pests relating to a specific horticultural situation
- 3.2 Control of diseases relating to a specific horticultural situation
- 3.3 Control of disorders relating to a specific horticultural situation
- 3.4 Control of weeds relating to a specific horticultural situation
- 3.5 Biosecurity measures to prevent the spread of pests, diseases and weeds

In this outcome learners will explore the control of plant pests, diseases, disorders and weeds within their specialist sector. For all pests, diseases, disorders and weeds being investigated, an integrated approach (IPM) should be considered, using a full range of control methods to include:

- Cultural
- Physical
- Chemical (selective, broad spectrum, systemic, contact, residual, translocated, organic, bio-pesticides)
- Biological.

The advantages, disadvantages and effectiveness (available budget, health and safety implications, environmental considerations, factors affecting the general health of the plant, including nutrition and environmental factors, level of staff training, monitoring, outdoors or under protection) of these approaches should be evaluated. The relationship between life cycle and control methods needs to be understood.

This outcome also explores the need of the industry to be pre-emptive and avoid the damaging effects of pest disease and weed infestations. Learners need to investigate the growing problem associated with the introduction of alien pest, disease and weed and their spread around the country as a result of international trade and travel. The Biosecurity subject is best explored using case studies of current or potential biosecurity concerns such as Giant Hogweed (*Heracleum mantegazzianum*), Ash dieback (*Chalara fraxinea*) and Potato Flea Beetle (*Epitrix* species).

Topic 3.1

Learners will understand how to control pests using a range of cultural, physical, chemical and biological control methods. The pests to include:

- Mammals
- Birds
- Molluscs
- Nematodes
- Insect

Topic 3.2

Learners will understand how to control diseases using a range of cultural, physical, chemical and biological control methods. Diseases to include:

- Viral and bacterial diseases
- Fungal diseases

Topic 3.3

Learners must understand how to control disorders using a range of cultural control methods.

Topic 3.4

Learners will understand how to control weeds using a range of cultural, physical, chemical and biological control methods. Weeds to include:

- Annual and ephemeral weeds
- Perennial weeds

Topic 3.5

Learners will understand the problems associated with the trade and movement of plants both nationally and internationally. This relates to the biosecurity measures (notifiable pests and diseases, certification schemes, plant passports, phytosanitary legislation), implemented to prevent the spread of plant pests, diseases and weeds.

Learning outcome

4 Understand the safe use of pesticides

Topics

4.1 Risks pesticide application may pose to people or the environment

4.2 Procedures for safe handling of pesticides

4.3 Correct storage and disposal of materials and equipment

4.4 Legislation applying to the use of pesticides and the records that must be kept

In this outcome learners will explore the legislation and principles behind the safe use of pesticide. This outcome aims to prepare students to be assessed for the NPTC PA1 award Safe use of Pesticides if they choose to register and sit the assessment. It must be stressed to students that the training received for this learning outcome does not entitle learners to use pesticides legally and if they wish to legally apply pesticide in the future they must achieve their NPTC PA1 and PA6 or equivalent qualification. The wording used and objectives of the NPTC PA1 have been modified to fit the format of the City and Guilds Level 3 qualification.

Topic 4.1

Learners will know factors to consider when protecting people and the environment from the risks posed by pesticide application, including:

- Specially designated areas (SSSI's etc.)
- Wildlife habitat protection
- Off target contamination
- Preferred time of day
- Preferred weather conditions
- Warning of neighbours/other interested parties
- Public rights of way.

Topic 4.2

Learners will know the procedures for safe handling of pesticides, to include;

- Using product label information (PPE, field of use, application rate, concentration, warnings)
- Following the appropriate personal hygiene procedures to prevent personal contamination
- Following the appropriate procedures for dealing with accidental personal contamination

Topic 4.3

Learners will understand the correct procedures for the

- Storage of pesticides
- Disposal of empty pesticide containers, surplus pesticide and washings
- Storage and maintenance of PPE.

Topic 4.4

Learners will know legislation which apply to the use of pesticides and the records that must be kept, to include:

- Control of Substances Hazardous to Health (2002) (COSHH)
- Food and Environment Protection Act 1990 (as amended) (FEPA)
- Control of Pesticides Regulations 1986 (COPR)
- Local Environment Risk Assessment for Pesticides (LERAPS)

Guidance for delivery

This unit is designed to provide the learner with an understanding of how plant pests, diseases, disorders and weeds can affect their horticultural specialisms. The information gained could quickly become adapted to other specialism within horticulture as the learner comes across new situations or as their career changes. Teaching should where ever possible highlight the crossover between pest, disease and weed control in different aspects of horticulture. The delivery of this unit may be integrated with the delivery of other units where this is feasible and every opportunity should be taken to show the link to horticultural practices.

The unit may be delivered by a wide range of techniques, including lectures, supervised practical work, experimentation, investigations using microscope slides and sections, discussions, video or DVD, site visits and research. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities.

Suggested learning resources

Books

- Brickell, C. 2007. RHS Encyclopaedia of Gardening. 3rd ed. Harlow: Dorling Kindersley Publishing.
- Buczacki, S. 1989. Collins Guide to the Pests, Diseases and Disorders of Garden Plants. Hammersmith: Harper Collins.
- FBC Limited. 1975. Broad-leaved weeds, a guide to identification. Nottingham: FBC Limited.
- Halstead, A., Greenwood, P. 2009. RHS Pests and Diseases. Harlow: Dorling Kindersley.
- Hubbard, C.E. 1992. Grasses: v. 1: A Guide to Their Structure, Identification, Uses and Distribution. 3rd ed. London: Penguin Books.
- Ingram, D.S. et al. 2008. Science and the Garden: The Scientific Basis of Horticultural Practice. 2nd ed. Sussex: Wiley Publishing.
- Lainsbury, M. 2009. UK Pesticide Guide 2009. Oxford: CABI Publishing.
- Phillips, R. 1977. Wild flowers of Britain. London: Pan Books.
- Chancellor, R.J. 1981. The Identification of Weed Seedlings of Farm and Garden. Sussex: Wiley Publishing.
- Clapham et al. 1987. Flora of the British Isles. Cambridge: Cambridge University Press.
- Health and Safety Executive Codes of Practice Leaflets

Websites

www.rhs.org.uk

The Royal Horticultural Society

www.bcpc.org

British Crop Production Council

www.defra.gov.uk

Department for Environment, Food and Rural Affairs

www.wales.gov.uk

Welsh Assembly Government

www.scotland.gov.uk

www.dardni.gov.uk

www.gov.uk/plant-health-controls

Scottish Executive Environment and Rural Affairs

Department of Agriculture and Rural Affairs (Northern Ireland)

UK Government guidance on plant health controls

UAN:	L/507/4637
Level:	3
GLH:	60

What is this unit about?

This unit aims to provide learners with an understanding of the principles of plant and soil science and how these can be applied in practice within land based or related industries. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learners will be able to develop an understanding of soil characteristics and their relationship to crop growth and development. They will investigate how plants grow and develop, through a knowledge of their structure and physiology. In addition, the learners have the opportunity to consider factors which influence production of commercial crops and other plants, which provides a basis for plant and soil management techniques.

Learning outcomes

In this unit, learners will be able to

1. Understand the function of plant structures
2. Understand the main processes of plant physiology, growth and development
3. Understand how soils affect plant growth and development

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the function of plant structures

Topics

1.1 Internal and external structures of plants

1.2 Function of plant structures

Topic 1.1

Learners will understand the major internal and external structures of plants:

- Major internal structures: cell structure (cytoplasm, organelles), parenchyma, collenchyma, sclerenchyma, xylem tissue, phloem tissue, cambium, epidermis, guard cells, and stomata
- Major external structures: roots, shoots, stem, leaves, buds, flowers, fruit and seeds
- Specialised cells, tissues and organs: eg pericycle, endodermis, lenticels, cotyledons, stolons, rhizomes, bulbs, corms, root and stem tubers.

Topic 1.2

Learners will understand the function of the major plant structures (eg photosynthesis, reproduction, support, transport, anchorage, absorption, storage, defence, attraction, gaseous exchange, respiration, division).

Learning outcome:

2. Understand the main physiological processes and growth and development of plants

Topics

2.1 Processes of plant physiology

2.2 Life cycle of selected plants

2.3 Growth and development of plants

In this outcome learners will explore the major processes of plant physiology and identify factors affecting growth and development of plants. Learners will also need an awareness of how knowledge of plant physiology can be applied within land based management scenarios.

Topic 2.1

Learners will understand the major processes of plant physiology:

- Photosynthesis: process and equation for photosynthesis, chloroplasts, function of chlorophyll, functionality of guard cells and stomata, factors influencing the rate of photosynthesis (light, chlorophyll, temperature, carbon dioxide, water, leaf colour)
- Respiration: definition of aerobic and anaerobic respiration, equation for aerobic respiration, structure and function of mitochondria, diffusion, compensation point, factors influencing the rate of respiration (temperature, water availability, seasonal growth)

- Uptake, transport and loss of water and nutrients: osmosis, diffusion, plasmolysis, turgor, translocation, transpiration, factors influencing transpiration (eg temperature, humidity, air movement, water supply, light, stomata).

Topic 2.2

Learners will understand the life cycle of plants:

- Life cycle types: ephemeral, annual, biennial, perennial
- Germination: process and stages, types of germination (eg epigeal, hypogeal), types of reproduction (sexual reproduction eg flower structures, pollination and fertilisation, seed production, dispersal), (asexual reproduction eg vegetative propagation, parthenogenesis).

Topic 2.3

Learners will understand the growth and development of plants, to include: cell division, cell expansion, cell differentiation, apical meristems, lateral meristems, formation of roots, shoots, leaves and buds.

Learning outcome:

3. Understand how soils affect plant growth and development

Topics

- 3.1 Soil types and soil formation
- 3.2 Investigate characteristics of soil types
- 3.3 How soils affect plant growth and development
- 3.4 Cultural techniques that affect soil characteristics

In this outcome learners will need to investigate a range of soil types and carry out supervised basic soil experiments to investigate different soil characteristics. These could include investigating the proportion of sand, silt and clay through suspending in water, investigating the water holding capacity of different soil types, and determining soil pH. The learners' understanding of the effects of soil characteristics on plant growth and development could be supported by some controlled experiments, where learners grow plants in different soil types.

Delivery could be enhanced by visits to see different types of plants growing in different soil types. Visiting expert speakers' input would be useful, as they would describe practical aspects of managing soil structure and plant nutrition.

Topic 3.1

Learners will identify a range of soil types to include:

- Loams
- Clays
- Silts
- Sands
- Organic soils

Understand how soil is formed.

Topic 3.2

Learners will investigate the characteristics of a range of soil types and profiles to include:

- Soil profiles and different horizons
- Properties of soil particles and texture (clay, silt and sand)
- Soil structure (i.e. Crumb structure, aggregate sizes)
- Water holding capacity
- Aeration
- Stability
- Organic matter
- pH
- Soil life: decomposers, mycorrhizae.

Topic 3.3

Learners will understand how soil properties and characteristics can affect plant growth and development, to include:

- Rooting depth and plant stability
- pH and organic matter
- Availability or lack of macronutrients and micronutrients
- Effects of organic and inorganic fertiliser application
- Nutrient retention to include cation exchange capacity
- Drainage/water logging
- Compaction/poor aeration
- Effects of high or low soil water content
- Effects on ability to prepare soil for planting.

Topic 3.4

Learners will understand how cultural techniques affect soil structure, to include:

- Soil amelioration (eg green manure, addition of lime, organic matter, hydrogels, mycorrhizae, textural amendment)
- Soil cultivation (eg sub-soiling, ploughing, single and double digging, rotavating, minimal cultivation, zero cultivation)
- Soil protection and prevention of damage (eg capping, erosion, cultivation pans, surface and subsurface compaction).

Guidance for delivery

On completion of this unit, the learner will have developed an understanding of how plants grow and develop, through knowledge of their structure and physiology. It will be important that delivery relates to plants that are vocationally relevant to the learners. Laboratory and field based practicals will be essential to help learners to explore soil characteristics, plant physiology and structure, and a series of visits to growing plants could help learners better understand plant growth and development. Learners are required to study a range of plants for this unit, although they should be able to focus upon plant types that are most relevant to their vocational area of study. Learners will also need to have access to a range of soils, as well as appropriate equipment and resources to undertake soil sampling and investigate soil profiles.

Visiting speakers could enhance relevance of the subject to learners Development of areas within a college environment where learners are able to modify and manipulate plant environments may enhance understanding of the complexities of plants and their life cycles.

Employer engagement

Employer engagement is essential in order to maximise the value of learners' experience. A partnership approach should be adopted where possible with employers with whom the consortium has links, and with employers used for work experience placements.

It would be helpful for teachers to develop a method of maintaining contact with a range of employers in the sectors may be able to help with keeping the examples of legislation, policies and codes of practice used in the taught content, up to date.

Suggested learning resources

Books

Principles of Horticulture. 6th Edition
Published by: Routledge, 2011
ISBN: 0080969577

Adams, C.R. & Early, M.

A Dictionary of Plant Science. 3rd Edition
Published by: OUP Oxford, 2012
ISBN: 0199600570

Allaby, M.

Essential Soil Science: A clear and concise introduction to soil science
Ashman, M & Puri, G
Published by: Wiley-Blackwell, 2008
ISBN: 0632048859

An Introduction to Plant Structure and Development: Plant Anatomy for the Twenty-First Century. 2nd Edition
Beck, C.B
Published by: Cambridge University Press, 2010
ISBN: 0521518059

Nature and Properties of Soils. 14th Edition
Published by: Pearson Education, 2014
ISBN: 9332519102

Brady, N.C. & Weil, R.R.

Plant Anatomy: An Applied Approach
Published by: John Wiley & Sons, 2008
ISBN: 1405126795

Cutler, D.F; Botha, T & Stevenson, D.W.

Biochemistry and Molecular Biology of Plants. 2nd Edition

Buchanan, B.B; Gruissem, W & Jones, R

Published by: Wiley-Blackwell, 2015
ISBN: 0470714212

Raven Biology of Plants. 8 th Edition Published by: WH Freeman & Co Ltd., 2012 ISBN: 1464113513	Evert, R.F & Eichhorn, S.E.
Instant Notes in Plant Biology. 2 nd Edition Published by: Taylor and Francis, 2005 ISBN: 0415356431	Lack, A & Evans, D
Botany: An Introduction to Plant Biology. 5 th Edition Published by: Jones & Bartlett Publishers, 2014 ISBN: 1284068854	Mauseth, J.D.
Advanced Biology Published by: Nelson Thornes, 2000 ISBN: 0174387326	Reiss, M & Monger, G
Biology. 2 nd Revised Edition Published by: Nelson Thornes, 2001 ISBN: 0748762388	Roberts, M & Ingram, N
Plant Biology Published by: Garland Science, 2009 ISBN: 0815340257	Smith, A; Coupland, G; Dolan, L; Harberd, N; Jones, J; Martin, C; Sablowski, R & Amey A
Plant Physiology. 5 th Edition Published by: Sinauer Associates, 2010 ISBN: 0878935657	Taiz, L & Zeiger, E
Plant Cell Biology Published by: Academic Press, 2009 ISBN: 0123747783	Wayne, R
Principles and Practice of Soil Science: The Soil as a Natural Resource. 4 th Edition Published by: Wiley-Blackwell, 2005 ISBN: 0632064552	White, R.E

Journals and magazines

- Arborist News
- Essential Arb
- Forestry Journal
- Journal of Arboriculture

- Quarterly Journal of Forestry
- The Arb Magazine
- Field mycology

Websites

Biotechnology and Biological Sciences Research Council	http://www.bbsrc.ac.uk
British Society of Soil Science	http://www.soils.org.uk/
DEFRA	http://www.defra.gov.uk
Environment Agency	http://www.environment-agency.gov.uk
Health and safety Executive	http://www.hse.gov.uk
Science and Plants for Schools	http://www.saps.org.uk/
The Arboricultural Association	http://www.trees.org.uk/
The Forestry Commission	http://www.forestry.gov.uk

Unit 308

Tree and shrub maintenance

UAN:	T/507/4681
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of tree and shrub pruning and maintenance, and how these can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training.

The learner will understand the reasons for undertaking pruning of trees and shrubs and their varying requirements, as well as the law relevant to the work. Common equipment used to undertake this work will be examined, as well as the biological processes of trees and shrubs and their impact upon pruning and maintenance work. The learner will be able to assess trees and shrubs for failure and suggest appropriate pruning and other remedial action.

Learning outcomes

In this unit, learners will:

1. Understand the pruning of trees and shrubs
2. Prune and maintain trees and shrubs
3. Understand the potential problems associated with trees and shrubs

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome

1. Understand the pruning of trees and shrubs

Topics

- 1.1 The aims and considerations of pruning trees and shrubs
- 1.2 Pruning techniques
- 1.3 The immediate and long term biological processes of trees and shrubs in response to pruning and possible consequences of not pruning
- 1.4 Legislation relevant to pruning trees and shrubs

Topic 1.1

Learners will know the common reasons for pruning which should include:

- health and safety
- physical access (pedestrian and vehicular)
- size control
- improve formative performance (appearance, structure, flower, fruit)
- disease controls
- restoration
- Learners should also be aware of the threat from competition for space, light, and nutrients. The financial constraints and client requirements of pruning should also be considered.

Topic 1.2

Learners will know the common pruning techniques for trees and shrubs and the British Standard (3998) requirements for crown thinning, crown reduction, crown lifting, formative pruning, dead-wooding, pollarding and coppicing.

Learners will also need to understand the natural target pruning process, branch collars, branch bark ridge, and be able to use appropriate tools and equipment to carry out pruning which should include a range of the above where appropriate.

Topic 1.3

Learners will know how pruning impacts upon energy use, wound response and closure, storage and mobilisation of energy reserves, Compartmentalisation of Decay in Trees (CODIT), wound and callus growth and the development of epicormic and adventitious shoots. Learners will need to recognise how the age, species of trees and shrubs, and environmental constraints affect pruning.

Topic 1.4

Learners will know how legislation dictates, restricts and controls pruning operations and should include statute law examples:

- Planning processes, Town and Country Planning Act 1990, Conservation areas, The Town and Country Planning (Tree Preservation)(England) Regulations 2012 (TPOs),
- Health and Safety at Work Act 1974
- Wildlife and Countryside Act (1981) (as amended)
- Highways Act 1980

- Exemptions

Learners will also know how failure to carry out pruning could result in nuisance, liability and negligence including high hedges and highway trees.

Learning outcome

2. Prune and maintain trees and shrubs

Topics

- 2.1 Plan the pruning and maintenance of trees and shrubs
- 2.2 Carry out appropriate pruning and maintenance of trees and shrubs

In this outcome learners will need to plan and carry out pruning work on trees and shrubs. It is not a requirement for the learner to climb or use other mechanisms to access tree crowns to undertake pruning for this outcome but where access/climbing occurs, this should be accompanied by appropriate risk assessment, management and supervision to ensure the safety of the learner.

Topic 2.1

Learners will identify trees and shrubs for pruning. They will also select appropriate method of pruning, tools and equipment for the planned works.

Topic 2.2

Learners will carry out tree and shrub pruning, to include:

- correct pruning techniques and timing,
- correct operation of tools and equipment,
- safe working practices
- appropriate disposal of waste,
- minimising environmental impact.

Learning outcome

Understand the potential problems associated with trees and shrubs

Topics

- 3.1. The potential of trees and shrubs for failure
- 3.2. The detrimental effects of trees and shrubs on the human environment

Topic 3.1

Learners will identify failure potential in trees and shrubs including:

- Decay
- structural weaknesses
- injury
- species characteristics
- growth habit
- site and environmental influences and factors

Topic 3.2

Learners will understand the detrimental effect of trees and shrubs on the human environment, such as:

- underground and overhead services
- highways
- footpaths
- rights of way
- easement
- building foundations
- cultivated areas
- surface and drainage systems.

Guidance for delivery

This unit is designed to provide the learner with sound knowledge and practical skills associated with the requirements to maintain trees and shrubs by pruning. The content and context of the unit should be adapted where possible to the learner's area of study. The unit should cover a range trees and shrubs, as well as techniques and equipment, appropriate to the area of study and those that are locally or regionally significant to the learner. Consideration should be given to the seasonal nature and timing of pruning in relation to tree and shrub species, as well as when signs and symptoms associated with causes of potential failure may be easily observed.

It is anticipated that the delivery of this unit may initially focus mainly upon formal lectures but it is recommended that, as far as is possible, they are linked directly with interactive lessons in a real environment. Where practical learning is undertaken, the emphasis should be on safe working. It is expected that learners will be aware of safe working practices and familiar with accepted practices and behaviours within the context in which they are working.

Any legal permission required to prune trees must be obtained and equipment/machinery used must comply with relevant requirements of the Provision and Use of Work Equipment Regulations (PUWER) 1998. If chainsaws are used, the learner must hold a Certificate of Competence in Chainsaw and Related Operations.

Adequate Personal Protective Equipment (PPE) appropriate to the learner, the machinery and the task must be provided and worn in accordance with the associated risk assessment, industry guidance and operator's manual. It is a requirement for the learner to use pruning equipment; health and safety issues relevant to the equipment being used must be stressed and regularly reinforced. In addition the learner should be actively involved in comprehensive risk assessment. Simulation and demonstration could be used to illustrate appropriate equipment and techniques, such as decay detection or bracing which are commonly used, but unavailable to the learner.

A learner working towards level 3 is likely to have experience of the promotion of healthy establishment and growth of trees. This unit aims to extend the learner's knowledge and skills involved with ensuring the long term health and management of trees and shrubs. Emphasis should be placed on the importance of planning and implementation of strategies to promote the health of trees within their charge and the practical application of current knowledge. Current and topical issues regarding pruning should be highlighted as and when they arise.

Centres are encouraged to introduce employers and specific professionals from the horticulture, forestry or arboriculture industries to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of establishments to add depth to the learner experience and enable them to examine pruned and un-pruned trees throughout the year.

Suggested learning resources

Books

Arboricultural Association. 1994. *A Guide to Tree Pruning*. Cheltenham: Arboricultural Association. ISBN 090097821X.

Arboricultural Association. 2005. *Arboricultural Association Health and Safety Package*. Cheltenham: Arboricultural Association. ISBN 0900978406

British Standards Institute. 2010. *Tree work - Recommendations (British standard 3998:2010)*. London: British Standards Institution.

British Standards Institute. 2012. *BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations*. London: British Standards Institution. ISBN 0580464180

Brown G.E., Kirkham T. 2009. *The Pruning of Trees, Shrubs and Conifers*. Portland: Timber Press. ISBN 0881926132.

Lonsdale, D. 1999. *Principles of Tree Hazard Assessment and Management*. Norwich: Stationery Office Books. ISBN 0117533556.

Mattheck C. 2007. *Field Guide for Visual Tree Assessment*. Karlsruhe Research Centre. ISBN 9783923704590

Mynors, C. 2010. *The Law of Trees, Forests and Hedgerow*. London: Sweet and Maxwell. ISBN 0421590408.

Shigo A.L. 1989. *Tree Pruning: A Worldwide Photo Guide*. Snohomish: Shigo and Trees Associates. ISBN 0943563089.

Strouts, R.G., Winter, T.G. 2000. *Diagnosis of Ill-Health in Trees*. 2nd ed. Norwich: The Stationery Office Books. ISBN 0117535451.

Journals and magazines

Arboricultural Advisory Information Service publications

Arboricultural Association newsletter

Forestry and British Timber

Journal of Arboriculture

Quarterly Journal of Forestry

Arboriculture and Forestry Advisory Group (AFAG) Safety Guides

Forest Industry Safety Accord (FISA) Safety Guides

Websites

The Arboricultural Association – resources page

<http://www.trees.org.uk/Help-for-Arborists/Help-becoming-an-ArbAC>

The Health and Safety Executive

<http://www.hse.gov.uk/>

Unit 309

Undertake estate skills

UAN:	K/507/4645
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to introduce learners to common estate skills and knowledge and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or into further/higher education.

The learner will look at constructing, repairing and maintaining boundaries, structures and surfaces. They will build their experience and confidence in developing practical skills in a range of situations. The learner will be able to contextualise practical management work to a particular habitat that lies within their primary area of learning.

Learning outcomes

In this unit, learners will be able to

1. Construct, repair or maintain boundaries
2. Construct, repair or maintain structures
3. Construct, repair or maintain surfaces
4. Carry out practical habitat management work

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome

1. Construct, repair or maintain boundaries

Topics

- 1.1 Types of boundaries
- 1.2 Prepare for work on boundaries
- 1.3 Select equipment and materials
- 1.4 Construct, repair or maintain boundaries

In this outcome learners will develop the practical skills needed to construct, repair or maintain at least **two** different boundaries.

Topic 1.1

Learners will know the types of boundaries, e.g.

- hedge, bank, ditch
- fence (post and rail, post and wire, electric, netting)
- wall (stone, brick).

Topic 1.2

Learners will plan the task, clear debris and prepare the site, ensure livestock and public safety, consider factors associated with the location (e.g. power supply, waste disposal, equipment and materials storage).

Topic 1.3

Learners will select materials and equipment relevant to the task, taking into account health and safety, sustainable practice and cost implications.

Topic 1.4

Learners will undertake the task safely (e.g. implementation of risk assessment and appropriate Personal Protective Equipment (PPE)) and to the required standards.

Learning outcome

2. Construct, repair or maintain structures

Topics

- 2.1 Types of structures
- 2.2 Prepare for work on structures
- 2.3 Select equipment and materials
- 2.4 Construct, repair or maintain structures

In this outcome, learners will construct, repair or maintain at least **two** different structures. These may typically be constructed from wood, metal, stone or brick. Learners are not expected to be able to fully construct substantial structures such as animal or machinery housing, however, it is anticipated that delivery could include repair and maintenance of such larger structures as would be

found in an estate setting. Large structures requiring repair or maintenance may include animal house or pen, machinery or feed store, garden furniture, shed and pergola.

Topic 2.1

Learners will know the different types of structures e.g. gate, stile, horse jump, bird box, table, bench, door, raised bed, composting area or swim platform, animal house or pen, machinery or feed store, garden furniture, shed and pergola.

Topic 2.2

Learners will plan the activity, clear debris and prepare the site, ensure livestock and public safety, consider location factors (power supply, waste disposal, equipment and materials storage).

Topic 2.3

Learners will select materials and equipment relevant to the task, taking into account health and safety, sustainable practice and cost implications

Topic 2.4

Learners will undertake the task safely (e.g. implementation of risk assessment and appropriate Personal Protective Equipment (PPE)) and to the required standards

Learning outcome

3. Construct, repair or maintain surfaces

Topics

- 3.1 Types of surfaces
- 3.2 Prepare for work on surfaces
- 3.3 Select equipment and materials
- 3.4 Construct, repair or maintain surfaces

In this outcome learners are required to construct, repair or maintain **one** surface (e.g. path, road and hard standing) which could be either solid (e.g. decking, concrete and paving), or loose (e.g. gravel, wood chippings and sand). Where appropriate, learners should be aware of timeliness considerations, for example preparing concrete at the right time for construction.

Topic 3.1

Learners will know different types of surfaces, eg:

- solid (e.g. decking, concrete and paving)
- loose (e.g. gravel, wood chippings and sand).

Topic 3.2

Learners will plan the task, clear debris and prepare the site, ensure livestock and public safety, consider factors associated with the location (e.g. power supply, waste disposal, equipment and materials storage).

Topic 3.3

Learners will identify and select materials and equipment relevant to the task, taking into account health and safety, sustainable practice and cost implications.

Topic 3.4

Learners will undertake the task safely (e.g. implementation of risk assessment and appropriate Personal Protective Equipment (PPE)) and to the required standards.

Learning outcome

4. Carry out practical habitat management work

Topics

- 4.1 Habitat management activities
- 4.2 Prepare for habitat management work
- 4.3 Select equipment and materials
- 4.4 Carry out practical habitat management work

In this outcome learners should be aware of time considerations for practical habitat management work, for example preparing concrete at the right time for construction.

Topic 4.1

Learners will know different types of activities required for habitat management, eg: mowing, renovation, tree and shrub planting, clearing unwanted vegetation, coppicing, pruning, thinning, pond, stream and ditch clearance, and control of invasive species.

Topic 4.2

Learners will plan the task, clear debris and prepare the site, ensure livestock and public safety, consider factors associated with the location (e.g. power supply, waste disposal, equipment and materials storage)

Topic 4.3

Learners will identify and select materials and equipment relevant to the task, taking into account health and safety, sustainable practice and cost implications

Topic 4.4

Learners will undertake the task safely (e.g. implementation of risk assessment and appropriate Personal Protective Equipment (PPE)) and to the required standards.

Guidance for delivery

This unit has a very practical focus, and aims to enable learners to develop estate skills which can be applied to a range of situations and circumstances. The unit has been written such that naturally occurring and locally relevant opportunities can be used in selecting sites, structures and surfaces to construct, repair or maintain.

As learners will be engaged in practical activity there should be an emphasis on safe working practices, including the use of appropriate personal protective equipment (PPE), and appropriate risk assessments should be undertaken. At Level 3 it is expected that learners will take an active part in

completing risk assessments, so that this becomes an integral part of all practical activity. Learners should also be made aware of the impact on the environment, and sustainability concepts should also be demonstrated where possible.

Learners should have the opportunity to undertake estate skills activity in a land based setting wherever possible to maximise the vocational relevance. It will be most beneficial if the structures, boundaries and surface selected are for a clear purpose above and beyond delivery of this unit. It is recognised that there will not be opportunities to carry out construction, repair *and* maintenance in each of the categories, but it would be appropriate for the skills of construction, repair and maintenance to each be developed in one aspect of the unit.

It is anticipated that most delivery of this unit will take place in a practical setting, with supervised practice of skills. Delivery will also include some classroom based activity in ensuring learners have a good understanding of planning, materials selection and preparation, and underpinning knowledge.

Suggested learning resources

Agate E (Ed), Brooks A and Adcock S (1999) *Dry Stone Walling: A Practical Handbook*. The Conservation Volunteers.

Agate E (2001) *Fencing: A Practical Handbook*. The Conservation Volunteers.

Agate E (2001) *Footpaths: A Practical Handbook*. The Conservation Volunteers.

Agate E and Brooks A (1998) *Hedging: A Practical Handbook*. The Conservation Volunteers.

Agate E (Ed) (2001) *Tree Planting and Aftercare: A Practical Handbook*. The Conservation Volunteers.

Agate E (2000) *Tool Care: A Maintenance and Workshop Manual*. The Conservation Volunteers.

Agate E (2001) *Waterways & Wetlands: A Practical Handbook*. The Conservation Volunteers.

Agate E (Ed) (2002) *Woodlands: A Practical Handbook*. The Conservation Volunteers.

Maclean M (2006) *Hedges and Hedgelaying – A Guide to Planting, Management and Conservation*. The Crowood Press.

Roberts, M. (1997) *Poultry House Construction*. Gold Cockerel Books

Roberts, M. (1999) *The Smallholder's DIY*. Gold Cockerel Books

Roberts, M. (2005) *Farm and Smallholder Fencing: A Practical Guide to Permanent and Electric Livestock Fencing on the Farm and Smallholding*. Gold Cockerel Books

Stokes A (1999) *Health and Safety Overview for Practical Conservation Project: A Guide to Good Practice for Conservation Groups and Land Managers*. The Conservation Volunteers.

Websites

The Conservation Volunteers www.tcv.org.uk

Department for Environment, Food and Rural Affairs www.defra.gov.uk

Health and Safety Executive www.hse.gov.uk

The Wildlife Trusts

www.wildlifetrusts.org

Forestry Commission

www.forestry.gov.uk

Unit 310

Business management in the Land based sector

UAN:	A/507/4648
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is for learners look at the businesses within the land based sector, the role and responsibilities of those employed in land based businesses and resource requirements.

This unit links closely to **Unit 302: Undertake and review work related experience in the Land based Industries**

Learning outcomes

In this unit, learners will be able to

1. understand the breadth and importance of an industry in the land based sector
2. understand business resources and structures
3. understand the business marketplace
4. understand how to use financial and physical record keeping systems

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the breadth and importance of an industry in the land-based sector

Topics

- 1.1 Importance to the economy
- 1.2 Associated businesses

In this outcome, learners will investigate the size, scope and importance of their specialist sector within the environment and land-based industries, and how this has developed over the last 50 years or so. They will also investigate the range of business types and other organisations that are represented in their sector, including important regulatory, professional or representative organisations. Wherever possible this should be related to specific businesses and organisations.

Topic 1.1

Learners will understand the importance of businesses within the industry to the economy:

- Using measures available to the industry, including:
 - value of output
 - contribution to Gross Domestic Product (GDP)
 - employment
 - land use
 - economic and social benefits
 - trends in importance
- Range of organisations:
 - typical types of businesses and other organisations (eg representative, regulatory, not-for-profit)
 - regional variations
 - changes and developments in the last 50 years.

Topic 1.2

Learners will understand the range of associated businesses allied to the industry, to include:

- relevant industries in primary, secondary and tertiary industrial sectors (eg suppliers of raw materials, processors, distributors, retailers, service providers)
- associated organisations:
 - specific interrelationships between one business and other associated organisations eg:
 - suppliers of goods and services
 - representative organisations and professional bodies
 - regulatory bodies
 - competitors
 - customers
 - aims and roles of important organisations in the sector.

Learning outcome:

2. Understand business resources and structures

Topics

- 2.1 Legal structure and organisation
- 2.2 Physical resource requirements
- 2.3 Job roles and responsibilities

This outcome focuses on the legal and resource implications of constituting a business. Learners will learn about the range of business organisations in the private and public sectors, and the legal and practical implications of different business types. This should be related to the types of business important in their sector. Learners will investigate the physical resource requirements of businesses, and how they are managed.

Topic 2.1

Learners will understand the legal structure and organisation for the following business types:

- sole trader
- partnership
- limited company
- not-for-profit organization
- charity
- public sector organisations
- organisation staffing structure.

Topic 2.2

Learners will understand the physical resource requirements of a selected land-based business, to include:

- property ie forms of tenure, appraisal of business potential
- vehicles and machinery
- tools and equipment
- materials ie stocks control procedures
- insurance of physical resources.

Topic 2.3

Learners will understand different job roles and responsibilities in a selected land-based business.

- Job roles relevant to the sector, including:
 - director
 - manager
 - supervisor
 - team worker
 - trainee
 - administrator
 - volunteer
 - sub contractor
- For each of the above job roles, learners will explore:
 - job description (eg responsibilities for financial physical and human resources, staff motivation and performance management)
 - person specification (typical skills, qualifications and experience required to fulfil the role)

- legal rights and responsibilities in work (eg pay, working hours, holidays, equal opportunities, health and safety, employment protection).

Learners will know relevant employment legislation, including:

- Employment Act 2002
- National minimum wage Act 1998
- Working times regulation Act 1998
- Equality Act 2010.

Learning outcome:

3. Understand the business marketplace

Topics

3.1 Marketplace, customers and competitors

3.2 Supply chain

3.3 Quality management

In this outcome, learners will analyse the market for a specific land-based business. This could involve a case study project and should identify, for that business, information on the content listed. External influences should be relevant and current to that business. Specific competitors should be identified and analysed to identify strengths and weaknesses to the case study business. When investigating the supply chain learners will need to identify the flow of resources from production of raw materials, through relevant manufacture and processing, to end consumers. Quality management will include reference to any formal standards or approvals that are relevant. It should also consider the quality standards required by the industry, any systems and practices that are used to achieve quality, and implications of failing to meet prescribed or assumed levels of quality.

Topic 3.1

Learners will understand the marketplace, customers and competitors for a land-based business by investigating the following:

- size of market ie value of sales, number of customers
- external influences on the market ie political, economic, socio-cultural, technological
- customer base ie number, type, characteristics, market segments
- competitor analysis ie direct and indirect competitors.

Topic 3.2

Learners will understand the importance of efficiency and interdependency in a supply chain in a land-based context, considering the following:

- suppliers
- distributors
- customers
- supply chain assurance
- ethics.

Topic 3.3

Learners will understand quality management systems and practices within a land-based business:

- Important aspects of quality in the sector
- Formal quality standards or approval eg BALL approved, Plant Passports, British Standards

- Informal systems and practices to achieve quality
- Problems arising if quality is not achieved.

Learning outcome:

4. Understand how to use financial and physical record keeping systems

Topics

4.1 Financial records

4.2 Physical records

4.3 Monitor business performance and progress

This outcome focuses on the range of financial and physical records that are required to meet legal requirements as well as to ensure effective business operation. Learners will complete a range of financial records. They should be aware of paper-based and computerised systems for financial records but are not expected to become competent in the use of IT accounts software. The range of physical records investigated should be related to the needs of the learners' specialist sector, and should include important current examples of legally required records. In addition to completing a range of records, learners will investigate how specific examples can be used to aid decision making, monitor and control business performance.

Topic 4.1

Learners will understand the importance of keeping accurate financial records for a selected land-based business in relation to legal requirements and management efficiency. Learners will understand the following financial records:

- purchasing and ordering procedures
- order forms and orders
- deliveries and receipts
- invoices and sales records
- credit control
- payment methods
- bookkeeping ie cash analysis, petty cash, cash flow, budgets, computer accounts programmes
- basic accounts ie trading account, balance sheet, depreciation
- taxation ie VAT, income tax PAYE, national insurance contributions, corporation tax
- wage calculation.

Topic 4.2

Learners will understand the importance of recording physical records for a selected land-based business, to include:

- production
- inputs
- staffing
- customers
- resource use
- data protection
- legal requirements to keep records eg pesticide use, veterinary medicines, transport, animal movement, passports.

Topic 4.3

Learners will understand how financial and physical records are used in monitoring business performance and progress, to include:

- production levels
- costs of production
- financial efficiency
- monitoring against targets
- budgets
- previous periods
- relevant review periods ie weekly, monthly, annually
- appropriate remedial actions
- staff roles in recording and analysing information.

Guidance for delivery

This unit is designed to provide the learner with an understanding of the business aspects of their industry. It is applicable to all sectors of the environment and land-based sector and learners focus their study on the sector most relevant to their vocational interests.

Centres are encouraged to introduce employers and specific professionals from industry to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of establishments to add depth to the learner experience.

It is accepted that formal lectures will be necessary at level 3 but for this unit it is recommended that they are they are linked directly with interactive lessons in a real environment.

Unit 311

Undertake a specialist project in the Land based sector

UAN:	D/507/4643
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is for learners to gain an understanding of the principles of undertaking a specialist project and how this can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training.

Learners will develop project knowledge and skills by studying a chosen topic area through a project. They will explore topic areas that interest them and select one topic for their project. They will plan and carry out their specialist project working to meet deadlines and monitoring performance. Learners will prepare an evaluative report looking at how the project performed, if the schedule plan met the project aims and objectives and how improvements could be made in the future.

Learning outcomes

In this unit, learners will be able to

1. Develop proposals for specialist projects
2. Plan for specialist projects
3. Carry out specialist projects
4. Evaluate specialist projects

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Develop proposals for specialist projects

Topics

1.1 Research topics for specialist sources using information sources

1.2 Project proposal

In this outcome, learners will need to identify a suitable topic for their investigative project. This should be relevant to their programme of study and have a particular interest for them, for example in relation to a special area of interest, experience or future employment of study ambitions. Ideal project topics could have a practical or theoretical focus, but all projects should include potential for research into existing literature and information sources as well as a practical investigation or application, so should be chosen in agreement with the tutor. Learners are likely to need guidance on suitable project topics and tutor support to ensure that selected topics are achievable in the timescale and with the resources available. The proposal should outline the aims and objectives, information sources, resource requirements, and the methodology by which the learner intends to complete the project, as well as their justification for topic selection. If appropriate to the investigation, a hypothesis should be included as part of the methodology.

Topic 1.1

Learners will use a range of information sources to research topics for specialist project, including:

- textbooks
- journals
- magazines
- internet
- trade literature
- television and radio
- subject experts.

Learners will comment on the validity and reliability of each type of information source.

Learners will carry out research using methods appropriate to the topic, for example:

- literature review
- trials, experiments
- practical activities
- questionnaires
- interviews
- surveys.

Topic 1.2

Learners will produce proposals for specialist projects, to include:

- Title
- aims/objectives
- methodology
- information sources
- resources required for completion of the project ie advice and support, computers, materials

- justification of proposed project.

Learning outcome:

2. Plan for specialist projects

Topics

2.1 Planning operations and resources

2.2 Selection of resources

In this outcome, learners will complete a detailed action plan for completion of the specialist project within the set timescale. This should include, as a minimum:

- a detailed breakdown of key milestones from starting the project up to submission of the completed project report
- resources required at each stage (and reasons for their selection)
- time expected for completion and interim target completion dates.

Learners should also consider possible setbacks to their planned schedule and contingency plans to ensure timely completion of the project.

Topic 2.1

Learners will plan operations required to carry out a selected specialist project, to include:

- Project planning techniques
 - critical path analysis
 - Gantt charts
- sequencing of activities
- working to deadlines
- allowing for other commitments
- project action plan:
 - aims
 - objectives
 - specific operations / tasks
 - start and completion dates
 - time required
 - resources required
 - possible disruptions to plan eg illness, IT problems, resource problems, cost
 - Contingencies
 - remedial actions.

Topic 2.2

Learners will justify reasons for resources selected based on suitability, availability and cost, to include:

- people
- time
- buildings
- equipment
- animals
- materials
- literature and media eg internet, trade magazine
- IT applications and budget.

Learning outcome:

3. Carry out specialist projects

Topics

3.1 Monitor progress

3.2 Health and safety implications

In this outcome, learners will conduct and complete their specialist project, collecting supporting evidence as appropriate, for example literature review, artefacts, witness statements, photographs or videos. Whilst doing this, they should maintain a log or diary of all actions, and regularly monitor their progress against their action plan. It would be appropriate for tutors to conduct progress reviews at key stages of the project. As part of conducting the project, learners should discuss any health and safety implications of their work, and identify any relevant legislation or codes of practice. Risk assessments may contribute to evidence of this.

Topic 3.1

When carrying out their project, learners will monitor progress against deadlines using a diary or action log.

Learners will monitor performance against :

- schedule plan ie daily, weekly, monthly progress
- budget
- other appropriate measures for each tasks.

Learners will capture reasons and remedial actions if falling behind schedule using a diary or action log.

Deadlines can be defined as interim, key milestones or final, and should be reviewed at regular intervals by tutor/supervisor.

Topic 3.2

Learners will discuss the health and safety implications, where applicable, of the specialist project, taking into consideration:

- health and safety
- risk assessment
- Personal Protective Equipment (PPE)
- relevant regulations and legislation
- codes of practice.

Learning outcome:

4. Evaluate specialist projects

Topics

4.1 Report on project

4.2 Evaluating achievements and areas for improvement

In this outcome, learners will produce a summary report of their project and the process of its completion. This should cover, as a minimum:

- title
- aims / objectives
- review of existing literature / information
- methodology
- results / findings
- conclusions
- references.

Topic 4.1

Learners will report on the project either in a written report format, or verbally through a presentation.

Topic 4.2

Learners will evaluate achievements and areas for improvement for their specialist projects, including:

- conduct and management of the project:
 - action plan
 - keeping to deadlines
 - problems and remedial actions
 - project results/findings
 - strengths and weaknesses.
- Areas for improvement:
 - Planning
 - Implementation methodology
 - results/findings
 - report
 - topics for further investigation.

Guidance for delivery

This unit is designed to encourage and develop learners' independent thinking and research skills. The concept of the project is applicable across all of the vocational areas in the environmental and land-based sector, and learners should be guided and encouraged to select a project topic that is particularly relevant to their interests. Suitable project topics could include:

- trial or experiment
- investigation of an issue important to the sector
- production of a structure or artefact
- training programme
- improving a process
- investigation of a new product or service.

All referencing should comply with academic conventions.

The project evaluation should consider the strengths and weaknesses of the finished project and the process of its completion. Consideration of the usefulness and importance of project planning, and ways in which the project could have been improved.

Unit 312

Principles of advanced horticultural science

UAN:	A/507/4682
Level:	3
GLH:	

What is this unit about?

The purpose of this unit is to provide learners with an understanding of the principles of advanced horticultural science, how these can be applied in practice and provide underpinning knowledge that will enhance understanding of horticultural production techniques. This unit enables learners to develop knowledge of the structures and complex processes that take place in the plant and soil and their relationship to plant growth. Learners will be able to relate advanced horticultural practices to these processes and understand how environmental conditions affect the growth and development of plants.

Opportunities throughout this unit may allow Learners to carry out management of plants. This management may include the growing of photoperiodic flowering plants, germination of seeds that require treatments to overcome dormancy, application of plant growth regulators in horticultural practice, micro-propagation of plants, investigations into plant adaptation and management of specific soil types to ensure optimum growth for plants. These opportunities will provide Learners with practical scientific skills that will be of high value in the horticultural science industry.

Learning outcomes

In this unit, learners will be able to:

1. Know plant adaptations in response to environment
2. Understand the principles and processes of plant growth regulation
3. Understand the physiology of flowers, buds and seeds
4. Understand plant breeding and genetics

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Know plant adaptations in response to environment

Topics

- 1.1 Variations in plant physiology in relation to environment
- 1.2 Diversity of floral structure and its relationship with pollinator agents
- 1.3 Diversity of vegetative structure in response to environmental conditions.

In this outcome the many plant adaptations which have occurred in response to the environment in which they grow will have to be discussed. Examples of plants which demonstrate physiological, vegetative and floral adaptations should be provided to the learner.

Topic 1.1

Learners will be able to relate physiological adaptations to environmental factors such as:

- light
- humidity
- water availability and heat.

Adaptations to include:

- photosynthesis with C4 and CAM plants
- oils and waxes that reduce transpiration.

Topic 1.2

Learners will be able to relate floral structure to pollination vector. Examples being the catkins and small female flowers on wind pollinated plants such as *Corylus avellana* and protruding flowers on wind pollinated grasses such as *Stipa gigantea*. Examples of insect pollinated plants should also be given, such as *Rosa* species that have specialised pigments, scents and nectaries for attraction of insects. Differences of anthers and stigmas should be compared between wind pollinated and insect pollinated flowers.

Topic 1.3

Learners will be able to recognise variations and adaptations of stem, leaves, flowers and roots and how each modification aids survival in the wild.

Examples of modified stems to include: adaptations for storage of water, such as cacti, and defence mechanisms, such as thorns. Examples of modified leaves to include water storage as found in succulents and reduction in transpiration by production of hairy leaves. Adaptation of roots to include pneumatophores that reduce anaerobic respiration within waterlogged soils, eg *Taxodium*, and deep roots to access underground water.

Learning outcome:

2 Understand the principles and processes of plant growth regulation

Topics

2.1 The responses to natural plant hormones (plant growth regulators)

2.2 The interactions between different natural plant hormones (plant growth regulators)

2.3 The effects of applied synthetic plant growth regulators

Topic 2.1

Learners will understand physiological responses to natural plant growth regulators to include auxin, cytokinin, gibberellin, abscisic acid, and ethylene.

- Responses to auxin to include apical dominance, adventitious rooting and tropic responses.
- Responses to gibberellin to include breaking seed dormancy, unfertilised fruit production and stem elongation.
- Responses to cytokinin to include breaking bud dormancy, shoot development and delaying senescence.
- Responses to abscisic acid to include seed dormancy, growth retardation and stomatal closure.
- Responses to ethylene to include defoliation, fruit ripening and cell death.

Topic 2.2

Learners will understand plant responses to specific balances of growth regulators

- auxin and cytokinin for root/shoot balance
- gibberellin and abscisic acid for dormancy balance
- ethylene and auxin for leaf abscission.

Topic 2.3

Learners will understand the application of synthetic plant growth regulators used in industry. These should have specific horticultural purposes to include:

- auxin for rooting of cuttings
- cytokinin and auxins for tissue culture (micro-propagation)
- gibberellin for fruit set in grape vines
- ethylene for ripening fruit within the food supply chain
- abscisic acid for dormancy anti-gibberellins for growth inhibitors/retardants that stop stem elongation
- abscisic acid for prevention of wilting in cut flower market.

Learning outcome:

3 Understand the physiology of flowers, buds and seeds

Topics

3.1 The management and growth of photoperiodic plants in relation to flowering and other plant processes

3.2 The processes of dormancy in buds and seeds.

3.3 Stages and processes involved in germination

In this outcome learners will investigate photoperiodism in plants, dormancy in seed and buds and the germination of seeds. A thorough understanding of the principles involved is required of the learner. It is also important that learners can relate the scientific principles to horticultural practices therefore

opportunities should be sought to ensure a practical approach, involving for example being responsible for manipulating day length to initiate a photoperiodic response, collecting seed and breaking dormancy, together with sowing a range of seeds to better appreciate the germination process.

Topic 3.1

Learners will understand photoperiodism as a change in physiology related to day length, and how this relates to named examples of short day plants, long day plants and how this process does not affect day neutral plants.

An evolutionary advantage relating to photoperiodism can include the promotion of cross pollination, and a disadvantage is that some plants can only be grown in certain latitudes. Management of photoperiodism to include the use of replacement lighting and blackout screens within controlled environments.

Topic 3.2

Learners will understand the reasons for dormancy in buds and seeds. These reasons will include changes in the balance of plant growth regulators (hormones) and environmental influences such as temperature and light. Learners will be able to describe the temperature requirements to initiate or accelerate flower bud development.

Learners will know different types of physical and physiological dormancy in seeds, and describe reasons for dormancy in seeds such as links between successful germination and correct environmental conditions.

Topic 3.3

Learners will understand the stages and processes involved in germination including, where applicable, breaking dormancy. This will include the structure of seeds (endospermic, non-endospermic), and hypogeal, epigeal and coleoptile germination.

Learners will understand the requirements for successful germination that include temperature, moisture, oxygen, and sometimes light.

Learners will also carry out seed storage, seed viability testing, and practice methods of breaking dormancy in seeds, to include stratification (exposure to cold in moist environments) and scarification (physical and chemical weakening of impermeable seed coats).

Learning outcome:

4 Understand plant breeding and genetics

Topics

4.1 The processes of mitosis and meiosis in plants

4.2 Mendel's laws of inheritance, segregation, dominance and recession

4.3 Techniques, uses and ethical considerations of genetic manipulation in plant breeding

This outcome covers plant breeding and genetics, including the processes of mitosis and meiosis. Emphasis should be placed on Mendel's laws of inheritance, together with carrying out an evaluation of the uses of genetic manipulation and tissue culture in plant breeding and propagation. Learners should be introduced to Punnett squares, in order to predict genetic outcomes through breeding that include F1 and F2 hybrids

Topic 4.1

Learners will understand the processes of mitosis and meiosis regarding cell division, and compare the similarities and differences. Stages in mitosis should include prophase, anaphase, metaphase, telophase and cytokinesis. Stages in meiosis should include prophase I&II, anaphase I&II, metaphase I&II, telophase I&II and cytokinesis I&II

Topic 4.2

Learners will understand Mendel's Laws. These are to include, Mendel's laws of inheritance, segregation, dominance and recession. Learners will be able to determine simple breeding outcomes by using Punnett squares to calculate F1 and F2 genotypes and phenotypes

Topic 4.3

Learners will understand the techniques used to genetically modify plants, such as *Agrobacterium tumifaciens* as a transfer vector, particle bombardment and X-Ray induced polyploidy. Learners will also understand the uses and ethical considerations of genetic manipulation.

Guidance for delivery

This unit enable learners to develop knowledge of the structures and complex processes that take place in the plant and soil and their relationship to plant growth. Learners will be able to relate advanced horticultural practices to these processes and understand how environmental conditions affect the growth and development of plants.

Where possible, centres should provide facilities and situations in which theory can be applied in practice. If this is not possible then visits to commercial establishments is recommended.

Centres are encouraged to introduce employers and specific professionals from the horticultural science industry and from the production horticulture industry. Teaching would benefit from visits to a variety of establishments to add depth and enhance the learner's experience.

The unit may be delivered by a wide range of techniques, including lectures, supervised practical work, experimentation, investigations using microscope slides and sections, discussions, video or DVD, site visits and research. The delivery of this unit may be integrated with the delivery of other units on the production horticulture pathway where this is feasible and every opportunity should be taken to show the link to horticultural practices. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities.

Suggested learning resources

Organisations

EMR research centre, East Malling, Kent, ME19 6BJ

Stockbridge Technology Centre, Selby, YO8 3TZ

Warwick Crop Centre, Warwick CV35 9EF

Institute of Biological, Environmental and Rural Sciences, Aberystwyth University

Books

Dirr, M.A. 2006. *The Reference Manual of Woody Plant Propagation*. 2nd ed. Portland: Timber Press.

Hartman, H et al. 2010. *Plant Propagation, principles and practices*. 8th ed. Harlow: Prentice Hall.

Ingram, D.S et al. 2008. *Science and the Garden: The Scientific Basis of Horticultural Practice* Sussex: Wiley

Kyte *et al* 2013. *Plants from Test Tubes: An Introduction to Micropropagation*. 4th Edition.

Stamp, D.L. 2008. *Britain's Structure and Scenery*. London: Collins

Taiz L. & Zeiger E. 2010. *Plant Physiology 5th Edition*. USA: Sinauer

Websites

UK plant Science Federation <http://www.plantsci.org.uk/>

BBC Bitesize <http://www.bbc.co.uk/schools/gcsebitesize/>

Unit 313

Identification and use of ornamental plants

UAN:	F/507/4683
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to undertake identification, selection and use of ornamental plants, and how this can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learners will be able to identify plants by botanic name, and specify and design ornamental plant displays that are suitable for the situation and site. Plant knowledge is the foundation of all good horticultural practice and is an essential tool for those with technical and supervisory roles in garden centres, parks, gardens and related areas.

Learning outcomes

In this unit, learners will be able to:

1. Identify plants
2. Prepare ornamental planting plans
3. Establish ornamental plant displays

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome

1. Identify plants

Topics

1.1 Identify plants by botanical names

Topic 1.1

Learners will identify a minimum of a hundred and fifty (150) plants as appropriate to industry setting. Live specimens, either growing or as classroom samples, are preferred, but high quality images may be used to assist out-of-season identification.

Learners will need access to live specimens and reference material to practise identification.

Specimens for identification must show the typical characteristics of the plant.

The following are **examples** of how the 150 plants could be split:

Example 1: 60 trees, 60 shrubs, 20 natives, 10 weeds

Example 2: 20 alpiners, 30 perennials, 30 annuals and tender perennials, 20 trees, 40 shrubs, 10 grasses

Learners will identify plants from a minimum of 4 categories, with a minimum of 20 plants per category, to make up a total of 150. The categories are:

- annuals and tender perennials
- hardy herbaceous perennials including bulbs
- alpiners and rock plants
- grasses
- shrubs
- trees
- weeds
- water garden plants
- native
- indoor plants

Learning outcome

2 Prepare ornamental planting designs

Topics

2.1 Site conditions in preparation for planting designs

2.2 Evaluate aesthetic factors that influence plant selection and plant combinations

2.3 Planting designs which are appropriate for the site, including temporary and permanent displays.

Learners must evaluate site conditions and prepare appropriate temporary and permanent planting designs, which should include annual bedding, herbaceous and woody plants.

Learners must prepare a minimum of two planting designs which are appropriate for specified sites, one (1) temporary display and one (1) permanent display. They must use a suitable scale, give details

of plant selection, spacing and quantities. The plan must be drawn, labelled, orientated and titled in the conventional manner.

Topic 2.1

Learners will evaluate site conditions in preparation for planting designs taking into account plant factors to choose suitable planting material.

Topic 2.2

Learners will be able to evaluate the aesthetic value of plants and plant combinations including

- use of colour and colour wheels (flower, foliage, contrasts and harmonies, tone, shade, warm and cool themed, approaching and receding colours, mood),
- texture (rough, smooth, coarse, glossy, sharp, hard, soft, contrasts and harmonies of texture),
- categories of planting types (anchor domes, emergent, base planes, accents and structural dominants),
- form (upright, weeping, columnar, broad, round, conical, dense, open, trailing/arching, prostrate, contrasts and harmonies of form)
- flowers (size, shape, colour, scent), fruit (size, shape, colour), leaves (size, shape, colour, aroma,), stems (size, shape, colour, texture, thorns), seasonal interest.

Topic 2.3

Learners will prepare planting designs which are appropriate for the site, including temporary and permanent displays.

Learners will understand the functional, aesthetic and thematic requirements of displays. Designs may be formal, informal or themed.

Learners may design displays such as seasonal bedding, plunge and carpet bedding, rose borders, herbaceous borders, mixed herbaceous/woody plantings.

Learning outcome

3 Establish ornamental plant displays

Topics

3.1 Establish ornamental plant displays from planting design

Topic 3.1

Learners will use one of the planting designs prepared in LO 2 to establish an ornamental plant display.

Guidance for delivery

The learner will be able to identify plants by botanic name and specify and design ornamental plant displays that are suitable for the site and situation. In addition, they will create an ornamental plant display following the design they produced. Plant knowledge is the foundation of all good horticultural practice and is an essential tool for those with technical and supervisory roles in garden centres, parks, gardens and related areas.

Suggested learning resources

Books

- Alexander, R. 2009. The Essential Garden Design Workbook 2nd Ed. London: Timber Press.
- Brickell, C. 2012. RHS Encyclopaedia of Gardening. Harlow: Dorling Kindersley.
- British Standards Institution. 1989. BS 3936-7: 1989 Nursery stock. Specification for bedding plants. London: BSI
- British Standards Institution. 1990. BS 3936-2: 1990 Nursery stock. Specification for roses. London: BSI
- British Standards Institution. 1990. BS 3936-10: 1990 Nursery stock. Specification for ground cover plants. London: BSI
- British Standards Institution. 1992. BS 3936-1: 1992: Nursery stock. Specification for trees and shrubs. London: BSI
- British Standards Institution. 2014. BS 8545: 2014: Trees: from nursery to independence in the landscape. Recommendations. London: BSI
- Hillier Nurseries. 1998. The Hillier Manual of Trees and Shrubs. Devon: David and Charles Plc.
- Thomas, G.S. 2004. Perennial garden plants. London: Frances Lincoln.
- Phillips, R. et al. 1978. Trees in Britain, Europe and North America. New York: Pan Books.
- Phillips, R., Rix, M. 1993. Perennials: Early Perennials v.1: Early Perennials Vol 1. New York: Pan Books.
- Phillips, R., Rix, M. 1993. Perennials: Late Perennials v.2: Late Perennials Vol 2. New York: Pan Books.
- Robinson, N, 2004, The Planting Design Handbook, Aldershot: Ashgate Publishing Limited
- Stace, C. 2010. New Flora of the British Isles. 3rd ed. Cambridge: Cambridge University Press.
- Young, C (Ed). 2013. RHS Encyclopaedia of Garden Design. London: Dorling Kindersley

Brochures from hardy plant nurseries in UK and Europe are also useful

Websites

www.rhs.org.uk

The Royal Horticultural Society

Unit 314

Principles of sustainable management of turf

UAN:	J/507/4684
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of the principles of sustainable management of turf and how these can be put into practice. The learners will be able to develop the skills and knowledge involved in the sustainable management of sports and amenity turf areas. They will be able to analyse and evaluate data to make informed turf management decisions.

Learning outcomes

In this unit, learners will be able to:

1. Understand the principles of sustainable turf management
2. Understand turf management
3. Understand turf management strategies in relation to the sustainability of the surface.

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the principles of sustainable turf management

Topics

- 1.1 The terms sustainability and carrying capacity
- 1.2 Benefits and limitations of management strategies in sustainable management
- 1.3 The effects that components of the soil ecosystem, usage patterns and weather conditions have on the carrying capacity
- 1.4 Sustainable management of water and material inputs
- 1.5 Cost savings or additional costs of material inputs to improve the sustainability of turf surfaces

In this outcome, learners will develop knowledge of sustainable turf management and how to maximise carrying capacity of an area. They need to develop an understanding of the relationships between the soil eco-system, the weather, material inputs and maintenance operations on different types of turf and the subsequent effect on levels of quality. It is essential that the learners fully understand these principles as they will be applied in the other outcomes in this unit and throughout other units within their course.

Topic 1.1

Learners will understand the principles of sustainability:

- Economic
- Social
- Environmental.

They will understand that the concept involves a long lasting, responsible and balanced approach to turf management, with efficient and effective use of resources and minimising waste. The learners will also understand that high resource inputs can conflict with the principle of sustainability. They will also need to know how to manage material inputs including “reduce, reuse and recycle”.

Learners will understand the concept of carrying capacity: the maximum level of use or activity of a sports or amenity surface that can be supported without causing an unacceptable deterioration of the surface or reduction in playing quality or user experience.

Topic 1.2

The learners will understand management strategies and determine their appropriateness within a sustainable management programme. They will need to consider factors such as:

- Achievable level of sustainable management for different situations
- Choice of equipment and machines and their season of use (eg the debate between the use of rollers and mowers for increasing green speed),
- Frequencies, duration, direction of travel, rotation and intensity of utilised areas,
- Sequence of different operations.

Topic 1.3

Learners will understand the effects that components of the soil ecosystem (i.e. mineral and organic matter, soil air, soil water, nutrient and pH status, soil organisms), along with usage patterns of an area and weather conditions, have on the carrying capacity of an area.

Topic 1.4

Learners will understand that water is a finite resource and how it can be managed sustainably. They will know the sources of supply, the quality and quantity of supply and the potential use of grey and saline water. They will also understand how other material inputs i.e. fertilisers, pesticides, fungicides, herbicides, can be managed sustainably and how good cultural practices can reduce the dependency on these products.

Topic 1.5

Learners will understand that there will be cost savings when adopting a more sustainable management programme eg water, fertiliser, energy, but that there will also be additional costs as good cultural practices will become more important eg topdressing, seed, turf, labour.

Learning outcome :

2. Understand turf management

Topics

- 2.1 Determine the Performance Quality Standards
- 2.2 The use of efficiency ratios to inform improvements in management practices
- 2.3 The review of climate data and subsequent recommendations for turf management activities

In this outcome, learners will develop skills and knowledge in assessing turf against Performance Quality Standards (PQS) using a standard range of tests. They will need to understand the importance of using appropriate efficiency ratios and exploring how changes in input or maintenance operations affect the costs involved. The learners will need to practice using the PQS tests to develop the required level of skill to ensure accurate data collection and analysis. Learners will also need to understand how to modify management regimes in relation to local climate data.

Topic 2.1

Learners will determine levels of Performance Quality Standards:

- basic (recreational use)
- standard (club use)
- high (national and international competition use)
- through the use of a range of tests.

The level of quality will be assessed in three areas:

- structural quality: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, root zone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational quality: eg appearance, visibility of and width of markings, surface debris, and sward colour

- playing quality: eg vertical ball bounce, traction, ball roll, spin, hardness.

Learners will then decide if the assessed level is acceptable for the given area and usage.

Topic 2.2

Learners analyse turf management information using efficiency ratios for example: cost per hour of use, cost per game, cost per user, and cost per unit area (eg square metre or hectare). They will also need to determine the value of input (in terms of labour hours) per unit output (hour of use or game), and input (in terms of material quantities) per unit output (hour of use or game).

Topic 2.3

Learners will understand the value of local climate data when determining appropriate management activities and longer term management plans. They will review data such as:

- current season information compared with longer term averages
- quantity of precipitation
- quantity and quality of light
- shading effects
- seasonal and unseasonal frost
- maximum and minimum temperatures
- air movement
- endemic and catastrophic climatic events.

They also will understand the impact on the quality of turf surface, grass species selection, irrigation, fertiliser application, mowing specifications, sequence of operations, pests, diseases and disorders, and frequency and intensity of use.

Learning outcome:

3. Understand turf management strategies in relation to the sustainability of the surface

Topics

- 3.1 The benefits of using Performance Quality Standards
- 3.2 Relationship between quality objectives of a turf surface and resource inputs and usage
- 3.3 Evaluate the use of efficiency ratios when assessing a turf surface
- 3.4 The impact of mowing and other maintenance practices on sustainability

In this outcome, learners should be able to explain the purpose, benefits and limitations of the use of Performance Quality Standards and the tests used to assess them, along with the use of efficiency ratios. Learners will be able to identify all the resource inputs, including personnel, materials, equipment, machinery and finances for a stated sport or amenity surface to maintain it to a specific level of quality.

Topic 3.1

Learners will understand the benefits of using Performance Quality Standards to include:

- informing management decisions
- determining maintenance requirement accurately
- justifying purchase of equipment/ resources
- allowing effective use of inputs
- reducing wastage

- determining the carrying capacity of the turf.

Topic 3.2

From the previous outcome learners will be able to determine the level of Performance Quality Standard of a surface: basic, standard and high. They will then need to use this information to determine the requirements of the surface for that particular playing quality or amenity use and whether this matches the resource inputs available. Learners will also determine resource inputs to move a surface to the desired Performance Quality Standard if necessary.

Topic 3.3

Learners will be able to evaluate the use of efficiency ratios when assessing turf surface to include:

- informing management decisions
- objectivity and subjectivity
- relative comparison of inputs
- level
- frequency of the activity.

Topic 3.4

Learners will understand how a variety of maintenance activities such as mowing, edging, aeration, scarification, top dressing, rolling, turfing, seeding, irrigation, brushing/switching, fertilising and line marking can all impact on sustainability and the successfulness of a sustainable management plan.

Guidance for delivery

The learner will be able to develop the skills and knowledge involved in the sustainable management of sports and amenity turf areas. They will be able to analyse and evaluate data to make informed turf management decisions. The unit should cover as wide a range of activities as possible.

Throughout the unit, the emphasis should be on safe working. It is expected that the learner may be aware of basic safe working practices with turf maintenance and is likely to be familiar with accepted practices and behaviours within the context in which they are working. It is not a requirement for the learner to operate machinery however health and safety issues relevant to turf maintenance must be stressed and regularly reinforced. The learner should be actively involved in comprehensive risk assessments.

A learner working towards level 3 is likely to have experience of maintaining sports or amenity turf. The unit may be delivered by a wide range of techniques, including lectures, supervised practical work, discussions, site visits and research. The learner will require access to specialised literature and other resources. The delivery of this unit may be integrated with the delivery of other units where this is feasible. Current and topical issues regarding turf management should be highlighted as and when they arise.

Suggested learning resources

Books

Adams W.A., Gibbs R.J.1993. *Natural Turf for Sport and Amenity*. Oxford: CAB International. ISBN 0851987206.

Brown S. 2005. *Sports Turf and Amenity Grassland Management*. Wiltshire: The Crowood Press. ISBN 1861267908.

Brown S. 2009. *Sports Ground Management: A Complete Guide*. Wiltshire: The Crowood Press. ISBN 184797094X.

Evans R.D.C. 1991. *Cricket Grounds: The Evolution, maintenance and Construction of Natural Turf Cricket Tables and Outfields*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431007.

Evans R.D.C. 1994. *Winter Games Pitches: The Construction and Maintenance of Natural Turf Pitches*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431031.

Perris, J. 2000. *Grass Tennis Courts: How to construct and maintain them*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431341

Perris, J. 2008. *All About Bowls: The History, Construction and Maintenance of Bowling*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431066

Perris, J., Evans, R.D.C. 1996. *The Care of the Golf Course*. 2nd ed. Yorkshire: The Sports Turf Research Institute. ISBN 1873431198.

Sachs P. 2004. *Managing Healthy Sports Fields*. Sussex: Wiley Publishing. ISBN 0471472697.

Sports Turf Research Institute. 2005. *STRI Guidelines to Golf Green Construction in the United Kingdom*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431597

Websites

www.iog.org

www.golfcoursemanagement.randa.org

www.sportengland.org

The Institute of Groundsmanship

The R&A

Sport England – Natural Turf for Sport

Unit 315

Sustainable development

UAN:	L/507/4685
Level:	3
GLH:	60

What is this unit about?

This unit aims to provide learners with an understanding of the principles of sustainable development and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

The learner will be able to develop knowledge of the complex issues surrounding sustainable development strategies and the significance of these to future generations.

Learning outcomes

In this unit, learners will be able to

1. Understand the principles of sustainable development
2. Understand resource and environmental management in relation to sustainable development
3. Understand how economics and society contribute to sustainable development
4. Understand methods in use to implement sustainable development

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome

1. Understand the principles of sustainable development

Topics

- 1.1 The concept of sustainable development
- 1.2 The Gaia hypothesis and the human, evolutionary and global issues that impact on sustainability
- 1.3 Global conventions and protocols related to sustainable development
- 1.4 Methods used globally to encourage countries to agree a sustainable policy

Topic 1.1

Learners will understand the concept of sustainable development, to include:

- The term came to prominence in 1987, United Nations (UN), World Commission on Environmental Development (the Brundtland Commission), report produced entitled “Our Common Future”)
- Many definitions, interpretations, understandings: radical focus towards organisation of social, economic and political life or simply economic growth linked to social and environmental progress, living within environmental limits
- Main focus on: environment, society, economy, balancing the needs of the present with the future

Topic 1.2

Learners will understand the Gaia hypothesis - “an ecological hypothesis proposing that the biosphere and the physical components of the Earth (atmosphere, cryosphere, hydrosphere and lithosphere) are closely integrated to form a complex interacting system that maintains the climatic and biogeochemical conditions on Earth in a preferred homeostasis”.

They will also know human, evolutionary and global issues that impact on sustainability, to include human population growth, agricultural development, industrial development, resource consumption and pollution local and global transport systems.

Topic 1.3

Learners will know global conventions and protocols related to sustainable development, such as:

- International convention protocols
- Legislation and the methods used to ensure countries adhere to agreed principles
- United Nations Earth Summit Rio de Janeiro, Agenda 21, 1992 a commitment to sustainable development focusing on conservation and preservation
- United Nations Climate Change Convention, Kyoto Protocol 1997
- United Nations Copenhagen Conference 2009

Topic 1.4

Learners will understand methods used globally to encourage countries to agree a sustainable policy, to include:

- Political (local, national and international)
- General public and independent pressure groups
- Consumers
- Growers/producers
- Food industry
- Governmental watchdogs
- National and international governmental guidance, protocols, legislation, summits (UN), Agenda 21, 1992 a commitment to sustainable development focusing on conservation and preservation

Learning outcome

2. Understand resource and environmental management in relation to sustainable development

Topics

- 2.1 Environmental systems impacting on plant and animal life
- 2.2 The effects of human activities on the environment

This outcome could be supported by off site visits to specialist resources eg The Sustainability Centre.

Topic 2.1

Learners will know the essential requirements for plant and animal life e.g. air, water, sunlight, space and biological cycles to include: hydrological cycle, Carbon cycle, Nitrogen cycle.

They will also understand the population dynamics, to include: food webs, predator/prey relationships, use of resources, finite and renewable

Topic 2.2

Learners will understand the effects of human activities on the environment, to include:

- Pollution
- Use and where possible renewal of natural resources e.g. Timber
- Catastrophic and gradual climate change
- Increase in carbon dioxide levels
- Exhaustion of natural resources
- Sustaining biological diversity (biodiversity, current problems affecting biodiversity e.g. habitat destruction, pollution, invasion of alien (feral) species, biodiversity initiatives e.g. UK biodiversity action plan and the ability of an ecosystem to sustain diversity).

Learning outcome

3. Understand how economics and society contribute to sustainable development

Topics

- 3.1 How sustainable development is affected by investment, competition and stability
- 3.2 Role of citizens in achieving sustainable development
- 3.3 Difference between 'standard of living' and 'quality of life'
- 3.4 How the behaviour of one generation impacts on the environment for future generations
- 3.5 How the behaviour of one generation impacts on the environment for future generations

This outcome could be supported by specialist lecturers delivering underpinning knowledge and off site visits to specialist resources.

Topic 3.1

Learners will understand how sustainable development is affected by investment, competition and stability. They will take into account issues such as:

- Importance of education and learning
- The development of skills, environmental awareness and protection
- Cultural competitiveness
- Entrepreneurialism
- Innovation
- Technological advancement
- The availability of financial, physical and human resources
- The effects of economic stability and growth
- Adoption and awareness of concepts (eco-footprint, carbon foot printing, eco-efficiency, recycling, interdependence and "preferable futures"), what man works for and hopes to create, based on hopes, aspirations and dreams

Topic 3.2

Learners will understand the role of citizens in achieving sustainable development, to include:

- Participation of the global, national and local community to achieve a more sustainable lifestyle
- The responsibility of government, businesses, colleges, schools, households and individuals towards the goal of sustainable development (sustainable future)

Topic 3.3

Learners will understand the difference between 'standard of living' and 'quality of life', the global or local factors that influence or affect the quality of life, the link between action taken (today) and impact on the environment, the drivers of consumerism and personal choice.

Topic 3.4

Learners will understand how the behaviour of one generation impacts on the environment for future generations, taking into consideration:

- Methods of reducing impacts on the environment
- Use of natural resources, reasons and benefits for restraint
- Why it is necessary and why it matters

Learning outcome

4. Understand methods in use to implement sustainable development

Topics

- 4.1 Agenda 21
- 4.2 Introduction of sustainable development strategies

In this outcome learners will be able to summarise Agenda 21 and evaluate a number of international and national sustainable development strategies. Learners should be encouraged to keep up to date with local, national and international developments and strategies, via local and national press, radio/TV news/documentaries, industry journals and research/reports.

Topic 4.1

Learners will know the main points of the United Nations Earth Summit, Rio de Janeiro, Agenda 21, 1992 a commitment to sustainable development focusing on conservation and preservation.

The blueprint for sustainability in the 21st Century, local and regional promotion, the development of societies and economies, conservation and preservation of the environment and natural resources, local Agenda 21 community involvement, vision statements, action plans and methods of implementation

Topic 4.2

Learners will understand the introduction of sustainable development strategies, taking into consideration:

- Global issue
- United Nations' Commission on Sustainable Development
- UK Sustainable Development Commission
- The creation of a national strategy
- The UK Government sustainable Development strategy e.g. guiding principles, agreed priorities, indicators of success

Guidance for delivery

The learner will understand the principles of sustainable development, resource use and environmental management. They will know how economics and society contribute to sustainable development and the methods used to implement sustainable development.

The unit may be delivered by a wide range of techniques, including lectures, video or DVD, supervised practical work, discussions, learner presentations, guest speakers, site visits and research. Learners will require access to specialised literature and other resources. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to off site visits and practical activities.

Suggested learning resources

Books

Blake, F. 1994 Organic Farming and Growing: A Guide to Management. The Crowood Press

Websites

www.soilassociation.org	Soil Association
www.gardenorganic.org.uk	Garden Organic
www.rhs.org.uk	Royal Horticultural Society
www.biodynamics.or.uk	Biodynamic Agricultural association
www.defra.gov.uk	Department for Food, Environment and Rural Affairs
www.wales.gov.uk	Welsh Assembly Government
www.scotland.gov.uk	Scottish Executive Environment and Rural Affairs Department
www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)
www.unric.org	United Nations Regional Information Centre

Unit 316

Manage plant propagation activities

UAN:	R/507/4686
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to manage plant propagation activities and how these can be applied in practice. Learners will practice different propagation methods and aftercare for propagated plants. This should be carried out in professional propagation facilities or facilities that replicate this.

This unit will provide learners with a theoretical understanding and a practical experience that will underpin how plants used in a variety of horticultural settings are produced.

Learning outcomes

In this unit, learners will be able to:

1. Develop propagation schedules
2. Demonstrate management of vegetative propagation activities
3. Demonstrate management of seed propagation activities
4. Understand seed treatments and supply

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Develop propagation schedules

Topics

- 1.1 The environmental conditions necessary for propagation by seed and vegetative means
- 1.2 Propagation facilities suited to seed and vegetative propagation
- 1.3 Develop schedules for seed and vegetative propagation

This outcome requires that the range of propagation facilities and environments as well as the physical needs of propagation material are recognised and understood. Where not all of these are present at the centre it may be advantageous to visit suitable commercial propagation units including those undertaking micro-propagation if possible to ensure that the learner gains a full appreciation of the unit content.

The development of propagation schedules can be applied to seed and vegetative propagation and should clearly take into account the requirements of the market/end-use of the plants produced, including the time at which the plant material must be available for supply. All other aspects of the propagation schedules, including sources of propagation material, growing media/site, facilities, numbers, timing and seasonality and staff expertise and availability must be considered

Topic 1.1

Learners will understand the environmental conditions necessary for:

- seed propagation: air temperatures, moisture status, light levels (natural and artificial), aeration and moisture holding capacity of growing media, hygiene, sterile or enhanced microbial conditions
- vegetative propagation: temperature at point of regeneration or union (base temperature), humidity light levels (natural and artificial), shade, moisture content, air temperature.

Learners will understand propagation methods for the following seed and vegetative means:

- seed: fine, medium and large awkward seed, seed sown outdoors, seed sown in protected environments (in containers)
- vegetative: division of herbaceous perennials, cuttings – soft, semi-ripe and hardwood stem, nodal/internodal, whole leaf, leaf section and leaf petiole, single-node stem/leaf bud, budding – shield (T), chip, grafting – whip and tongue, side veneer.

Topic 1.2

Learners will understand the propagation facilities for seed and vegetative propagation, to include:

- mist units
- fog units
- low polythene tunnels
- closed cases
- heated beds and benches
- germination cabinets/germination rooms

- protective structures - green/glass houses, polythene tunnels, net tunnels, combined polythene/net tunnels, growth and growing rooms
- cloches
- cold and heated frames
- outdoor cuttings beds
- seed beds
- heated bins (garner bin)
- lined out rootstock beds for budding and grafting
- hot-pipe grafting facilities, micro propagation facilities.

Topic 1.3

Learners will develop schedules for seed and vegetative propagation by hand or automated. They will schedule for named seed and specified vegetative means, timings/dates, market and customer requirements. The schedule will include:

- containers
- growing media
- fertilisers
- environmental requirements and control systems
- irrigation
- growing space
- record keeping.

Learning outcome:

2. Demonstrate management of vegetative propagation activities

Topics

2.1 Collect and prepare vegetative propagation material

2.2 Prepare growing media suitable for vegetative propagation and propagate plants

2.3 Establish propagation material in the propagation environment

The requirements to understand and prepare suitable growing media should be referred to in this outcome. In addition, the moisture and related conditions of growing media when bench grafting, should be considered. Learners must propagate plants by vegetative means covering division and cuttings, in sufficient quantities to develop the necessary skills and the appreciation of industrial practice. They must have also covered grafting and budding in sufficient quantities to develop an appreciation of industrial practice. They must also be able to contribute to the establishment of propagation material.

Topic 2.1

Learners will collect and prepare the vegetative propagation material using the following methods:

- time of year
- time of day
- removal from stock plant
- tools (secateurs, snips, knives, spade, fork, dividing knife)
- resources (polythene bags, trays/boxes)
- select material which is 'true to type', of appropriate size

- not too vigorous and pest and disease free.

Topic 2.2

Learners will prepare appropriate growing media containing a range of ingredients and propagate plants. They will perform the following tasks in order to propagate plants:

- division and layering of fibrous roots, of herbaceous crowns, simple layering
- cuttings: soft, semi-ripe and hard-wood stem (evergreen and deciduous), nodal and intermodal stem, single-node stem/leaf bud, , leaf section and leaf petiole, root cuttings ('thick' and 'thin'), use of rooting hormones and wounding where applicable
- grafting
- budding.

Learners will select and use the appropriate tools and equipment to perform the tasks.

Topic 2.3

Learners will establish previously propagated material in the propagation environment.

The propagation environment can include:

- mist units
- fog units
- low polythene tunnels (closed cases)
- heated beds and benches
- germination cabinets/germination rooms
- protective structures - green/glass houses, polythene tunnels, net tunnels, combined polythene/net tunnels
- growth and growing rooms
- cloches
- cold and heated frames
- outdoor cuttings beds
- seed beds
- heated bins (garner bin)
- lined out rootstock beds for budding and grafting
- hot-pipe grafting facilities.

Learners will understand the importance of keeping records of propagation environment compared to success rates.

Learning outcome:

3. Demonstrate management of seed propagation activities

Topics

3.1 Carry out collection and extraction of seeds

3.2 Treat seeds to overcome dormancy

3.3 Sow seeds in containers

3.4 Sow seeds outdoors in seedbeds

The requirements to understand and prepare suitable growing media should be referred to in this outcome. In outcome 3, seed sowing should cover fine and large seed, space-sown and broadcast seed and seed sown in containers and in seedbeds. Seed sowing should be by hand and/ with machinery if available and as applicable to the site and species. Those learners who will not be using or observing seed-sowing machinery at the centre should be given the opportunity to see current seed-sowing technology in operation in a commercial or demonstration setting if possible. The learner will also carry out collection and extraction of seed and straightforward seed treatments, for at least one (1) dry seed and one (1) fleshy seed (fruit).

Seed sowing techniques to be carried out include: broadcast and space sowing in containers under protection (fine, medium and large awkward seed – one standard seed tray for each), seed sowing should be done outdoors in both 'V' shaped and flat bottomed drills (minimum length of drill should be 3m).

Topic 3.1

Learners will carry out collection and extraction of different types of named seeds.

Learners will consider the following when collecting seeds:

- Timing
- seed ripeness
- weather conditions
- handling
- containers for collection
- labelling

Learners will extract seed from:

- dry fruit (split pods/capsules, extract debris and save seed)
- fleshy fruits (fermentation, remove seed and dry).

Topic 3.2

Learners will carry out techniques to overcome dormancy, such as scarification, fruit fermentation (to extract seed) and stratification.

Topics 3.3 and 3.4

Learners will select and prepare ground/containers/growing media and sow a range of fine, medium and large seeds in trays, pots and modules and in drills outdoors.

Learners will broadcast into containers, sow fine seed with added carrier eg fine dry sand, sow seed that can be broadcast easily by hand without carriers, space sowing, maintain hygiene throughout, minimise waste.

Learners will carry out post-germination care of seedlings including pricking out and potting up.

Learners will prepare seedbeds taking into account the following: structure, aeration and drainage, amelioration, enhancement by added mycorrhizae or similar

Learners will prepare V-shaped and flat bottomed drills by hand, taking into consideration depth and moisture content. They will ensure that seed is scattered into drills or space-sown along the

drill by hand depending on species. Hygiene should be maintained throughout, and waste minimised.

Learning outcome:

4. Understand seed treatments and supply

Topics

4.1 Sources of seed and provenance

4.2 Storage conditions required for different types of seeds

4.3 Seed treatments to overcome dormancy

For this outcome, learners should be aware of the advantages and disadvantages of stock beds, bought in material, material collected from young 'plants for sale', and of plant material which is restricted for propagation or distribution due to legislation eg Plant Breeders Rights.

This outcome enables the learner to develop an understanding of dormancy and seed treatments and a combination of lectures and guided individual research will be helpful. Learners must be able to demonstrate that they understand the reasons why plants may develop seed dormancy and identify the actions necessary to overcome varied physical and physiological dormancy. Learners should also be aware of double and multiple dormancy.

Topic 4.1

Learners will understand the advantages and disadvantages of different sources of seeds, to include: own collected, seed houses, heritage seeds.

Learners will distinguish the sources of hybrids F1, F2, open-pollinated. They will also understand the advantages and disadvantages of viability testing, pelleted and primed seeds.

Learners will know the current legislation on sourcing seeds, and the significance of provenance.

Topic 4.2

Learners will know the storage conditions required for different types of seeds. Storage conditions: length of storage for orthodox and recalcitrant seeds, temperatures, humidity levels, packaging.

Topic 4.3

Learners will understand seed treatments to overcome dormancy and multiple dormancy. Learners will distinguish between s to overcome the following:

- physical dormancy, to include: use of physical and acid scarification, hot water treatment
- physiological dormancy, to include: use of water and hormone treatments, temperature controlled dormancy, moisture and temperature combined, undeveloped embryo, use of stratification/cold moist treatment.

Guidance for delivery

This unit is to be preferably delivered in a practical environment, with learners taking control of the propagation of plants. This should include the planning of propagation activities, managing the propagation of plants by vegetative means and by seed. Learners should manage the aftercare of plants to ensure health establishment and record activities and productivity throughout the unit delivery.

Suggested learning resources

Books

Adams, C.R., Early, M.P. 2014 *Principles of Horticulture Level 3*. Oxford: Butterworth-Heinemann.
Arbury, J, et al. 2004. *The Complete Book of Plant Propagation*. London: Octopus
Bird C. 2014. *The Fundamentals of Horticulture: Theory and Practice* UK: Cambridge
Hartman, H et al. 2010. *Plant Propagation, principles and practices*. 8th ed. Harlow: Prentice Hall.
Lamb, K., Kelly, J., Bowbrick, P. 1995. *Nursery Stock Manual: Grower Manual 1*. London: Grower Books.
Macdonald B. 2006 *Practical Woody Plant Propagation for Nursery Growers*. UK: Timber Press
RHS 2013. *RHS Handbook: Propagation Techniques: Simple techniques for 1000 garden plants*. London: Octopus

Websites

The international Plant Propagators Society	http://www.ipps.org/
RHS advice website	https://www.rhs.org.uk/advice
BBC gardening advice	http://www.bbc.co.uk/gardening/gardening_guides/

Unit 317

Construct horizontal landscape surfaces

UAN:	Y/507/4687
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to construct horizontal landscape surfaces and how this can be applied in practice. The learner will be able to develop the skills and knowledge to construct horizontal landscape surfaces, including setting out the site and constructing rigid and flexible surfaces and simple steps. They will consider the range of materials and techniques and the health and safety implications of this work.

Learning outcomes

In this unit, learners will be able to:

1. Form ground profiles for landscape works
2. Understand the formation of ground profiles for landscape works
3. Construct horizontal surfaces and simple steps
4. Understand the maintenance of horizontal surfaces and simple steps

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Form ground profiles for landscape works

Topics

1.1 Set and mark out a site from a plan

1.2 Establish sub-base and bases

In this outcome learners cover marking out and forming ground profiles. Learners will need to practise transferring information from scale plans and marking out geometric and irregular shapes. They will also need to practise establishing and marking levels and gradients. The learner must be able to transfer information from a scale plan to the ground, position effective markers on the ground, for linear measurements, shapes (rectangles, circles, ellipses and irregular shapes) and levels and carry out changes of level/gradient work as required. Learners must also be able to demonstrate that they can establish a suitable sub-base and base for subsequent work, according to project specifications.

Topic 1.1

Learners will set out accurate boundary dimensions and shapes, using triangulation, running lines and offsets. The setting out must be correctly orientated working from an appropriate base line and datum point on the plan. Learners will set out levels and gradients for mechanical and manual methods of establishing horizontal and vertical profiles.

Learner should be able to mark out straight lines, curves and irregular shapes.

Topic 1.2

Learners will establish suitable sub-base and bases according to specifications, accurate dimensions and orientation

Learning outcome:

2. Understand the formation of ground profiles for landscape works

Topics

2.1 Construction standards and regulations for foundations

2.2 Layers and materials and their uses

2.3 Potential sources of waste

2.4 Site problems and contingencies

Topic 2.1

Learners will know current construction standards and regulations for foundations, and where to source current information.

Topic 2.2

Learners will understand layers and materials in the construction of:

- Sub-grade
- Sub-base
- Base
- Formwork
- Trench supports
- Edge restraints
- Geo-membranes
- Granular fill
- Concretes
- Reinforcements.

Topic 2.3

Learners will know different potential sources of waste including:

- Waste materials through poor, incorrect and excessive ordering
- Poor handling or storage
- Weather damage
- Wasted time through poor systems.

Topic 2.4

Learners will know potential problems and contingencies to include:

- Site services (known and unknown)
- Soft pockets
- Permits
- Unexpected finds
- Ground pollution
- Weather conditions (including water logging, frost, snow)
- Boundary disputes
- Shortage of labour/skills
- Delays in delivery of materials
- Equipment/machinery breakdown
- Inappropriate equipment/machinery on site
- Contingency plans.

Learning outcome:

3. Construct horizontal surfaces and simple steps

Topics

- 3.1 Construct rigid hard surfaces safely
- 3.2 Construct flexible hard surfaces safely
- 3.3 Set out formwork and construct simple steps

Learners must comply with legislation during construction.

Topic 3.1

Learners will construct rigid paved surfaces using materials such as: flag stones or pavers (natural and artificial), concrete, tarmac, block paving. Learners will also repair environmental damage and ensure the site is left safe, clean and secure.

Topic 3.2

Learners will construct flexible hard surfaces using materials such as: gravels/aggregates, hoggin, bark chip and other loose materials, including edgings. Learners will also repair environmental damage and ensure the site is left safe, clean and secure.

Topic 3.3

Learners will construct, including the erection of any formwork, simple steps from a plan. Learners will identify line and dimensions of tread and risers, mark out step line, width and location of risers, excavate, construct treads and risers. Learners will also repair environmental damage and ensure the site is left safe, clean and secure.

Learners will apply the legal requirements for step construction (risers and treads), as well as for ramps construction (gradients and dimensions).

Learning outcome:

4. Understand the maintenance of horizontal surfaces and simple steps

Topics

- 4.1 Estimation of run off and drainage requirement
- 4.2 Maintenance operations.

Topic 4.1

Learners will use formula to calculate estimation of run off and drainage requirements. Learners will understand the principles involved and where to source information and expert advice.

Topic 4.2

Learners will understand maintenance requirements for the range of surfaces in the unit, potential problems during maintenance and how to overcome them, where to source technical information.

Guidance for delivery

This unit is an option within many of the land-based pathways and provides essential knowledge and understanding to support skill within a range of Horticultural industries. Although no prior learning is expected to undertake this unit it would be advisable to have completed the 'Undertake site surveying, levelling and setting out' which may support learners to better understand the processes and practices delivered within this unit.

This unit is designed to ensure the learner will be able to develop the skills and knowledge to construct horizontal landscape surfaces, including setting out the site and constructing rigid and flexible surfaces and simple steps. They will consider the range of materials and techniques and the health and safety implications of this work. They will develop further practical landscape skills acquired at level 2, and be able to set and mark out the site from a scale plan and form ground profiles. A greater depth and breadth of technical knowledge and skill is required at this level, including a wide range of materials and their uses.

The unit may be delivered by a wide range of techniques, including lectures, video or DVD, supervised practical work, site visits and research. Real projects are a valuable means to boost learners' confidence, technique and understanding, following initial acquisition of the skills. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities and learners must comply with all current legislation.

Suggested learning resources

Books

Brickell, C. 2006. RHS essential garden planning and construction. London: Mitchell Beazley

Chudley, R. 2008. Building Construction Handbook. 7th ed. Oxford: Butterworth-Heinemann.

Derek Lovejoy Partnership. 1997. Spon's Landscape Handbook. Oxford: Taylor and Francis.

Fortlage, C.A., Phillips, E. 1996. Landscape Construction: Roads, Pavings and Drainage Volume 2. Surrey: Ashgate Publishing.

Langdon, D. 2008. Spon's Landscape and External Works Price Book. Oxford: Taylor and Francis.

Littlewood, M. 1993. Landscape Detailing Volume 1: Enclosures. 3rd ed. Oxford: Architectural Press.

Littlewood, M. 1993. Landscape Detailing Volume 2: Surfaces. 3rd ed. Oxford: Architectural Press.

Littlewood, M. 1997. Landscape Detailing Volume 3: Structures. 3rd ed. Oxford: Architectural Press.

Littlewood, M. 2001. Landscape Detailing Volume 3: Water. 3rd ed. Oxford: Architectural Press.

Lovejoy et al. 2001. Landscape Construction: Earth and Water Retaining Structures Volume 3. Surrey: Ashgate Publishing.

McCormack, T. 2006. Driveways, Paths and Patios. Wiltshire: The Crowood press Ltd.

Sauter, D. 2010. Landscape Construction. 3rd ed. New York: Delmar Learning.

Websites

www.pavingexpert.com

www.cambridgeshire.gov.uk/leisure/libraries/online/bgsi.htm - gives free access to British standards online

www.planningportal.gov.uk

Unit 318

Establish and manage exterior plant displays

UAN:	D/507/4688
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with the knowledge and skills required to establish and manage exterior plants including annual, herbaceous and woody plants in outdoor displays.

Learning outcomes

In this unit, learners will be able to

1. Plan and establish annual and herbaceous plant displays outdoors
2. Plan, establish and maintain plants in outdoor containers
3. Establish and manage shrubs and hedges

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome

1. Plan and establish annual and herbaceous exterior plant displays

Topics

- 1.1 Establish annual and herbaceous exterior plant displays
- 1.2 Manage annual and herbaceous exterior plant displays

In this outcome learners will focus on the establishment and maintenance of annual bedding and herbaceous displays. Sites should include both private garden situations and public areas. Specialist planting e.g. bulbs, carpet beds, plunge bedding may be considered through visits and demonstrations if preferred.

Topic 1.1

Learners will perform the range of tasks required to establish exterior plant displays using annuals and herbaceous plants including:

- primary and secondary ground cultivations
- application of base/top dressing
- calculation of numbers of plants required
- planting (position, spacing, depth, firming, irrigation).

Learners will be able to differentiate between edging, ground cover, dot, trailing and seasonal bedding plants.

Topic 1.2

Learners will manage annual bedding and herbaceous displays by carrying out maintenance tasks appropriate to the display and the season such as:

- Provision of support
- Pest, disease, disorder monitoring and control
- Weed control (hoeing, hand weeding, mulching)
- Mulching (soil enrichment, protection of tender perennials from frost)
- Lifting tender perennials
- Dividing herbaceous plants
- Deadheading
- Irrigation
- Cutting back and removal (chelsea chop and at the end of the display season)
- Maintenance of edges if set in grass
- All as relevant to either/both annual and herbaceous borders.

Learning outcome

2. Establish and maintain plants in outdoor containers

Topics

2.1 Establish exterior plants for temporary and permanent display in outdoor containers

2.2 Manage exterior plant displays in containers

Topic 2.1

Learners will plant up outdoor container displays such as: single and multiple planters, window boxes/troughs, hanging baskets, displays for summer and winter use, in public and private locations and permanent container displays of perennials in public and private locations.

When planting containers learners must take into account:

- appropriate season and weather conditions
- plant type
- planting (depth, position, firming, irrigation)
- growing media, water retention materials, nutritional levels/feeding, container material (plastic, plastic coated wire, wood, pot, terracotta, fibreglass, lead, stone, concrete, metals) and liners.

Topic 2.2

Learners will manage exterior containers by carrying out maintenance tasks appropriate to the display and the season such as:

- Watering
- Feeding
- Dead-heading
- Pruning
- Plant replacement
- Support
- Mulching
- Pest, disease and disorder monitoring and control
- Site cleaning in public areas.

All the above as applicable to the container type, plants displayed and location.

Learning outcome

3. Establish and manage shrubs and hedges

Topics

3.1 Establish shrubs and hedges

3.2 Maintain woody plants to include shrubs and hedges

3.3 Carry out pruning and training techniques for woody plants

3.4 Know the legal, environmental and health and safety requirements for working with shrubs and hedges

In this outcome, learners will be able to establish plants for hedging and container-grown shrubs. Shrub and hedge pruning should cover a wide range of plant species and should require that the learner demonstrates full understanding of the relationship between type and season of pruning and the species/cultivar of plants involved. Formative and routine pruning should be planned and carried out. Learners must be able to identify and summarise the legal, environmental and health and safety requirements associated with the establishment and maintenance of shrubs and hedges.

Topic 3.1

Learners will prepare soil to receive plants by hand or with machinery, carry out surface cultivation, soil improvement and vegetation removal, as applicable to site and type of plant. Learners will mark out the position of specimen plants, plant groupings and linear planting from plans. Learners will carry out a range of planting techniques including “T” and notch planting, pit planting (round or square holes) and will be able to determine if fertilisers, organic materials, mycorrhizae or water retention materials are required.

Learners will also carry out immediate aftercare such as: pruning and trimming, providing support (short, long, straight, angled, multiple stakes, guys, anchors), protection from weeds, pests and machinery (mulching, shelters, guards, cages, fencing), watering (all as applicable to site, situation and plant type).

Topic 3.2

Learners will plan maintenance schedules for a range of woody plants as well as carry out maintenance activities including:

- Routine pruning appropriate to the time of year/season and weather conditions
- Formative pruning for development of shape and habit
- Weed control
- Mulching
- Feeding
- Surface cultivation
- Pest, disease and disorder monitoring and control
- Clearance of detritus
- Removal/re-positioning of support and ties.

Topic 3.3

Learners will perform a range of pruning and training techniques including:

- Routine pruning of shrubs from different pruning groups with spring flowers, summer/autumn flowers, winter stem displays, fruit and foliage displays,
- Formative and routine pruning of formal and informal hedges, pruning with secateurs and hedge-trimmers
- Removal of dead, dying, diseased, reverted, weak, and crossing stems as appropriate

Topic 3.4

Learners will know the legal, environmental and health and safety requirements associated with the establishment and maintenance of shrubs and hedges such as:

- Part 8 of the Anti-social Behaviour Act 2003
- Wildlife and Countryside Act 1981
- Health and Safety at Work etc Act 1974
- Highways Act 1980
- Working at Heights Regulations 2005
- Certificates of Competence (or QCF equivalent qualifications).

Guidance for delivery

This unit is designed to equip learners with the knowledge and skills required to establish and manage ornamental seasonal bedding schemes, herbaceous borders and woody plants in the open ground and in containers.

Centres are encouraged to introduce employers and specific professionals from industry to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of establishments to add depth to the learner experience.

The unit may be delivered by a wide range of techniques, including supervised practical work, lectures, video or DVD, discussions, site visits and research. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities and learners should not be asked to undertake physical tasks beyond their physical capabilities. All tasks should be carried out within the appropriate season (time of year) and in the appropriate weather conditions.

Suggested learning resources

Books

- Bird, R. 2000. Annual and Perennials: The Complete Gardeners Guide to Bedding Plants. London: Anness
- Brickell, C., Joyce, D. 2011. RHS Pruning and Training. London: Dorling Kindersley
- British Standards Institution. 2014. BS 8545: 2014: Trees: from nursery to independence in the landscape. Recommendations. London: BSI
- Derek Lovejoy Partnership. 1997. Spon's Landscape Handbook. 4th ed. Oxford: Taylor and Francis.
- Fish, M. 2004. Bedding Plants. London: Harper Collins
- Hessayon, D. 1997. The Bedding Plant Expert. London: Expert Books.
- Lloyd, C. 2005. Succession Planting for Adventurous Gardeners. London: BBC Books.

Website

www.rhs.co.uk

The Royal Horticultural Society

Unit 319

Principles and practices of garden design

UAN:	H/507/4689
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of the principles and practices garden design and how these can be applied in practice.

The learner will be able to develop the skills and knowledge to take the results of site analysis and simple brief and produce a workable design for a garden to suit the situation. They will also be able to develop these plans into basic presentation drawings suitable for presentation to a client. The drawings include plan, elevation, and projection in suitable graphic presentation format.

Learning outcomes

In this unit, learners will be able to:

1. Understand the elements and principles of design as they relate to domestic garden design
2. Understand the use of design drawings and plans in the design process.
3. Interpret site information and simple briefs.
4. Produce garden design plans
5. Produce a range of plans and visualisations

Scope of content

Learning outcome:

1. Understand the elements and principles of design as they relate to domestic garden design

Topics

- 1.1 Hard and soft landscape materials and features and their uses
- 1.2 Basic design elements within a garden environment

Topic 1.1

Learners will understand hard landscape materials and features including

- fences, pergolas and trellis work
- water features
- garden buildings (summer houses, sheds, pavilions, arbours, gazebos, conservatories and greenhouses)
- paved surfaces, patios and timber decked areas (in brick, stone, concrete slabs, macadam, tiles, bitmac, aggregates, types of timber for different purposes, finishes to surfaces)
- vertical surfaces (brick walls, block-work, rendered work, free standing and retaining structures, and stone, bonded and inbound walls and their finishes).

Learners will also understand soft landscape materials and features including

- seasonal schemes (spring, summer, plunge, carpet), container planting
- herbaceous perennial uses, mixed and shrub borders, groundcover
- ornamental trees, avenues, belts and copses, hedges (formal, informal), screens, shelter belts and wind breaks
- grassed and turfed features, naturalised plantings, including bulbs.

Topic 1.2

Learners will understand how elements of design can be found and created within a garden context.

Learners will understand the following elements:

- formality and informality
- balance
- symmetry
- proportion
- contrast
- dynamic movement
- light and shade
- colour and seasonality

recognise examples of their use within garden design.

Learning outcome:

2. Understand the use of design drawings and plans in the design process.

Topics

- 2.1 Use of visual communication within a garden design contract.

- 2.2 Graphic, audio-visual and computer aided presentation formats and verbal presentation techniques
- 2.3 The purpose of supporting documentation for design presentations.

Topic 2.1

Learners will understand how graphical techniques can be used to provide information-rich imagery for clients and others involved in the design process.

Learners will understand where design drawings fit within any contract with a client to undertake design work or design-and-build work as part of a contracted service.

Learners should be given access to relevant case study material as part of the learning to identify where design ideas have been used both successfully and unsuccessfully within garden design projects, particularly where elements such as water features and earth movement/retention are involved in a design proposal.

Topic 2.2

Learners will know how to use the following drawing media:

- pens and inks
- coloured and non coloured pencils
- watercolours
- marker pens and felt-tip pens,
- Computer Aided Design (CAD)
- papers and surfaces.

Learners will use a range of:

- drawing equipment (parallel motion, set square, circle template, compass)
- labelling (letter size, hand or word processed text)
- handwritten and printed text
- invented and standardised graphics to develop skills in producing consistent clear drawings as part of the garden design process.

Learners will know how to use:

- freehand illustration
- technical drawing, including plans, elevations, 1-point perspectives and axonometric projections
- drawing aids such as stencils, stamps, templates, transfers, photographs
- Computer Aided Design (CAD)
- graphic symbols including hard and soft landscape and site conventions, standard notations, outline, habit and texture symbols, ground cover and mass effect symbols, colour rendering techniques.

They will also know how to use:

- paper, surface and media selection
- selection of appropriate illustrations
- plan annotations

- overlays
- story boards
- base/master/presentation/elevation plans
- style (historical, traditional, abstract, contemporary)
- hierarchy of line and shade to aid clarity
- scale
- frames
- borders
- mounts and backgrounds
- audio-visual and computer aided presentation format.

Topic 2.3

Learners will understand the purpose of:

- a design explanation
- planting/material/resource lists
- details and sources of supply
- construction/working drawings
- photographs
- specifications
- bills of quantity
- contracts
- layouts,
- written reports and assessments
- clients brief
- clients questionnaire
- site survey/inventory for design presentations.

Learning outcome:

3. Interpret site information and simple briefs.

Topics

- 3.1 Interpreting site information
- 3.2 Client briefs and the design process

In this outcome learners will take the results of a site investigation and a client brief and develop ideas for the site design, producing, concept plans, in order to then produce a garden design plan. The sites must be a minimum of 100m² in order to provide scope and realism.

Topic 3.1

Learners will understand basic site information, including qualitative information such as knowledge of existing vegetation, and quantitative information such as the results of basic site surveys, and subsequently transferring this information into a visual format.

Qualitative information could include existing vegetation, natural light ambience, local topography and local climate, aspect, soil conditions and type, presence or location of services and utilities, access

and current use of the site. Learners will use visual analyses of this information to identify site constraints and opportunities for design proposals.

Topic 3.2

Learners will interpret the client brief, including the aspiration for use, current use, dislikes and likes, ability and knowledge. Learners will use this information to develop concepts for the layout and use of the site to best suit a client's needs and wishes, using simple conceptual plans for the site.

Learning outcome:

4. Produce garden design plans

Topics

- 4.1 Development of conceptual plans into master plans
- 4.2 Using graphical information to communicate design ideas

Topic 4.1

Learners will produce garden design proposals derived from the site survey, base plan and location plan, site inventory and evaluation including sketch designs/plans and annotations. They will be developed through concept (synthesis) and design explanation, design development, preliminary plans and costs.

Topic 4.2

Learners will use a limited range of representative graphical symbols and conventions to efficiently communicate relevant information to other people involved in the design process. Learners will demonstrate skills in achieving clarity, economy and consistency in the use of graphic techniques to develop and communicate design proposals and ideas.

Learning outcome:

5. Produce a range of plans and visualisations

Topics

- 5.1 Types and content of design drawings for garden design.
- 5.2 Development of details and projections for use by others

Topic 5.1

Learners will know the range and use of design drawings in use within the industry. Learners know the standards and conventions for arrangement, scale, sheet size, orientation, lettering and use of colour for plan drawings.

Topic 5.2

Learners will develop details and projections including construction details to assist the implementation and building of hard landscape features, and projections such as sections, elevations and 3D projections to assist the representation of the design proposals to a client or third party involved in the design process. It is not considered essential that learners should be able to produce perspective drawings, but the use of computer-assisted design should be included to assist with visual communication of the 3D space planned for the site.

Guidance for delivery

This unit is designed to equip the learner with the skills and knowledge required to take the results of site analysis and client brief and produce a range of concept plans to suit the situation. They then develop these into formal presentation plans, using a variety of media to a level of completion suitable for use by a client. The drawings include plan, elevation, section, detail and axonometric projection.

The unit may be delivered by a wide range of techniques, including lectures, video or DVD supervised practical work, discussions, site visits and research. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities.

Wherever possible a range of 'real' sites and case studies should be used giving the learner an experience of a wide range of sites displaying different characteristics. This experience will help the learner to develop a deeper understanding of the processes involved and the opportunities and constraints relating to specific sites.

Suggested learning resources

Books

- Alexander, R. 2009. *The essential garden design workbook*. Lincolnshire: Timber Press.
- Barber, B. 2009. *The fundamentals of drawing*. 2nd ed. London: Arcturus Publishing Limited.
- Bertauski, T. 2006. *Plan graphics for the landscape designer*. 2nd ed. Harlow: Pearson Education Ltd.
- Brookes, J. 2007. *Room Outside*. Suffolk: Garden Art Press.
- Chan, G. 2009. *Planting design illustrated*. Colorado: Outskirts Press.
- Doyle, M.E. 2006. *Color drawing*. 3rd ed. Sussex: Wiley Publishing.
- Hillier, J. 2007. *The Hillier Manual of Trees and Shrubs*. Devon: David and Charles.
- Hobhouse, P. 2003. *Colour in Your Garden*. London: Frances Lincoln.
- Lauer, D., Pentak, S. 2004. *Design basics*. 6th ed. Florence: Wadsworth Publishing.
- Reid, G.W. 2002. *Landscape graphics*. New York: Watson-Guption Publications.
- Reid, G.W. 2007. *From concept to form in landscape design*. 2nd ed. Sussex: Wiley Publishing.
- Scarfone, S.C. 2007. *Professional planting design: an architectural & horticultural approach for creating mixed bed plantings*. Sussex: Wiley Publishing.

Websites

www.rhs.org.uk

The Royal Horticultural Society

Unit 320

Construct and maintain timber landscape features

UAN:	Y/507/4690
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to construct and maintain timber landscape features and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training. The learners will be able to develop the skills and knowledge to be able to construct and maintain timber landscape features. They will consider the range of materials and techniques, and the health and safety implications of this work

Learning outcomes

In this unit, learners will be able to:

1. Construct and repair timber features
2. Understand the construction of timber features
3. Understand the maintenance and preservation of timber features

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Construct and repair timber features

Topics

1.1 Construct and repair horizontal timber features

1.2 Construct and repair vertical timber features

1.3 Maintain timber feature

In this outcome learners cover the construction and repair of horizontal and vertical timber features. Learners will need sufficient time and access to materials and sites to practise these techniques to meet the required standard and carry them out with confidence. They should be familiar with a range of timbers, other materials, construction techniques and features and should be able to select and use them confidently and safely. Learners should be familiar with the techniques required to construct different types of timber features and they must be able to carry out repairs efficiently, including making the feature safe before work begins. The learner must be able to comply with all current, relevant legislation during construction of horizontal and vertical timber features. Learners must recognise how to keep the site safe and tidy during construction, minimise unnecessary waste and unwanted impact to the site and use protection techniques for security and to protect the work until it is ready for use. They should be aware of potential problems during construction work and how to overcome them.

Topic 1.1

Learners will construct horizontal timber features following specifications, identify line, dimensions and orientation of the feature. Learners will construct at least one horizontal feature from the following: decking, simple steps, bridges, using appropriate joins and techniques.

Learners will also identify and carry out repairs of horizontal features.

Topic 1.2

Learners will construct vertical timber features, identify line, dimensions and orientation of the feature.

Learners will construct at least two vertical timber features from the following:

- post and rail fences
- gates
- simple steps
- bridges
- pergolas
- arbours and palisades
- using appropriate joins and techniques.

Learners will identify and carry out repairs of vertical features.

Topic 1.3

Learners will maintain timber features, identify and assess maintenance requirements, and carry out maintenance operations.

Learning outcome:

2. Understand the construction of timber features

Topics

- 2.1 Timber features and their uses,
- 2.2 Repair requirements of timber features
- 2.3 Timbers suitable for outdoor use
- 2.4 Potential problems

Topic 2.1

Learners will understand the purpose of a range of timber features and their aesthetic value. These should include decking, steps, bridges, pergolas, arbours, palisades, post and rail fences, gates. Evaluation to include uses, materials, benefits, limitations, maintenance requirements, ease of construction and repair, health and safety.

Topic 2.2

Learners will understand the repair requirements of timber features including structural damage, decay patterns in horizontal and vertical timbers, making safe and repair techniques.

Topic 2.3

Learners will know timbers suitable for features, identifying the range of softwood and hardwood timbers suitable for outdoor use, taking into consideration relative costs, life expectancy, ease of fabrication, the merits and limitations of each, types of feature for which each is appropriate, preferred preservation techniques for each type.

Topic 2.4

Learners will know potential problems with the construction of timber features, including site services, anchorage, unexpected finds, weather conditions, boundary disputes, minimising waste, materials wasted through poor or excessive ordering, poor handling or storage, weather damage, waste time through poor systems.

Learning outcome:

3. Understand the maintenance and preservation of timber features

Topics

- 3.1 Use and effectiveness of preservatives
- 3.2 Environmental and health and safety legislation and codes of practice

Topic 3.1

Learners will understand the use and effectiveness of paints, water-based and solvent-based preservatives. Factors to consider include: suitability for the project, safety, ease of handling, PPE, equipment used and application techniques, decontamination/cleaning of operative and equipment, frequency of application, weather conditions and cost.

Topic 3.3

Learners will understand the legislation concerning the construction and maintenance of timber features including current health and safety legislation, environmental legislation, planning legislation and codes of practices pertinent to the construction and maintenance of specified timber features including: decking, steps, bridges, pergolas, arbours, palisades, post and rail fences, gates.

Guidance for delivery

This unit is designed to ensure the learner will be able to develop the skills and knowledge to construct and maintain timber landscape features. They will evaluate the range of materials and techniques and the health and safety implications of this work. A greater depth and breadth of technical knowledge and skill is required at this level, including a wide range of materials and their uses. The unit focuses on the features for which timber is particularly appropriate. It covers construction, repair and maintenance of timber features and dealing with the particular problems associated with them.

The unit may be delivered by a wide range of techniques, including lectures, video or DVD, supervised practical work, site visits and research. Real projects are a valuable means to boost learners' confidence, technique and understanding, following initial acquisition of the skills. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities and learners must comply with all current legislation.

Suggested learning resources

Books

- Brickell, C. 2006. RHS essential garden planning and construction. London: Mitchell Beazley
- Derek Lovejoy Partnership. 1997. Spon's Landscape Handbook. Oxford: Taylor and Francis.
- Fortlage, C.A., Phillips, E. 1996. Landscape Construction: Roads, Pavings and Drainage Volume 2. Surrey: Ashgate Publishing.
- Littlewood, M. 1993. Landscape Detailing Volume 1: Enclosures. 3rd ed. Oxford: Architectural Press.
- Littlewood, M. 1993. Landscape Detailing Volume 2: Surfaces. 3rd ed. Oxford: Architectural Press.
- Littlewood, M. 1997. Landscape Detailing Volume 3: Structures. 3rd ed. Oxford: Architectural Press.
- Littlewood, M. 2001. Landscape Detailing Volume 3: Water. 3rd ed. Oxford: Architectural Press.
- Lovejoy et al. 2001. Landscape Construction: Earth and Water Retaining Structures Volume 3. Surrey: Ashgate Publishing.
- Sauter, Sauter, D. 2010. Landscape Construction. 3rd ed. New York: Delmar Learning.

Websites

www.cambridgeshire.gov.uk/leisure/libraries/online/bgsi.htm - gives free access to British standards online

<http://www.fsc-uk.org/>

Forest Stewardship Council (FSC)

Unit 321

Horticultural production techniques – protected environments

UAN:	D/507/4691
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of the practicalities of protected environments within production horticulture. Learners will have an understanding of how to undertake horticultural production techniques within protected environments and how these can be applied in practice. The learner will develop their practical skills and competencies in establishing and harvesting crops within protected environments. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learning outcomes

In this unit the learners will be able to

1. Understand how to plan production of crops in protected growing environments
2. Establish crops in containers in protected environments
3. Establish crops in the ground in protected environments
4. Maintain, harvest, grade and store protected horticultural crops

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand how to plan production of crops in protected growing environments

Topics

- 1.1 Facilities and environments for protected plant production
- 1.2 Physical and human resources for plant production in protected environments
- 1.3 Preparation of a potting/planting schedule

Topic 1.1

Learners will understand protection facilities and environments that are utilised within the production for horticulture industry, including:

- facilities; glasshouses, polythene tunnels, net tunnels, combined polythene/net tunnels, growth and growing rooms, cloches, cold and heated frames
- environments; for growing, potting, propagation, mist units, fogging units, closed cases, supplementary, photoperiodic and replacement lighting, shading, heated benching, aerial heating and distribution, ventilation, air circulation, Co2 enrichment, space utilisation.

Topic 1.2

Learners will understand the physical and human resources which are necessary for a successful production for horticultural business including:

- physical resources; propagation facilities as above, areas for storage and preparation of growing media, equipment for preparation of growing media, fertiliser, areas for potting/planting, potting/planting equipment, containers, irrigation equipment, tanks/reservoirs, power supply, generator, compressor, equipment for liquid feeding, feed mixing, water softening (nitric acid injection into water supply), equipment and materials for the storage and application of pesticides and ancillary equipment, transport and handling equipment and materials (trolleys, forklift, conveyors, crates, barrows), waste handling and disposal equipment and materials, equipment and materials (including sensors, environmental control systems and computers) for monitoring of the growing environment and for administration of the nursery
- human resources (skilled and semi-skilled): for horticultural and administrative activities

Topic 1.3

Learners will know the elements required in the preparation of a potting/planting schedule. These include production method (seed, cuttings, micro-propagation), seasonality of production (timing/cropping dates), market, crop sales window and customer requirements. Historical production records and systems for record keeping should be considered by learners.

Learners will know the physical materials for operation which include: containers, growing media, fertilisers, environmental requirements and control systems, irrigation, growing on space.

Learning outcome:

2. Establish crops in containers in protected environments

Topics

- 2.1 Prepare growing media for protected crops
- 2.2 Pot plants

Topic 2.1

Learners will prepare growing media for container crops to be produced in a protected environment, which may include:

- media for seedlings/transplants and cuttings
- media for potting on established material.

Preparation by hand and/or mechanical means.

Learners will understand the requirements for space, preparation and storage.

Ingredients eg peat, coir, rock-wool, bark, perlite (silvaperl), vermiculite, horticultural sand or grit, loam, fertiliser.

Topic 2.2

Learners will perform potting plants by hand to include potting up/off rooted cuttings from trays and potting on of young plants into the final marketing container.

Learners will perform potting competently at a consistent commercial standard. Learners will consider potting station layout and material handling. Operations may include young plant preparation, weeding trimming, positioning the plant in the container, support, irrigation, transportation to facility.

Learners will know the range of resources used throughout the protected production industry, including potting area/bench, containers, growing media.

Learners will know mechanical methods of potting (potting machines).

Learning outcome:

3. Establish crops in the ground in protected environments

Topics

- 3.1 Plan and prepare sites to receive plants
- 3.2 Establish plants to optimise plant development
- 3.3 Ensure that protection and suitable growing conditions are provided

This outcome involves the planning and preparation of soil and site for planting of crops. This could be a cut flower crop such as stocks or chrysanthemums, a salad crop such as lettuce, or other appropriate crop. Learners must also have the opportunity to contribute to the establishment of

plants in order to optimise their growth and development, this should include ensuring that protection and suitable growing conditions are provided and they must be able identify and describe means of minimising adverse environmental impacts as part of the process.

Topic 3.1

Learners will assess the suitability of the soil conditions within the protected growing facility for a named crop. They will plan operations to be performed taking into account crop and variety choice, crop rotation, soil structure, nutrient and pH status analysis, seasonality, irrigation application, harvest period, weed growth. Soil bed preparation will require primary, secondary and final cultivations by hand/mechanical methods. Learners will perform operation in bed formation, levelling, tilth production, firming/consolidation and marking out.

Topic 3.2

Learners will identify young crop formats including young seedling, transplants, cell/plug grown plants. Learners will perform sowing, planting and sticking of crops within a formed soil bed. The quality of the crop will be assessed when planting is performed, with consideration to handling, spacing, depth and firming for optimum crop establishment. Post planting operations will be performed including labelling, irrigation, crop protection and supply of nutrients.

Topic 3.3

Learners will understand which protective structures are required when producing a named crop, and what other resources are required which may include, irrigation, nutrient supply, temperature control, light, shading, ventilation humidity and atmosphere control (CO₂ enrichment). Learners will also ensure that adverse environmental impacts (drying out, high evapotranspiration rate, scorch; cold water damage, temperature extremes, excessive or deficiencies of nutrients) are minimised as necessary.

Learning outcome:

4. Maintain, harvest, grade and store protected horticultural crops

Topics

- 4.1 Maintain crops in containers and in the ground
- 4.2 Harvest, prepare for sale and grade protected crops
- 4.3 Store crops

Topic 4.1

Learners will perform maintenance of crops in containers and in the ground which may include weed control, pruning, supporting, irrigating nutritional application and monitoring the temperature, humidity, ventilation, lighting, shading and environmental control.

Topic 4.2

Learners will perform harvesting (hand and mechanical) by pulling, cutting, picking, collecting, picking out. They will apply methods of post-harvest preparation including grading (size, shade, height, weight, quality), handling, cleaning, washing, trimming, packing and labelling in accordance to the customer specifications.

Topic 4.3

Learners will identify appropriate methods of storage by crop type. Types of storage may include, cool room, cold storage, controlled and modified atmosphere, cold chain, vacuum chilled. Crops storage environments including darkness, humidity, modified atmosphere (oxygen, carbon dioxide and ethylene gas levels) as applicable to the crops being collected.

Guidance for delivery

This unit covers the production of container grown crops including seasonal bedding plants, flowering and foliage pot plants, cut flower crops growing in containers, bulbs to include prepared hyacinths, tulips, lilies and narcissi or in soil to include stocks, asters, chrysanthemums, antirrhinums, roses. Vegetable and salad crops in containers, soil or hydroponic conditions are also within the scope of the unit. Given this extreme variation in potential production systems it is expected that there will be, in practice, a narrower focus, and that the diversity will be covered in outline only, though visits to production nurseries which demonstrate the diverse range of cropping systems will be most valuable. There will be inevitably be areas of commonality between this unit and 'Advanced Nursery Stock Production'

The unit may be delivered/or by a wide range of techniques, including lectures, supervised practical work, discussions, video, DVD, site visits and research. The delivery of this unit may be integrated with the delivery of other units where this is feasible and every opportunity should be taken to show how the knowledge acquired in this unit may be applied to practical horticultural tasks. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities.

Learners would greatly benefit from the opportunity to visit protected crop producers, in order to better appreciate the facilities, resources, scale of operation, plant quality, growing, planning, harvesting, grading and storage techniques available.

Suggested learning resources

Books

- Adams, C.R., Early, M.P. 2004. Principles of Horticulture. 4th ed. Oxford: Butterworth-Heinemann.
- Brown, L. 2008. Applied Principles of Horticultural Science. 3rd ed. Oxford: Butterworth-Heinemann, ISBN 9780750687027.
- Dawson, P. 2006. A Handbook for Horticultural Students. Rushden: Dawson. ISBN 0-9525911-11
- Lamb, K., Kelly, J., Bowbrick, P. 1995. Nursery Stock Manual: Grower Manual 1. London: Grower Books. ISBN 0901361 801.

Journals

- Horticulture Week – weekly trade magazine
- Grower Manuals
- Commercial Greenhouse Grower - periodical

Unit 322

Horticultural production techniques - outdoors

UAN:	H/507/4692
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to undertake horticultural production techniques - outdoors and how these can be applied in practice. The learner will develop practical skills and competencies in planning, establishing and harvesting outdoor horticultural crops. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learning outcomes

In this unit, learners will be able to:

1. Site selection and planning for outdoor crops
2. Prepare site and establish outdoor horticultural crops
3. Harvesting and grading of outdoor horticultural crops
4. Manage outdoor horticultural crops

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand site selection and planning for outdoor crops

Topics

- 1.1 Suitability of the site for outdoor cropping
- 1.2 Growing requirements for outdoor crops
- 1.3 Developing cropping plans

Topic 1.1

Learners will know factors that affect cropping choices and planning based on:

- site (geographical location, topography, climate, aspect, exposure and shelter)
- climate and microclimate (seasonal changes, average rainfall, soil temperature, light, day length, dates of first and last frost, average aerial day and night temperatures)
- soil (soil types and structure, texture, depth, contaminants, drainage, nutrient status, pH, soil life)
- location and infrastructure (services, access for machinery, transport links, access to markets and labour).

Topic 1.2

Learners will understand the cultivation requirements and the techniques employed to prepare a site and establish and manage outdoor horticultural crops. Learners know crops raised from seed sown in situ, transplanted crops and crops planted from vegetative material (such as sets, tubers and cuttings) under the following headings:

- ideal site and growing conditions
- site preparation and establishment of the crop
- maintenance of the growing crop.

Topic 1.3

Learners will understand the factors that need to be considered when producing a cropping schedule which would be viable and successful for current market conditions. Learners will relate their knowledge to crops raised from seed sown in situ, transplanted crops and crops planted from vegetative material (such as sets, tubers and cuttings):

- seasonality of cropping
- market requirements
- selection of varieties/cultivars
- opportunities and limitations of the site
- planning of crop location; rotation, headlands, bed widths,
- crop needs; soil preparation, establishment, maintenance and harvest
- integrated pest management and model forecasting of pest and disease infestation.

Learning outcome:

2. Prepare site and establish outdoor horticultural crops

Topics

- 2.1 Prepare site for establishing outdoor crops
- 2.2 Establish crops outdoors

Topic 2.1

Learners will perform site clearance which may include residue crop and weed control/clearance, apply methods of soil improvement which may include planting and incorporating green manure and application of bulky organic matter. Learners will be able to perform primary and secondary cultivations. These may include sub soiling, ploughing, rotary cultivator (tractor mounted or pedestrian), digging, harrowing, tilth production, application of base dressing, rolling, firming, levelling and bed formation.

Topic 2.2

Learners will establish outdoor horticultural crops

- perform sowing, transplanting and planting of crops planted from vegetative material (such as sets, tubers and cuttings) to a commercial standard (selection of tools, technique, depth, spacing, grading and selection of plant material, preparation of plants for planting such as root trimming, removal of damaged growth, suckers and non-typical growth, waste disposal)
- carry out initial aftercare (protection from weather, pest and disease, watering in and formative pruning).

Learning outcome:

3. Harvesting and grading of outdoor horticultural crops

Topics

- 3.1 Harvesting and grading crops to meet customer and market requirements
- 3.2 Waste management and minimising adverse environmental impacts

In this outcome learners are required to understand the factors that need to be considered when harvesting, grading, storing and transporting outdoor crops for sale. The appropriate methods and factors to consider will vary greatly due to the wide range of outdoor crops and cropping situations. However learners must show a full understanding of the harvesting/collection and preparation for sale to meet customer requirements of at least two different crops of their choice.

Topic 3.1

Learners will be able to evaluate the journey of outdoor crops from harvest to sale under the following headings;

- harvest/collection (consider mechanical and manual methods, timing and selection of crop, speed and labour)
- grading (consider specifications for size, vigour, shape, height, weight, damage, colour, quality, quantity, tolerance)

- preparation (consider trimming, washing, handling, packaging, labelling, pricing, drying, cooling)
- postharvest storage (consider storage environment, length of storage, signs of poor storage)
- legislation to include food assurance/traceability schemes.

Topic 3.2

Learners will understand the importance of waste management from an environmental, legislative and finance perspective.

Learners understand how adverse environmental impacts can be minimised in outdoor crop production in relation to transport, recycling crop residues, soil, waste water, production waste (containers, and packaging waste), efficient and effective use of materials, minimising crop losses, use of packaging and careful handling to avoid damage of harvested crops, Waste and Resources Action Programme (WRAP).

Learning outcome:

4. Manage outdoor horticultural crops

Topics

- 4.1 Manage the growth and development of outdoor crops
- 4.2 Harvest or collect and prepare outdoor crops for sale

Topic 4.1

Learners will manage the development of a crop from establishment to harvest/collection by providing irrigation, nutrition, training and support, environmental protection, weed and pest and disease control and other cultural techniques appropriate to the needs of that crop as and when required.

Topic 4.2

Learners will perform the harvesting/collection of a crop by hand or mechanical methods. This may include collecting and preparing, grading, cleaning, washing, handling and packing, labelling, pricing and drying to meet customers' requirements.

Guidance for delivery

This unit is applicable to cultivation of 'field-grown' horticultural crops such as vegetables, salads, fruits and outdoor cut flower crops. It does not apply to the production of field grown nursery stock which is dealt with in a separate unit.

The unit may be delivered by a wide range of techniques, including lectures, supervised practical work, discussions, DVD, site visits and research. The delivery of this unit may be integrated with the delivery of other units where this is feasible and every opportunity should be taken to show how the knowledge acquired in this unit may be applied to practical horticultural tasks. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities. Learners would greatly benefit from the opportunity to visit outdoor crop producers, in order to better appreciate the facilities, resources, scale of operation, growing and planning techniques available.

Suggested learning resources

Books

Adams, C.R., Early, M.P. 2004. Principles of Horticulture. 4th ed. Oxford: Butterworth-Heinemann.

Brown, L. 2008. Applied Principles of Horticultural Science. 3rd ed. Oxford: Butterworth-Heinemann, ISBN 9780750687027.

Dawson, P. 2006. A Handbook for Horticultural Students. Rushden: Dawson. ISBN 0-9525911-11

Grower Manuals

Horticulture Week incorporating 'the Grower' magazine

As the context of the unit is not specified, other recommended reading is not given on this occasion. The centre should recommend suitable current reference material, which may include grower manuals or websites, as related to the crop.

Unit 323

Construct and restore walls

UAN:	K/507/4693
Level:	3
GLH:	60

What is this unit about?

This purpose of this unit is to provide learners with an understanding of how to construct and maintain walls and how this can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training. The learners will be able to develop the skills and knowledge to construct and restore walls in gardens and the landscape. They will consider the range of materials and techniques, and the health and safety implications of this work

Learning outcomes

In this unit, learners will be able to:

1. Understand the construction of outdoor walls
2. Construct outdoor walls
3. Restore a wall

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the construction of outdoor walls

Topics

- 1.1 Construction techniques, specifications and bond types
- 1.2 Potential sources of waste,
- 1.3 Problems and contingencies
- 1.4 Current legislation

This outcome provides the learner with the opportunity to develop the breadth and depth of their knowledge and understanding of the construction of external walls, namely brick walls, stone walls and dry stone walls. Learners are also to evaluate construction techniques, specifications and requirements of the following stretcher bond, English bond, Flemish bond, garden wall bond, open bond, random bond, header bond and also screen blocks. They should understand the properties of a range of mortar mixes and additives and identify potential sources of waste, adverse environmental impact and methods to minimise these and explain typical site problems and contingencies for dealing with them.

Topic 1.1

Learners will understand:

- Specifications
- excavation techniques
- footings (materials, depth, width)
- free standing and retaining walls
- bond types (stretcher bond, English bond, Flemish bond, garden wall bond, open bond, random bond, header bond).

Topic 1.2

Learners will know potential sources of waste through incorrect and excessive ordering, poor handling or storage, weather damage, wasted time through ineffective systems.

Topic 1.3

Learners will understand potential problems and contingencies to include:

- site services (known and unknown)s
- soft pockets
- permits
- unexpected finds
- ground pollution
- weather conditions (including water logging, frost, snow)
- boundary disputes
- shortage of labour/skills
- delays in delivery of materials

- equipment/machinery breakdown
- inappropriate equipment/machinery on site
- contingency plans.

Topic 1.4

Learners will know current legislation and construction codes of practice, to include Personal Protective Equipment (PPE), Control of Substances Hazardous to Health (2002) (COSHH), manual handling, building and construction standards, staff certificates of competence and other required qualifications, Health and Safety at Work etc Act 1974, Management of Health and Safety at Work Regulations 1992 (as amended).

Learning outcome:

2. Construct outdoor walls

Topics

- 2.1 Mark out footings
- 2.2 Construct free-standing walls
- 2.3 Ensure security of the site and protection of the work

In this outcome learners will have the opportunity to mark out effective footings and construct at least one free-standing wall. Learners must also ensure security of the site, and comply with current legislation during construction work. They should also anticipate potential problems during construction work and identify how to overcome them.

Topic 2.1

Learners will undertake practical activities to mark out footings to include: identifying line and orientation, marking out from a plan, adhering to specifications (length, depth, width).

Topic 2.2

Learners will construct a free-standing wall with a right angle corner. Materials may include: mortared brick, pre-cast blocks, natural stone, blocks, screen blocks. Learners will construct the wall as per specification (unit size, bond, single or double brick width, height, length).

Topic 2.3

Learners will ensure a safe, secure and tidy site, with appropriate site signage, and lighting. They will minimise unnecessary waste, minimise detrimental environmental impact, identify potential problems, wear appropriate Personal Protective Equipment (PPE), comply with current health and safety and construction legislation.

Learning outcome:

3. Restore a wall

Topics

- 3.1 Evaluate the condition of a wall
- 3.2 Specify requirements for restoration
- 3.3 Restore a wall

Topic 3.1

Learners will inspect a wall and evaluate its condition considering the following factors: stability, durability, condition of mortar and bricks/blocks, correct bond for use, missing bricks or sections, plant growth in/on wall. The learner will establish what work is required to restore the condition as near to the original as possible/ feasible.

Topic 3.2

Learners will specify the practical requirements for restoration of a wall. Learners will identify and source appropriate materials, and estimate cost of restoration to include: labour, material, expert advice, legal/planning costs, equipment/machinery hire, survey and assessment costs

Topic 3.3

Learners will undertake restoration of a given wall, they will carry out this restoration safely and to specification, removing any plant material if required.

Guidance for delivery

This unit is designed to provide the learner with the skills and knowledge to construct outdoor walls, and be able to assess the condition of existing walls and carry out the required restoration. They will evaluate the range of materials and techniques. A greater depth and breadth of technical knowledge and skill is required at this level, including a wide range of materials and their uses.

The unit may be delivered by a wide range of techniques, including lectures, video or DVD, supervised practical work, site visits and research. Real projects are a valuable means to boost learners' confidence, technique and understanding, following initial acquisition of the skills. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities and learners must comply with all current legislation.

Suggested learning resources

Books

- Brick Development Association. 2000. The BDA guide to successful brickwork. 2nd ed. Oxford: Butterworth-Heinemann.
- Brickell, C. 2006. RHS essential garden planning and construction. London: Mitchell Beazley
- Chudley, R. 2008. Building Construction Handbook. 7th ed. Oxford: Butterworth-Heinemann.
- Derek Lovejoy Partnership. 1997. Spon's Landscape Handbook. Oxford: Taylor and Francis.
- Fortlage, C.A., Phillips, E. 1996. Landscape Construction: Roads, Pavings and Drainage Volume 2. Surrey: Ashgate Publishing.
- Littlewood, M. 1993. Landscape Detailing Volume 1: Enclosures. 3rd ed. Oxford: Architectural Press.
- Lovejoy et al. 2001. Landscape Construction: Earth and Water Retaining Structures Volume 3. Surrey: Ashgate Publishing.
- Sauter, Sauter, D. 2010. Landscape Construction. 3rd ed. New York: Delmar Learning.

Websites

www.cambridgeshire.gov.uk/leisure/libraries/online/bgsi.htm - gives free access to British standards online

Unit 324

Construct and establish sports and amenity turf areas

UAN:	M/507/4694
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to construct and establish sports and amenity turf areas and how these can be applied in practice. The learner will be able to develop practical, work-related skills alongside the knowledge involved in the preparation and construction of sports and other turf surfaces, including investigation of a suitable site, grading, drainage, land cultivation and establishment of the sports or amenity turf surface.

Learning outcomes

In this unit, learners will be able to:

1. Investigate and survey a site for a new sports or amenity turf area
2. Understand the principles of grading and drainage
3. Understand the construction and preparation of land for sports turf construction
4. Understand the use of artificial or ameliorated root zones and specialised constructions
5. Establish swards from seed and turf

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Investigate and survey a site for a new sports or amenity turf area

Topics

1.1 Site investigations and suitability for summer and winter use

1.2 Conduct site survey using appropriate equipment

1.3 Surface levels for winter and summer sports

Topic 1.1

Learners will understand the factors that determine the suitability of a site:

- choice and location of site
- existing use of that site
- soil
- topography
- drainage/signs of poor drainage
- services
- levels
- access and planning for a range of winter and summer use, eg football, cricket, bowls.

Learners will carry out site investigation in a professional and logical manner, using appropriate equipment (eg soil augers, existing site maps) to enable them to draw conclusion on site suitability. It will be essential that learners work with a real site of at least the size of a football pitch.

Topic 1.2

Learners will conduct site surveys and record their findings ensuring the correct and accurate use of:

- surveying terminology
- equipment (eg range poles, tapes and lines, straight edge, boning rods, optical and laser levels)
- methodology

Their findings to include recording and plotting of areas, boundaries, existing features and levels.

Topic 1.3

Learners will know the acceptable features and ranges of surface levels for winter and summer sports surfaces and at differing standards i.e. from local school and council pitches to professional surfaces.

Learning outcome:

2. Understand the principles of grading and drainage

Topics

2.1 The techniques of major and minor grading and equipment used for grading and earth movement

2.2 The suitability and layouts of types of drainage systems appropriate to turf areas

2.3 Aftercare for drainage systems appropriate to turf areas

Visits to contractors and/or sites where construction/grading/drainage is taking place will be beneficial to the learners.

Topic 2.1

Learners will know about the handling and preparation of topsoil to include: removal of topsoil and 'cut and fill', effects of stacking of topsoil, the moisture content of soils and the structural loss that occurs during operations. They will know the tools and equipment needed, to include: tractor mounted or trailed equipment, excavators, back-hoes, bulldozers, graders, levellers and rollers.

Learners will know site marking to facilitate operations and all health and safety considerations of both the operation and the equipment used.

The learners will also understand the benefits of grading and how this impacts on the success of the project.

Topic 2.2

The learners will understand different types of drainage systems to include: mole ploughing, open ditches, piped drainage systems, sand slitting.

Learners will understand the factors that affect the suitability of drainage systems

- layouts (eg herringbone, grid system)
- uses (eg type and use of surface, amount of water to be removed).

Topic 2.3

Learners will know the aftercare requirements of various drainage systems, to include: open ditches, piped drainage systems, sand slitting.

Learning outcome:

3. Understand the preparation and construction of land for sports turf surfaces

Topics

3.1 Land clearance methods

3.2 The establishment of swards from seed and turf for defined turf types and standards

In this outcome, learners will review methods of land clearance and primary and secondary land cultivation to include large-scale and small-scale methods and emphasise the reasons for the various operations. The establishment of swards from seed and turf will also be investigated and there should be focus on the species and cultivar mixes that will be used for specific purposes and soil types. Within this, appropriate application rates of seed and suitable types of available turf should be explored. This should be linked to the required type and standard of turf expected.

Topic 3.1

Learners will understand chemical and cultural methods of land clearance to include a review of

- techniques and purposes of primary and secondary cultivations to ensure correct tilth levels and degree of consolidation
- effect of poor/uneven consolidation on subsequent use and levels
- equipment that might be used (small and large scale)

- health and safety considerations.

Topic 3.2

Learners will understand how to establish turf areas from seed and turf for a range of sports, to meet the requirements of that surface. They will need to take into account what seed mixtures and turf types are appropriate to suit the use and soil type of that area. They will also need to review the application rates, treatments needed and the appropriate aftercare to aid establishment.

Learning outcome:

4. Understand the use of artificial or ameliorated root zones and specialised constructions

Topics

4.1 Specialised constructions for specific uses

4.2 The use and composition of artificial or ameliorated root zones in specific sports.

In this outcome, learners will consider artificial and ameliorated root zones including specific root zone layers for special constructions such as a cricket table or USGA construction. They will also consider the root zone materials and grades of materials and their suitability in different situations.

Topic 4.1

Learners will identify specialised construction systems to include

- combined drainage and sub-irrigation
- sand/gravel raft systems eg sand carpet, suspended water table
- construction of cricket tables and golf greens.

Topic 4.2

Learners will understand the composition of natural soil football pitches, sand football pitches, golf/bowling greens and cricket pitches. They will understand the differences in composition between the different surface types identifying what characteristics make one type of composition more appropriate than another.

Artificial or ameliorated root zones will also be evaluated to include high sand pitches for winter sports, use of clay for cricket and tennis, reinforcement systems (eg fibre sand, polypropylene fibres i.e. desso fibres and honeycomb systems for occasional use car parking).

Learning outcome:

5. Establish swards from seed and turf

Topics

5.1 Appropriate seed mixes and application rates for specified use

5.2 Prepare of land for sowing grass seed or laying turf

5.3 Check quality of delivered turf for a specific use.

5.4 Establish grassed areas from seed and turf

In this outcome, learners will develop skills in land cultivation and establishment of turf, and apply the knowledge they have gained in learning outcome 3. The learners will be expected to carry out

these tasks using hand/small scale techniques, but will have gained knowledge of the techniques needed for large-scale projects in learning outcome 3.

Topic 5.1

Learners will understand the characteristics of different grass seeds and mixes to allow them to select appropriate species and cultivar mixes and accurate application rates for given uses and sites. They will make these selections in response to external factors such as soil and climatic conditions along with the expected usage of the surface and probable maintenance regimes.

Topic 5.2

Whilst preparing land for seeding or turving learners will undertake primary and secondary cultivations to ensure correct tilth, levels and degree of consolidation.

Topic 5.3

On receipt of turf the learners must perform a quality check to ensure that the turf is fit for the intended purpose. They will check:

- species mix
- sward colour
- absence of weeds, pests and diseases
- overall quality to include thickness and uniformity.

Topic 5.4

Learners will sow grass using appropriate techniques. They will provide aftercare and protection to sites once the establishment is completed.

Guidance for delivery

This unit is designed to equip the learner with the skills and knowledge involved in the preparation and construction of sports and other turf surfaces, including investigation of suitable site, grading, drainage, land cultivation and establishment of the sports or amenity turf surface.

The unit may be delivered by a wide range of techniques, including lectures, supervised practical work, discussions, site visits and research. Learners will require access to specialised literature and other resources. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities.

Suggested learning resources

Books

Adams, W.A., Gibbs, R.J. 1994. *Natural Turf for Sport and Amenity, Science and Practice*. Oxford: CABI.

Baker, S.B. 2006. *Rootzones, Sands and Top Dressing Materials for Sport Turf*. STRI. ISBN: 187-343-1600

Evans, R.D.C. 1994. *Winter Games Pitches: The Construction and Maintenance of Natural Turf Pitches*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431031.

Brown S. 2005. *Sports Turf and Amenity Grassland Management*. London: The Crowood Press. ISBN: 1-861-26790-8.

Langdon, D. 2015. *Spon's Landscape and External Works Price Book*. Oxford: CRC Press.

Clamp, H. 1986. *Spon's Landscape Contract Manual: A Guide to Good Practice and Procedures in the Management of Landscape Contracts*. Oxford: Taylor and Francis.

Derek Lovejoy Partnership. 1997. *Spon's Landscape Handbook*. Oxford: Taylor and Francis.

Sports Turf Research Institute. 2005. *STRI Guidelines to Golf Green Construction in the United Kingdom*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431597

BS 3882: 2007 Specification for topsoil

BS 3969: 1998 Recommendations for Turf for general purposes

BS 4428: 1989 Code of Practice for general landscape operations (excluding hard surfaces)

STRI leaflets and Journals

Websites

www.iog.org

The Institute of Groundsmanship

www.stri.co.uk

The Sports Turf Research Institute

www.usga.org

The United States Golf Association

www.sportengland.org

Sport England – Natural Turf for Sport

Unit 325

Manage winter and summer sports turf surfaces

UAN:	T/507/4695
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of the principles of management of winter and summer sports turf and how these can be put into practice. The learners will be able to develop the skills and knowledge involved in the management of turf surfaces for winter and summer sports to a stated level of quality. They will be able to apply the principles of sustainable turf management and collect data using Performance Quality Standards to assess the level of quality of the surface.

Learning outcomes

In this unit, learners will be able to:

1. Understand the management of winter and summer sports turf surfaces to Performance Quality Standards
2. Manage winter and summer sports turf surfaces to Performance Quality Standards (PQS)
3. Evaluate maintenance operations and their contribution to overall quality
4. Understand the determination and maintenance of the level of quality of sports turf surfaces

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the management of winter and summer sports turf surfaces to Performance Quality Standards

Topics

- 1.1 Soil ecosystem assessment for the production of calendars of work
- 1.2 Management strategies to reduce the effects of wear on sports turf surfaces
- 1.3 Monitoring weather and climatic conditions for the management of sports turf surfaces
- 1.4 Using a maintenance plan and resource file in the management of surfaces to a stated PQS.

Topic 1.1

Learners will undertake assessments of the soil to include root zone composition, depth, structure, bulk density, aeration, moisture status, nutrient status and organic matter status including thatch.

The learners will understand why the soil ecosystem must be assessed before producing a maintenance plan and they will then use this information when producing their calendars of work for winter and summer sports turf surfaces.

Topic 1.2

Learners will understand a range of management strategies to reduce the effects of wear considering the following maintenance options:

- inputs
- choice of equipment and machines and season of use
- frequencies, depth, duration, direction of travel, rotation and intensity of utilised areas
- sequence of different operations.

Topic 1.3

Learners will review a range of weather and climate data

- current season information compared with longer term averages
- quantity of precipitation
- quantity and quality of light
- shading effects
- seasonal and unseasonal frost
- maximum and minimum temperatures
- air movement
- localised and catastrophic climatic events.

They will understand why this information should be monitored when managing winter and summer sports turf surfaces and the impact it could have upon management decisions. Learners will understand the quality of the turf surface, grass species selection, irrigation, fertiliser application, mowing specifications, sequence of operations, pests, diseases and disorders, and frequency and intensity of use in relation to weather and climatic conditions.

Topic 1.4

Learners will understand how a maintenance plan contributes to the management of surfaces to the desired standard. They will understand how consideration of the following factors contributes to the successful management of the surface. Factors to include: the operations required during the year, the equipment/machinery required, frequencies and timing, duration, intensity, depth, direction, high wear areas and a pest, disease and disorder management strategy.

Learners will also understand how a resource file contributes to the management of surfaces to the desired standard. They will understand how having a resource file that includes details of all resources, including personnel, materials, equipment, machinery and finances will aid the successful management of a surface.

Learning outcome:

2. Manage winter and summer sports turf surfaces to Performance Quality Standards (PQS)

Topics

- 2.1 PQS data collection for the assessment of the level of quality of a sports turf surface
- 2.2 Calendars of work for managing sports turf surfaces to a stated level of quality
- 2.3 Produce resource files for a sports turf surface
- 2.4 Carry out maintenance activities on winter and summer sports turf surfaces

Topic 2.1

Learners will determine levels of Performance Quality Standards:

- basic (recreational use)
- standard (club use)
- high (national and international competition use)
- through the use of a range of tests.

The level of quality will be assessed in three areas

- structural quality: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, rootzone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational quality: eg appearance, visibility of and width of markings, surface debris, and sward colour
- playing quality: eg vertical ball bounce, traction, ball roll, spin, hardness, and green speed.

Topic 2.2

Learners will understand the operations required during the year to maintain winter and summer sports turf surfaces. They will determine the most appropriate time of year to undertake these maintenance operations and stipulate the following for each operation: the equipment/machinery required, frequencies and timing, duration, intensity, depth and direction. Within their maintenance calendar they must also highlight methods of managing high wear areas and state a pest, disease and disorder management strategy.

Topic 2.3

Learners will produce a management file to include details of all resources, including personnel, materials, equipment, machinery and finances. The management file will fully represent the resources and inputs needed to manage winter and summer sports turf surfaces.

Topic 2.4

Learners will assess the surfaces of winter and summer sports turf areas and undertake maintenance tasks as required to include:

- mowing
- edging
- aeration
- scarification
- top dressing
- rolling
- turfing
- seeding
- brushing/switching.

Learners will determine the correct timing of operations, select and use the correct piece of equipment (pedestrian, ride-on and tractor mounted); mode of action i.e. powered hand held, non-powered) for a specific practical task. They also need to choose and apply materials (topdressing, seed, turf) using the correct method of application.

Learners will mark lines using the correct method and materials and be able to store all materials appropriately and safely.

Learning outcome:

3. Evaluate maintenance operations and their contribution to overall quality

Topics

- 3.1 Monitor the impact of maintenance operations on the quality of sports turf surfaces
- 3.2 Monitor material inputs and their impact on quality
- 3.3 Collect data for assessing the overall quality of sports turf surfaces

In this outcome learners will develop skills in monitoring operations and inputs to assess how each is contributing to the quality. Consideration should be given to setting up areas of turf where different operational regimes and levels of inputs can be compared. Monitoring should take place over as long a time as possible and the learner should be encouraged to experiment with different mowing practices, frequencies, heights-of-cut, adjustment and setting up of equipment. Note should be made of the effects of sharp and blunt blades on mowers upon the quality of the turf.

Topic 3.1

Learners will monitor a range of operations: mowing, edging (where a non-turf surface is used), aeration, scarification, topdressing, rolling, turfing, seeding, irrigation, brushing/switching, fertilising and marking out to assess their impact on the overall quality of specific sports turf surfaces and evaluate how each is contributing to the overall quality.

Topic 3.2

Learners will monitor and evaluate material inputs: eg topdressing, seed, turf, water, fertiliser, labour, finance and determine how each is contributing to the quality of the surface.

Topic 3.3

Learners will collect a range of PQS data:

- structural: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, rootzone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational: eg appearance, visibility of and width of markings, surface debris, and sward colour
- playing: eg vertical ball bounce, traction, ball roll, hardness, spin, green speed.

They will then use this to assess the suitability and impact of maintenance operations on the desired level of quality of the winter and summer sports turf surfaces, recommending changes in maintenance where necessary.

Learning outcome:

4. Understand the determination and maintenance of the level of quality of sports turf surfaces

Topics

- 4.1 Using Performance Quality Standards (PQS) to assess the quality of a turf surface
- 4.2 Levels of quality for specific sports turf surfaces
- 4.3 Material inputs and maintenance operations

Learners will need to practise using PQS to aid understanding and will need access to current sources of information.

Topic 4.1

Learners will understand the advantages and disadvantages of using Performance Quality Standards (PQS) to assess the quality of specific surfaces.

Learners will understand that this data is used to inform management decisions, determine maintenance requirement accurately, justify the purchase of equipment/resources, allow effective use of inputs, reduce wastage and determine the carrying capacity of the turf.

Topic 4.2

Learners will understand the different levels of quality, basic, standard and high, for specific surfaces and understand when they would be acceptable. They will ensure they consider the 3 areas of performance quality assessment when making this decision:

- structural: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, rootzone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational: eg appearance, visibility of and width of markings, surface debris, and sward colour
- playing: eg vertical ball bounce, traction, ball roll, spin, hardness.

Topic 4.3

Learners will understand the purposes of reviewing material inputs and maintenance operations to obtain maximum use from the surface. They will understand efficient use of available resources and effective operations to maximise the potential of the turf surface. They will also consider minimal waste and environmental impacts.

Guidance for delivery

The learner will be able to develop the skills and knowledge involved in the management of turf surfaces for winter (golf, football, rugby union, National Hunt racing) and summer sports (golf, bowls, tennis, cricket, rugby league, Flat racing) to a stated level of quality. They will be able to apply the principles of sustainable turf management and collect data using Performance Quality Standards (PQS) to assess the level of quality of the surface. The learner should be able to select and safely use appropriate machines, equipment and materials for these tasks. The unit should cover as wide a range of activities as possible, appropriate to the sports facilities available to the learner.

The unit may be delivered by a wide range of techniques, including lectures, supervised practical work, discussions, site visits and research. The learner will require access to specialised literature and other resources. The delivery of this unit may be integrated with the delivery of other units where this is feasible. Current and topical issues regarding turf management should be highlighted as and when they arise.

Suggested learning resources

Books

Adams W.A., Gibbs R.J.1993. *Natural Turf for Sport and Amenity*. Oxford: CAB International. ISBN 0851987206.

Arthur, J. 1997. *Practical Greenkeeping*. Scotland: Royal & Ancient Golf Club of St Andrews. ISBN 0907583121.

Brown S. 2005. *Sports Turf and Amenity Grassland Management*. Wiltshire: The Crowood Press. ISBN 1861267908.

Brown S. 2009. *Sports Ground Management: A Complete Guide*. Wiltshire: The Crowood Press. ISBN 184797094X.

Evans R.D.C. 1991. *Cricket Grounds: The Evolution, Maintenance and Construction of Natural Turf Cricket Tables and Outfields*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431007.

Evans R.D.C. 1994. *Winter Games Pitches: The Construction and Maintenance of Natural Turf Pitches*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431031.

Perris, J. 2000. *Grass Tennis Courts: How to construct and maintain them*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431341

Perris, J. 2008. *All About Bowls: The History, Construction and Maintenance of Bowling*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431066

Perris, J., Evans, R.D.C. 1996. *The Care of the Golf Course*. 2nd ed. Yorkshire: The Sports Turf Research Institute. ISBN 1873431198.

Sachs P. 2004. *Managing Healthy Sports Fields*. Sussex: Wiley Publishing. ISBN 0471472697.

Sports Turf Research Institute. 2005. *STRI Guidelines to Golf Green Construction in the United Kingdom*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431597

Turgeon A.J. 2009. *Turfgrass Management*. 8th ed. Harlow: Pearson Education. ISBN 0131140000

Websites

www.iog.org

The Institute of Groundsmanship

www.wimbledon.com

Wimbledon Tennis Club

www.sportengland.org

www.bigga.org.uk

www.stri.co.uk

www.golfcoursemanagement.randa.org/

www.footballfoundation.org.uk

www.ecb.co.uk

www.bowlsengland.com

www.bowls-central.co.uk

Sport England – Natural Turf for Sport

The British and International Golf Greenkeepers Association

The Sports Turf Research Institute

The R&A

The Football Foundation

The English Cricket Board

Bowls England. ebook available on greens maintenance.

Bowls Central; Greenkeeping and Club management

Unit 326

Manage sports turf surfaces - golf

UAN:	A/507/4696
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of the principles of management of golf courses and how these can be put into practice. The learners will be able to develop the skills and knowledge involved in the management of turf surfaces for golf to a stated level of quality. They will be able to apply the principles of sustainable turf management and collect data using Performance Quality Standards to assess the level of quality of the surface.

Learning outcomes

In this unit, learners will be able to:

1. Understand the management of golf surfaces to Performance Quality Standards
2. Manage golf surfaces to Performance Quality Standards (PQS)
3. Evaluate maintenance operations and their contribution to overall quality
4. Understand the determination and maintenance of the level of quality of golf surfaces

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the management of golf surfaces to Performance Quality Standards

Topics

- 1.1 Turf maintenance activities
- 1.2 Suitable conditions for maintenance operations
- 1.3 The effect of maintenance operations on the development of the turf surface

Topic 1.1

Learners will undertake assessments of the soil to include; rootzone composition, depth, structure, bulk density, aeration, moisture status, nutrient status and organic matter status including thatch. The learners will understand why the soil ecosystem must be assessed before producing a maintenance plan and they will then use this information when producing their maintenance plan for a golf course.

Topic 1.2

Learners will understand a range of management strategies to reduce the effects of wear evaluating the following maintenance options:

- inputs
- choice of equipment and machines and season of use
- frequencies, depth, duration, direction of travel, rotation and intensity of utilised areas
- sequence of different operations.

Topic 1.3

Learners will review a range of weather and climate data

- current season information compared with longer term averages
- quantity of precipitation
- quantity and quality of light
- shading effects
- seasonal and unseasonal frost
- maximum and minimum temperatures
- air movement
- localised and catastrophic climatic events.

They will understand why this information should be monitored when managing golf courses and the impact it could have upon management decisions. Learners will understand the quality of the turf surface, grass species selection, irrigation, fertiliser application, mowing specifications, sequence of operations, pests, diseases and disorders, and frequency and intensity of use in relation to weather and climatic conditions.

Topic 1.4

Learners will understand how a maintenance plan contributes to the management of surfaces to the desired standard. They will understand how consideration of the following factors contributes to the successful management of the surface. Factors to include: the operations required during

the year, the equipment/machinery required, frequencies and timing, duration, intensity, depth, direction, high wear areas and a pest, disease and disorder management strategy.

Learners will also understand how a resource file contributes to the management of surfaces to the desired standard. They will understand how having a resource file that includes details of all resources, including personnel, materials, equipment, machinery and finances will aid the successful management of a surface.

Learning outcome:

2. Manage golf surfaces to Performance Quality Standards (PQS)

Topics

2.1 PQS data collection for the assessment of the level of quality of golf turf surfaces

2.2 Produce a maintenance plan

2.3 Resource files for a golf course

2.4 Required maintenance activities on golf courses

Access to appropriate golf courses is essential to enable the learners to develop the required level of skill.

Topic 2.1

Learners will determine levels of Performance Quality Standards: basic (recreational use), standard (club use), high (national and international competition use), through the use of a range of tests.

The level of quality will be assessed in three areas:

- structural quality: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, rootzone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational quality: eg appearance, surface debris, and sward colour
- playing quality: eg ball roll, hardness, green speed

Topic 2.2

Learners will produce a maintenance plan stipulating how to manage each surface assessed in 1.1 to its stated level of quality, as well as consider other features such as bunkers.

Learners must be aware of the operations required during the year to maintain the range of golf surfaces and features. They will determine the most appropriate time of year to undertake these maintenance operations and stipulate the following for each operation: the equipment/machinery required, frequencies and timing, duration, intensity, depth and direction.

Learners will produce a maintenance plan within which they will highlight methods of managing high wear areas and the use of winter tees, and state a pest, disease and disorder management strategy.

Topic 2.3

Learners will produce a management file to include details of all resources, including personnel, materials, equipment, machinery and finances. The management file will fully represent the resources and inputs needed to manage golf courses.

Topic 2.4

Learners will assess the surfaces of golf courses and undertake maintenance tasks as required to include:

- mowing
- edging (including where a non-turf surface is used)
- aeration
- scarification
- top dressing
- rolling
- turfing
- seeding
- irrigation
- brushing/switching
- fertilising.

Learners will determine the correct timing of operations and be able to select and use the correct piece of equipment (pedestrian, ride-on and tractor mounted); mode of action i.e. powered hand held, non-powered) for a specific practical task. They also need to choose and apply materials (topdressing, seed, turf) using the correct method of application. Learners will set out tee markers and boundaries i.e. water hazards and ground under repair (GUR) and change holes.

Learning outcome:

3. Evaluate maintenance operations and their contribution to overall quality

Topics

3.1 Monitor the impact of maintenance operations on the quality of golf surfaces

3.2 Monitor material inputs and their impact on quality

3.2 Collect data for assessing the overall quality of golf surfaces

In this outcome learners will develop skills in monitoring operations and inputs to assess how each is contributing to the quality. Consideration should be given to setting up areas of turf where different operational regimes and levels of inputs can be compared. Monitoring should take place over as long a time as possible and the learner should be encouraged to experiment with different mowing practices, frequencies, heights-of-cut, adjustment and setting up of equipment. Note should be made of the effects of sharp and blunt blades on mowers upon the quality of the turf.

Topic 3.1

Learners will monitor a range of operations:

- Mowing
- verti-cutting
- aeration
- scarification
- topdressing
- rolling
- turfing
- grooming
- seeding,
- irrigation

- brushing/switching
- fertilising and marking out
- to assess their impact on the overall quality of the golf surfaces and evaluate how each is contributing to the overall quality.

Topic 3.2

Learners will monitor and evaluate material inputs, eg:

- topdressing
- seed
- turf
- water
- fertiliser
- labour
- finance
- determine how each is contributing to the quality of the surface.

Topic 3.3

Learners will collect a range of PQS data:

- structural: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, root zone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational: eg appearance, surface debris, and sward colour
- playing: eg ball roll, hardness, green speed.

They will then use this to assess the suitability and impact of maintenance operations on the desired level of quality of the golf surfaces, recommending changes in maintenance where necessary.

Learning outcome:

4. Understand the determination and maintenance of the level of quality of golf surfaces

Topics

4.1 Using Performance Quality Standards (PQS) to assess the quality of a turf surface

4.2 Levels of quality for golf surfaces

4.3 Material inputs and maintenance operations

Learners will need to practise using PQS to aid understanding and will need access to current sources of information.

Topic 4.1

Learner will understand the advantages and disadvantages of using Performance Quality Standards (PQS) to assess the quality of golf surfaces.

Learners will understand that this data is used to inform management decisions, determine maintenance requirement accurately, justify the purchase of equipment/resources, allow effective use of inputs, reduce wastage and determine the carrying capacity of the turf.

Topic 4.2

Learners will understand the different levels of quality, basic, standard and high, for golf surfaces and decide which is acceptable. They will ensure they consider the 3 areas of performance quality assessment when making this decision:

- structural: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, root zone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational: eg appearance, surface debris, and sward colour
- playing: eg ball roll, hardness, green speed.

Topic 4.3

Learners will understand the purposes of reviewing material inputs and maintenance operations to obtain maximum use from the surface. They will understand efficient use of available resources and that operations are effective to maximise the potential of the turf surface. They will also consider minimal waste and environmental impacts.

Guidance for delivery

The learner will be able to develop the skills and knowledge involved in the management of turf surfaces for golf to a stated level of quality. They will be able to apply the principles of sustainable turf management and collect data using Performance Quality Standards to assess the level of quality of the surface. The learner should be able to select and safely use appropriate machines, equipment and materials for these tasks. The unit should cover as wide a range of activities as possible, appropriate to the golf courses available to the learner.

The unit may be delivered by a wide range of techniques, including lectures, supervised practical work, discussions, site visits and research. The learner will require access to specialised literature and other resources. The delivery of this unit may be integrated with the delivery of other units where this is feasible. Current and topical issues regarding turf management should be highlighted as and when they arise.

Suggested learning resources

Books

Adams W.A., Gibbs R.J.1993. *Natural Turf for Sport and Amenity*. Oxford: CAB International. ISBN 0851987206.

Arthur, J. 1997. *Practical Greenkeeping*. Scotland: Royal & Ancient Golf Club of St Andrews. ISBN 0907583121.

Brown S. 2005. *Sports Turf and Amenity Grassland Management*. Wiltshire: The Crowood Press. ISBN 1861267908.

Evans R.D.C. 1994. *Winter Games Pitches: The Construction and Maintenance of Natural Turf Pitches*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431031.

Perris, J., Evans, R.D.C. 1996. *The Care of the Golf Course*. 2nd ed. Yorkshire: The Sports Turf Research Institute. ISBN 1873431198.

Sports Turf Research Institute. 2005. *STRI Guidelines to Golf Green Construction in the United Kingdom*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431597

Turgeon A.J. 2009. *Turfgrass Management*. 8th ed. Harlow: Pearson Education. ISBN 0131140000

Witteveen. G., Bavier, M. 2004. *Practical Golf Course Maintenance: The Magic of Greenkeeping*. Sussex: Wiley Publishing. ISBN 0471475823

Websites

www.bigga.org.uk

The British and International Golf Greenkeepers
Association

www.stri.co.uk

The Sports Turf Research Institute

www.golfcoursemanagement.randa.org

The R&A

Unit 327

Principles of sports turf maintenance

UAN:	F/507/4697
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of the principles of management of winter and summer sports turf and how these can be put into practice. The learners will be able to develop the skills and knowledge involved in the management of turf surfaces for winter and summer sports to a stated level of quality. They will be able to apply the principles of sustainable turf management and collect data using Performance Quality Standards to assess the level of quality of the surface.

Learning outcomes

In this unit, learners will be able to:

1. Understand the effects of sports turf maintenance activities
2. Understand sports turf renovation activities
3. Understand the effects of thatch on sports turf areas
4. Understand the use of turf and seed for the establishment and renovation of sports turf areas

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the effects of sports turf maintenance activities

Topics

- 1.1 Turf maintenance activities
- 1.2 Suitable conditions for maintenance operations
- 1.3 The effect of maintenance operations on the development of the turf surface

Topic 1.1

Learners will know the range of maintenance operations carried out on sports turf areas to include:

- mowing (pedestrian, ride-on, rotary, cylinder)
- aeration (hollow-tining, solid-tining, micro-tining, verti-draining)
- scarification
- verti-cutting
- top-dressing
- rolling
- switching
- application of fertiliser
- use of Plant Growth Regulators

For each of the above the learners will identify the range of machinery that could be used and which would be most appropriate in different situations. They will also know machinery settings such as height of cut, depth of aeration, and product amounts, such as fertiliser and top-dressing application rates.

Topic 1.2

Learners will understand the effect of weather and soil conditions on the range of turf maintenance activities listed above. They will know timings of operations in a range of different situations and for different sports.

Topic 1.3

Learners will understand the use of each maintenance activity on the development of the turf surface. They will understand that the benefits and limitations could be different for different sports surfaces.

Learning outcome:

2. Understand sports turf renovation activities

Topics

- 2.1 The effects of wear on the surface and the need for turf renovation work
- 2.2 Range of suitable renovation activities
- 2.3 Timing of renovation activities

Topic 2.1

Learners will understand when an area needs renovation work. They will understand acceptable levels of wear and how this is dependent on the type and level of quality of that area. Learners will also know the effect on the playing surface of not carrying out renovation activities.

Topic 2.2

Learners will know potential renovation activities for the following turf areas: cricket grounds, tennis courts, association football pitches, rugby pitches, bowling greens and golf courses. They will understand why particular renovation activities would be chosen in different situations.

Topic 2.3

Learners will know the timings of renovation activities and understand the consequences when renovation activities are carried out at the wrong time of year. Learners will know the reasons why renovation activities might have to be carried out at non-ideal times of the year, eg extended playing seasons, alternative use of venues.

Learning outcome:

3. Understand the effects of thatch on sports turf areas

Topics

- 3.1 Characteristics of thatch
- 3.2 Causes of thatch
- 3.3 Benefits of and problems caused by thatch
- 3.4 Methods of thatch control

Topic 3.1

Learners will know the characteristics of thatch and what it can be composed of. They will know acceptable amount of thatch for different turf surfaces.

Topic 3.2

Learners will understand why thatch build-up occurs and what conditions may affect the speed of build-up to include

- weather
- soil structure and texture
- grass species used
- cultural practices

Topic 3.3

Learners will understand the advantages and disadvantages of thatch within the sward as appropriate to different sports surfaces.

Topic 3.4

Learners will know the range of methods available to control thatch and determine the advantages and disadvantages of each. They will know which method is appropriate in different situations.

Learning outcome:

4. Understand the use of turf and seed for the establishment and renovation of sports turf areas

Topics

- 4.1 The use of turf for the establishment and renovation of sports turf areas
- 4.2 The use of seed for the establishment and renovation of sports turf areas
- 4.3 Comparison between the use of turf and seed for the establishment and renovation of turf areas
- 4.4 Comparison of maintenance of newly established / renovated areas from turf and seed

Topic 4.1

Learners will understand the use of turf in the establishment and renovation of sports turf areas. They will need to consider the following:

- the type and quality of the sports surface
- the use of the sports surface
- the quality of the existing turf
- sources, types and quality of turf.

Learners will understand the use of turf in a range of different situations and for a range of sports surfaces.

Topic 4.2

Learner will understand the use of seed in the establishment and renovation of sports turf areas. They will need to consider the following:

- the type and quality of the sports surface
- the use of the sports surface
- the quality of the existing turf
- sources, types and quality of turf.

The learner will understand the use of seed in a range of different situations and for a range of sports surfaces.

Topic 4.3

The learner will understand the use of turf versus seed for the establishment and renovation for sports turf areas. They will understand the advantages and disadvantages of each and when they should be used. They will need to consider the following factors:

- cost
- speed of visible establishment
- tolerance to wear
- weed invasion
- size of area being established / renovated
- range of grass species and cultivars available
- time of year.

Topic 4.4

Learners will understand the maintenance requirements of newly established / renovated areas for the first 12 months. They will know specifications for the following maintenance requirements

- mowing
- rolling
- topdressing
- fertiliser treatment
- weed control
- disease control
- irrigation
- stone removal
- protection

Guidance for delivery

The learner will be able to develop the knowledge involved in the management of turf. They will investigate the key principles of sports turf management and how these impact on the management of surfaces.

The unit may be delivered by a wide range of techniques, including lectures, discussions, site visits and research. The learner will require access to specialised literature and other resources. The delivery of this unit may be integrated with the delivery of other units where this is feasible. Current and topical issues regarding turf management should be highlighted as and when they arise.

Suggested learning resources

Books

- Adams W.A., Gibbs R.J.1993. *Natural Turf for Sport and Amenity*. Oxford: CAB International. ISBN 0851987206.
- Arthur, J. 1997. *Practical Greenkeeping*. Scotland: Royal & Ancient Golf Club of St Andrews. ISBN 0907583121.
- Brown S. 2005. *Sports Turf and Amenity Grassland Management*. Wiltshire: The Crowood Press. ISBN 1861267908.
- Brown S. 2009. *Sports Ground Management: A Complete Guide*. Wiltshire: The Crowood Press. ISBN 184797094X.
- Evans R.D.C. 1991. *Cricket Grounds: The Evolution, Maintenance and Construction of Natural Turf Cricket Tables and Outfields*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431007.
- Evans R.D.C. 1994. *Winter Games Pitches: The Construction and Maintenance of Natural Turf Pitches*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431031.
- Perris, J. 2000. *Grass Tennis Courts: How to construct and maintain them*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431341
- Perris, J. 2008. *All About Bowls: The History, Construction and Maintenance of Bowling*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431066
- Perris, J., Evans, R.D.C. 1996. *The Care of the Golf Course*. 2nd ed. Yorkshire: The Sports Turf Research Institute. ISBN 1873431198.
- Sachs P. 2004. *Managing Healthy Sports Fields*. Sussex: Wiley Publishing. ISBN 0471472697.
- Sports Turf Research Institute. 2005. *STRI Guidelines to Golf Green Construction in the United Kingdom*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431597
- Turgeon A.J. 2009. *Turfgrass Management*. 8th ed. Harlow: Pearson Education. ISBN 0131140000

Websites

www.iog.org	The Institute of Groundsmanship
www.wimbledon.com	Wimbledon Tennis Club
www.sportengland.org	Sport England – Natural Turf for Sport
www.bigga.org.uk	The British and International Golf Greenkeepers Association
www.stri.co.uk	The Sports Turf Research Institute
www.golfcoursemanagement.randa.org	The R&A
www.footballfoundation.org.uk	The Football Foundation
www.ecb.co.uk	The England and Wales Cricket Board
www.bowlsengland.com	Bowls England. ebook available on greens maintenance.
www.bowls-central.co.uk	Bowls Central; Greenkeeping and Club management

Unit 328

Manage sports turf surfaces - association football

UAN:	J/507/4698
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of the principles of management of football pitches and how these can be put into practice. The learners will be able to develop the skills and knowledge involved in the management of turf surfaces for football to a stated level of quality. They will be able to apply the principles of sustainable turf management and collect data using Performance Quality Standards to assess the level of quality of the surface.

Learning outcomes

In this unit, learners will be able to:

1. Understand the management of football pitches to Performance Quality Standards
2. Manage football pitches to Performance Quality Standards (PQS)
3. Evaluate maintenance operations and their contribution to overall quality
4. Understand the determination and maintenance of the level of quality of football pitches

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the management of football pitches to Performance Quality Standards

Topics

- 1.1 Soil ecosystem assessment for the production of calendars of work
- 1.2 Management strategies to reduce the effects of wear on football pitches
- 1.3 Monitoring weather and climatic conditions for the management of football pitches
- 1.4 Using a maintenance plan and resource file in the management of surfaces to a stated PQS.

Topic 1.1

Learners will undertake assessments of the soil to include; root zone composition, depth, structure, bulk density, aeration, moisture status, nutrient status and organic matter status including thatch. Learners will understand why the soil ecosystem must be assessed before producing a maintenance plan and they will then use this information when producing their maintenance plan for a football pitch.

Topic 1.2

Learners will understand a range of management strategies to reduce the effects of wear evaluating the following maintenance options:

- inputs
- choice of equipment and machines and season of use
- frequencies, depth, duration, direction of travel, rotation and intensity of utilised areas
- sequence of different operations.

Topic 1.3

Learners will review a range of weather and climate data:

- current season information compared with longer term averages
- quantity of precipitation
- quantity and quality of light
- shading effects
- seasonal and unseasonal frost
- maximum and minimum temperatures
- air movement
- localised and catastrophic climatic events.

They will understand why this information should be monitored when managing football pitches and the impact it could have upon management decisions.

Learners will understand the quality of the turf surface, grass species selection, irrigation, fertiliser application, mowing specifications, sequence of operations, pests, diseases and disorders, and frequency and intensity of use in relation to weather and climatic conditions.

Topic 1.4

Learners will understand how a maintenance plan contributes to the management of surfaces to the desired standard. They will understand how consideration of the following factors contributes to the successful management of the surface. Factors to include: the operations required during the year, the equipment/machinery required, frequencies and timing, duration, intensity, depth, direction, high wear areas and a pest, disease and disorder management strategy.

Learners will also understand how a resource file contributes to the management of surfaces to the desired standard. They will understand how having a resource file that includes details of all resources, including personnel, materials, equipment, machinery and finances will aid the successful management of a surface.

Learning outcome:

2. Manage football pitches to Performance Quality Standards (PQS)

Topics

- 2.1 PQS data collection for the assessment of the level of quality of football pitches
- 2.2 Produce calendars of work for managing football pitches
- 2.3 Produce resource files for football pitches
- 2.4 Carry out maintenance activities on football pitches

Access to appropriate football pitches is essential to enable the learners to develop the required level of skill.

Topic 2.1

Learners will determine levels of Performance Quality Standards: basic (recreational use), standard (club use), high (national and international competition use), through the use of a range of tests.

The level of quality will be assessed in three areas:

- structural quality: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, rootzone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational quality: eg appearance, visibility of and width of markings, goal posts, surface debris, and sward colour
- playing quality: eg vertical ball bounce, traction, ball roll, hardness.

Topic 2.2

Learners will know the operations required during the year to maintain football pitches. They will know the most appropriate time of year to undertake these maintenance operations and stipulate the following for each operation: the equipment/machinery required, frequencies and timing, duration, intensity, depth and direction.

Learners will produce a calendar of work within which they will highlight methods of managing high wear areas and state a pest, disease and disorder management strategy.

Topic 2.3

Learners will produce a management file to include details of all resources, including personnel, materials, equipment, machinery and finances. The management file will fully represent the resources and inputs needed to manage football pitches.

Topic 2.4

Learners will assess the surfaces of football pitches and undertake maintenance tasks as required to include:

- mowing
- line marking
- aeration
- scarification
- top dressing
- rolling
- turfing
- seeding
- irrigation
- brushing/switching
- fertilising.

Learners will determine the correct timing of operations and be able to select and use the correct piece of equipment (pedestrian, ride-on and tractor mounted; mode of action i.e. powered hand held, non-powered) for a specific practical task. They also need to choose and apply materials (topdressing, seed, turf) using the correct method of application.

Learners will mark lines using the correct method and materials and be able to store all materials appropriately and safely.

Learning outcome:

3. Evaluate maintenance operations and their contribution to overall quality

Topics

3.1 Monitor the impact of maintenance operations on the quality of football pitches

3.2 Monitor material inputs and their impact on quality

3.3 Collect data for assessing the overall quality of football pitches

In this outcome learners will develop skills in monitoring operations and inputs to assess how each is contributing to the quality. Consideration should be given to setting up areas of turf where different operational regimes and levels of inputs can be compared. Monitoring should take place over as long a time as possible and the learner should be encouraged to experiment with different mowing practices, frequencies, heights-of-cut, adjustment and setting up of equipment. Note should be made of the effects of sharp and blunt blades on mowers upon the quality of the turf.

Topic 3.1

Learners will monitor a range of operations: mowing, line marking, aeration, scarification, topdressing, rolling, turfing, seeding, irrigation, brushing/switching, fertilising and marking out to assess their impact on the overall quality of the football pitch and evaluate how each is contributing to the overall quality.

Topic 3.2

Learners will monitor and evaluate material inputs: eg topdressing, seed, turf, water, fertiliser, labour, finance and determine how each is contributing to the quality of the surface.

Topic 3.3

Learners will collect a range of PQS data:

- structural: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, rootzone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational: eg appearance, visibility of and width of markings, goal posts, surface debris, and sward colour
- playing: eg vertical ball bounce, traction, ball roll, hardness.

They will then use this to assess the suitability and impact of maintenance operations on the desired level of quality of the football pitch, recommending changes in maintenance where necessary.

Learning outcome:

4. Understand the determination and maintenance of the level of quality of football pitches

Topics

4.1 Using Performance Quality Standards (PQS) to assess the quality of a turf surface

4.2 Levels of quality for football pitches

4.3 Material inputs and maintenance operations

Learner will need to practise using PQS to aid understanding and will need access to current sources of information.

Topic 4.1

Learner will understand the advantages and disadvantages of using Performance Quality Standards (PQS) to assess the quality of football pitches.

Learners will understand that this data is used to inform management decisions, determine maintenance requirement accurately, justify the purchase of equipment/resources, allow effective use of inputs, reduce wastage and determine the carrying capacity of the turf.

Topic 4.2

Learners will understand the different levels of quality, basic, standard and high, for football pitches and decide which is acceptable. They will ensure they consider the 3 areas of performance quality assessment when making this decision:

- structural: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, rootzone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational: eg appearance, visibility of and width of markings, goal posts, surface debris, and sward colour
- playing: eg vertical ball bounce, traction, ball roll, hardness.

Topic 4.3

Learners will understand the purposes of reviewing material inputs and maintenance operations to obtain maximum use from the surface. They will understand efficient use of available resources and that operations are effective to maximise the potential of the turf surface. They will also consider minimal waste and environmental impacts.

Guidance for delivery

The learner will be able to develop the skills and knowledge involved in the management of turf surfaces for football to a stated level of quality. They will be able to apply the principles of sustainable turf management and collect data using Performance Quality Standards (PQS) to assess the level of quality of the surface. The learner should be able to select and safely use appropriate machines, equipment and materials for these tasks. The unit should cover as wide a range of activities as possible, appropriate to the football pitches available to the learner.

The unit may be delivered by a wide range of techniques, including lectures, supervised practical work, discussions, site visits and research. The learner will require access to specialised literature and other resources. The delivery of this unit may be integrated with the delivery of other units where this is feasible. Current and topical issues regarding turf management should be highlighted as and when they arise.

Suggested learning resources

Books

- Adams W.A., Gibbs R.J.1993. *Natural Turf for Sport and Amenity*. Oxford: CAB International. ISBN 0851987206.
- Brown S. 2005. *Sports Turf and Amenity Grassland Management*. Wiltshire: The Crowood Press. ISBN 1861267908.
- Brown S. 2009. *Sports Ground Management: A Complete Guide*. Wiltshire: The Crowood Press. ISBN 184797094X.
- Evans R.D.C. 1994. *Winter Games Pitches: The Construction and Maintenance of Natural Turf Pitches*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431031.
- Sachs P. 2004. *Managing Healthy Sports Fields*. Sussex: Wiley Publishing. ISBN 0471472697.
- Turgeon A.J. 2009. *Turfgrass Management*. 8th ed. Harlow: Pearson Education. ISBN 0131140000

Websites

- | | |
|--|--|
| www.iog.org | The Institute of Groundsmanship |
| www.footballfoundation.org.uk | The Football Foundation |
| www.sportengland.org | Sport England – Natural Turf for Sport |

Unit 329

Manage sports turf surfaces - cricket

UAN:	L/507/4699
Level:	3
GLH:	30

What is this unit about?

The purpose of this unit is to provide learners with an understanding of the principles of management of cricket turf surfaces and how these can be put into practice. The learners will be able to develop the skills and knowledge involved in the management of turf surfaces for cricket to a stated level of quality. They will be able to apply the principles of sustainable turf management and collect data using Performance Quality Standards to assess the level of quality of the surface.

Learning outcomes

In this unit, learners will be able to:

1. Understand the management of cricket surfaces to Performance Quality Standards
2. Manage cricket surfaces to Performance Quality Standards (PQS)
3. Evaluate maintenance operations and their contribution to overall quality
4. Understand the determination and maintenance of the level of quality of cricket surfaces

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the management of cricket surfaces to Performance Quality Standards

Topics

- 1.1 Soil ecosystem assessment for the production of calendars of work
- 1.2 Management strategies to reduce the effects of wear on cricket surfaces
- 1.3 Monitoring weather and climatic conditions for the management of cricket surfaces
- 1.4 Using a maintenance plan and resource file in the management of surfaces to a stated PQS.

Topic 1.1

Learners will undertake assessments of the soil to include; rootzone composition, depth, structure, bulk density, aeration, moisture status, nutrient status and organic matter status including thatch.

Learners will understand why the soil ecosystem must be assessed before producing a maintenance plan and they will then use this information when producing their maintenance plan for cricket surfaces.

Topic 1.2

Learners will understand a range of management strategies to reduce the effects of wear evaluating the following maintenance options:

- inputs
- choice of equipment and machines and season of use
- frequencies, depth, duration, direction of travel, rotation and intensity of utilised areas
- sequence of different operations.

Topic 1.3

Learners will review a range of weather and climate data:

- current season information compared with longer term averages
- quantity of precipitation
- quantity and quality of light
- shading effects
- seasonal and unseasonal frost
- maximum and minimum temperatures
- air movement
- localised and catastrophic climatic events.

They will understand why this information should be monitored when managing cricket surfaces and the impact it could have upon management decisions.

Learners will understand the quality of the turf surface, grass species selection, irrigation, fertiliser application, mowing specifications, sequence of operations, pests, diseases and disorders, and frequency and intensity of use in relation to weather and climatic conditions.

Topic 1.4

Learners will understand how a maintenance plan contributes to the management of surfaces to the desired standard. They will understand how consideration of the following factors contributes to the successful management of the surface. Factors to include: the operations required during the year, the equipment/machinery required, frequencies and timing, duration, intensity, depth, direction, high wear areas and a pest, disease and disorder management strategy.

Learners will also understand how a resource file contributes to the management of surfaces to the desired standard. They will understand how having a resource file that includes details of all resources, including personnel, materials, equipment, machinery and finances will aid the successful management of a surface.

Learning outcome:

2. Manage cricket surfaces to Performance Quality Standards (PQS)

Topics

2.1 PQS data collection for the assessment of the level of quality of cricket turf surfaces

2.2 Produce calendars of work for managing cricket surface

2.3 Produce resource files for each cricket surface

2.4 Carry out maintenance activities on cricket squares, pitches and outfield

Access to appropriate cricket grounds is essential to enable the learners to develop the required level of skill.

Topic 2.1

Learners will determine levels of Performance Quality Standards: basic (recreational use), standard (club use), high (national and international competition use), through the use of a range of tests.

The level of quality will be assessed in three areas:

- structural quality: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, rootzone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational quality: eg appearance, visibility of and width of markings, surface debris, and sward colour
- playing quality: eg vertical ball bounce, traction, ball roll, spin, hardness.

Topic 2.2

Learners will know the operations required during the year to maintain the range of cricket surfaces. They will know the most appropriate time of year to undertake these maintenance operations and stipulate the following for each operation; the equipment/machinery required, frequencies and timing, duration, intensity, depth and direction.

Learners will produce a calendar of work within which they will highlight methods of managing high wear areas and state a pest, disease and disorder management strategy.

Topic 2.3

Learners will produce a management file to include details of all resources, including personnel, materials, equipment, machinery and finances. The management file will fully represent the resources and inputs needed to manage cricket pitches.

Topic 2.4

Learners must be able to assess the surfaces of cricket pitches and undertake maintenance tasks as required to include:

- mowing
- line marking
- aeration
- scarification
- top dressing
- rolling
- turfing
- seeding
- irrigation
- brushing/switching
- fertilising.

Learners will determine the correct timing of operations and be able to select and use the correct piece of equipment (pedestrian, ride-on and tractor mounted; mode of action i.e. powered hand held, non-powered) for a specific practical task. They also need to choose and apply materials (topdressing, seed, turf) using the correct method of application.

Learners will mark lines using the correct method and materials and be able to store all materials appropriately and safely.

Learning outcome:

3. Evaluate maintenance operations and their contribution to overall quality

Topics

3.1 Monitor the impact of maintenance operations on the quality of cricket surfaces

3.2 Monitor material inputs and their impact on quality

3.3 Collect data for assessing the overall quality of cricket surfaces

In this outcome learners will develop skills in monitoring operations and inputs to assess how each is contributing to the quality. Consideration should be given to setting up areas of turf where different operational regimes and levels of inputs can be compared. Monitoring should take place over as long a time as possible and the learner should be encouraged to experiment with different mowing practices, frequencies, heights-of-cut, adjustment and setting up of equipment. Note should be made of the effects of sharp and blunt blades on mowers upon the quality of the turf.

Topic 3.1

Learners will monitor a range of operations: mowing, line marking, aeration, scarification, topdressing, rolling, turfing, seeding, irrigation, brushing/switching, fertilising and marking out to assess their impact on the overall quality of the cricket surfaces and evaluate how each is contributing to the overall quality.

Topic 3.2

Learners will monitor and evaluate material inputs: eg topdressing, seed, turf, water, fertiliser, labour, finance and determine how each is contributing to the quality of the surface.

Topic 3.3

Learners will collect a range of PQS data:

- structural: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, rootzone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational: eg appearance, visibility and width of markings, surface debris, and sward colour
- playing: eg vertical ball bounce, traction, ball roll, spin, hardness.

They will then use this to assess the suitability and impact of maintenance operations on the desired level of quality of the cricket surfaces, recommending changes in maintenance where necessary.

Learning outcome:

4. Understand the determination and maintenance of the level of quality of cricket surfaces

Topics

4.1 Using Performance Quality Standards (PQS) to assess the quality of a turf surface

4.2 Levels of quality for cricket surfaces

4.3 Material inputs and maintenance operations

The learner will need to practise using PQS to aid understanding and will need access to current sources of information.

Topic 4.1

Learner will understand the advantages and disadvantages of using Performance Quality Standards (PQS) to assess the quality of cricket surfaces.

The learner will understand that this data is used to inform management decisions, determine maintenance requirement accurately, justify the purchase of equipment/resources, allow effective use of inputs, reduce wastage and determine the carrying capacity of the turf.

Topic 4.2

Learners will understand the different levels of quality, basic, standard and high, for cricket surfaces and decide which is acceptable. They will ensure they consider the 3 areas of performance quality assessment when making this decision:

- structural: determines playing quality and impacts on presentational quality eg total ground cover, bare areas, desirable grass species, length of herbage, weeds, moss, algae and lichen, root depth, thatch, rootzone medium, evenness, gradient, pests, diseases, infiltration rate
- presentational: eg appearance, visibility of and width of markings, surface debris, and sward colour
- playing: eg vertical ball bounce, traction, ball roll, spin, hardness.

Topic 4.3

Learners will understand the purposes of reviewing material inputs and maintenance operations to obtain maximum use from the surface. They will need to ensure efficient use of available resources and that operations are effective to maximise the potential of the turf surface. They will also consider minimal waste and environmental impacts.

Guidance for delivery

The learner will be able to develop the skills and knowledge involved in the management of turf surfaces for cricket to a stated level of quality. They will be able to apply the principles of sustainable turf management and collect data using Performance Quality Standards (PQS) to assess the level of quality of the surface. The learner should be able to select and safely use appropriate machines,

equipment and materials for these tasks. The unit should cover as wide a range of activities as possible, appropriate to the cricket grounds available to the learner.

The unit may be delivered by a wide range of techniques, including lectures, supervised practical work, discussions, site visits and research. The learner will require access to specialised literature and other resources. The delivery of this unit may be integrated with the delivery of other units where this is feasible. Current and topical issues regarding turf management should be highlighted as and when they arise.

Suggested learning resources

Books

Adams W.A., Gibbs R.J.1993. *Natural Turf for Sport and Amenity*. Oxford: CAB International. ISBN 0851987206.

Brown S. 2005. *Sports Turf and Amenity Grassland Management*. Wiltshire: The Crowood Press. ISBN 1861267908.

Brown S. 2009. *Sports Ground Management: A Complete Guide*. Wiltshire: The Crowood Press. ISBN 184797094X.

Evans R.D.C. 1991. *Cricket Grounds: The Evolution, Maintenance and Construction of Natural Turf Cricket Tables and Outfields*. Yorkshire: The Sports Turf Research Institute. ISBN 1873431007.

Sachs P. 2004. *Managing Healthy Sports Fields*. Sussex: Wiley Publishing. ISBN 0471472697.

Tainton N & Klug J (2002). *The Cricket Pitch and its Outfield*. Kwazulu-Natal: University of KwaZulu-Natal Press. ISBN 0869809849

Turgeon A.J. 2009. *Turfgrass Management*. 8th ed. Harlow: Pearson Education. ISBN 0131140000

Websites

www.iog.org

The Institute of Groundsmanship

www.ecb.co.uk

The English Cricket Board

Unit 330

Construct and maintain decorative landscape features

UAN:	T/507/4700
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to enable learner to develop the skills and knowledge to construct and maintain specialist landscape features including rock and alpine features, ponds and water features and climbing and wall plants. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learning outcomes

In this unit, learners will be able to:

1. Understand the construction of rock and alpine features
2. Understand the construction and maintenance of ponds and water features
3. Demonstrate the construction and maintenance of rock and water features
4. Demonstrate the establishment and maintenance of climbing and wall plants

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the construction of rock and alpine features

Topics

- 1.1 Design principles of rock garden features
- 1.2 Rock selection for rock garden features
- 1.3 Problems associated with rock garden construction
- 1.4 Growing media and mulches for rock garden features
- 1.5 Plants suitable for rock gardens

Topic 1.1

Learners will understand the importance of an appreciation of rock for the successful design of rock garden features.

Learners will know natural rock environments and the geological contexts that rock garden features relate to.

Learners will understand the needs of rock garden and alpine plants and apply this knowledge to the design of rock garden features. They will consider:

- rock garden features: rockery, screes and moraines, limestone pavement, alpine sinks/troughs, gullies and cascades
- siting of a rock garden: aspect, lack of shade, scale and location, flat and sloping sites
- placement of rocks: start at base and work upwards, lines of strata, setting key stones, standing rocks and erratic.

Topic 1.2

Learners will know the characteristics of rocks suitable for use in rock garden features to include

- types of rock: sedimentary, igneous, metamorphic, artificial (hypertufa)
- rock characteristics: strata, durability, pH, aesthetic value, cost.

Topic 1.3

Learners will understand a range of problems commonly associated with the construction of rock garden features, to include:

- impacts of rock use: environmental impact (quarrying, habitat loss and creation), transportation costs, access routes, safe handling
- design, construction and maintenance problems: invasive weeds and difficulty to eradicate within rock garden features, erosion, shading, poor drainage.

Topic 1.4

Learners will understand the characteristics and constituents of suitable growing media and mulches for use in a range of rock garden features

- rock garden features: rockery, screes and moraines, alpine sinks/troughs

- constituents: stone chip, gravel, grit, sharp sand, peat, leaf mould, loam
- characteristics: drainage, water retention, nutrients, winter protection, weed control

Topic 1.5

Learners will know a range of plants suitable for rock gardens, to include: woody perennials, bulbs, herbaceous perennials.

Learning outcome:

2. Understand the construction and maintenance of ponds and water features

Topics

- 2.1 Design principles of ponds
- 2.2 Construction of ponds
- 2.3 Selection and installation of pumps, fountains and cascades
- 2.4 Maintenance of water features
- 2.5 Plants suitable for water features

Topic 2.1

Learners understand a range of pond styles and uses of ponds in gardens and evaluate their siting. Learners will know the factors that determine pond designs to ensure their success for the intended use, to include:

- styles and uses of ponds: formal, informal ponds, wildlife ponds, pond suitable for fish
- siting of ponds: aesthetic design considerations, surrounding vegetation, tree debris, aspect and shade, terrain and dangers of runoff, pollution and flooding
- design considerations: balanced ecosystem for aquatic plants and animals, needs of ornamental fish, needs of amphibians, provision of planting shelves, surface area in relation to depth and volume, specific heat capacity of water- overheating and freezing, oxygen levels, nutrient levels and eutrophication

Topic 2.2

Learners will understand the advantages and disadvantages associated with types of pond construction materials. For each material learners will know the most appropriate construction methods. They will consider

- types of pond construction materials: rigid fibre-glass/plastic, butyl rubber/UV stabilised PVC, concrete, puddle and bentonite clay
- associated considerations: cost, durability, aesthetic value, access routes and transportation
- construction methods: tools and equipment, health and safety, excavation of the hole, establishing a level, underlining the hole, installation of pond liner, filling with water.

Topic 2.3

Learners will know a range of alternative water features and evaluate their use. Learners will understand the installation of pumps used to support these features, to include

- alternative features: fountains and cascades
- installation of pumps: health and safety considerations, types and selection (submersible, external, solar), power, flow rates, positioning, filters, pipe-work, electrical requirements.

Topic 2.4

Learners will know the problems commonly associated with the upkeep of ponds and water features and suggest solutions. Learners will understand the maintenance of a pond and associated planting to include:

- problems: filamentous algae, green water, maintaining water levels, ice, , build up of debris, predators, lack of oxygen, build-up of nutrients and toxic gases
- maintenance: removal of debris, division, re-potting and cutting back of aquatic plants, pump maintenance.

Topic 2.5

Learners will know a range of plants suitable for water features, including: oxygenators, floating leaved deep water aquatics, marginal and bog plants.

Learning outcome:

3. Construct and maintain rock and water features

Topics

- 3.1 Construct rock garden features
- 3.2 Install a water feature
- 3.3 Maintain rock garden and water features and plants

Safe handling of materials and safe construction practices should be used at all times.

Topic 3.1

Learners will construct rock garden features using appropriate materials.

Learners will demonstrate an awareness of the suitability and function of the materials used and design appreciation in the layout and positioning of rocks.

Learners will select, position and plant suitable plants in the features constructed, eg

- rock garden features: rockery, scree bed, limestone pavement, alpine sinks/troughs
- design appreciation: arrangement of rocks, pattern, alignment, strata, keystones, formation of planting pockets, aspect, size of rocks.

Topic 3.2

Learners will install a water feature using appropriate materials. This may include installation of a pump, as in a pebble fountain, but does not include connection to the electricity supply. Learners will demonstrate an awareness of the suitability and function of the materials used. Installation of the feature must include finishing the edges and surrounding landscape. Learners will also plant water plants in a water feature.

- Water features: pre formed pond, flexible liner pond, bubble fountains and drilled rock features
- Planting: floating leaved deep water aquatics, marginals, bog plants, potting up into pond baskets and placing into the pond, direct planting into planting pockets, planting of bog plants beside water feature or in bog garden.

Topic 3.3

Learners will maintain an established rock garden and water feature. Learners will demonstrate the following

- rock garden maintenance: weed control, topping up mulch organic/inorganic, division, cutting back growth
- water feature maintenance: division of aquatic plants, removal of leaves and debris, algae control.

Learning outcome:

4. Establish and maintain climbing and wall plants

Topics

- 4.1 Select climbers and wall plants
- 4.2 Support systems for climbers and wall shrubs
- 4.3 Maintain wall shrubs and climbers
- 4.4 Maintain support systems

Learners must understand how climbing plants support themselves and how support can be provided for climbers and wall-shrubs. The associated merits and limitations of various support systems should be investigated. Learners are expected to attach and train wall shrubs and climbers to support systems. A range of maintenance tasks associated with climbers and wall shrubs should also be carried out on established plants. Learners must comprehend the maintenance required to keep support systems in good order.

Topic 4.1

Learners will identify climbers and wall shrubs. The growth form and method of support, height and spread of the plants and soil and site requirements will be known for each.

- Growth form and method of support: wall shrubs-not self-supporting, climbers-self-supporting (twining, twining leaf petioles, tendrils, adventitious roots).

Topic 4.2

Learners will know the use and design considerations of features used for the support and display of climbers and wall shrubs, to include:

- support features: pergolas, arches, arbours, trellis, vine eyes and wire, scrambling through other plants
- design considerations: materials used, aesthetics, durability, maintenance requirements

Topic 4.3

Learners will carry out a range of maintenance tasks associated with the upkeep of climbing plants and wall shrubs using safe methods and practices. Learners will prune a wall shrub and attach growth to a support system. The maintenance required will vary depending on the plants selected, season and situation.

- Methods of attachment: string, wire
- Support systems; vine eyes, wire, trellis, pergola and arches, wall nails
- Maintenance tasks: pruning, , tying into support.

Topic 4.4

Learners will inspect and stipulate the necessary maintenance required to maintain support systems.

- Inspection: annual and long-term maintenance, including repair and renovation

Guidance for delivery

This unit is designed to equip learners with the knowledge and skills required to construct and renovate specialist landscape features including rock gardens and alpine features, ponds and structures for climbers and wall shrubs. It includes the installation of the feature, the planting and the maintenance.

The unit may be delivered by a wide range of techniques, including lectures, video or DVD, supervised practical work, discussions, site visits and research. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities and learners should not be asked to undertake physical tasks beyond their physical capabilities. The identification of hard and soft landscaping materials is an essential part of this unit.

Suggested learning resources

Books

- Adams, C.R., Early, M.P. 2004. Principles of Horticulture . Oxford: Butterworth-Heinemann.
- Brickell, C., Joyce, D. 2006. RHS Pruning and Training. Essex: Dorling Kindersley Publishers.
- Hillier Nurseries. 1998. The Hillier Manual of Trees and Shrubs. 7th ed. Devon: David and Charles.
- Brickell, C. 2007. The RHS Encyclopaedia of Gardening. Essex: Dorling Kindersley Publishers.
- Buczacki, S. 1995. Best Water Plants. London: Hamlyn.

Websites

www.rhs.org.uk

The Royal Horticultural Society

Unit 331

Site surveying, levelling and setting out

UAN:	A/507/4701
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to undertake site surveying, levelling and setting out and how these can be applied in practice. The learner will be able to develop the skills and knowledge to survey a site for dimensions and level, using a range of techniques and to present the data in an appropriate format. Learners will also be able to set out geometric and irregular shapes and levels from a plan. This unit relates to the work of landscape designers and constructors, parks and gardens staff, nurseries and garden centres.

Learning outcomes

In this unit, learners will be able to:

1. Understand site survey equipment and techniques
2. Measure site dimensions and levels
3. Understand the presentation of survey data
4. Set out on the ground from plans, including shapes and levels

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand site survey equipment and techniques

Topics

- 1.1 Safe use and maintenance of surveying equipment
- 1.2 Principles and processes of surveying techniques

Topic 1.1

Learners will know the range of surveying equipment and their required maintenance, including ranging rods/poles, tapes, compass, optical equipment, height measuring devices and electronic measuring devices, Global Positioning Systems (GPS), optical or laser levels and theodolites of various types and associated equipment.

Topic 1.2

Learners will understand the principles of surveying for a range of situations and how they may be used in practice, to include:

- linear measurement
- right angles
- bearing and offsets
- triangulation and trigonometry
- traverse and radial surveys
- sloping ground
- adjustments,
- vertical angles
- height measuring,
- levelling and contour surveys
- optical measuring
- GPS grid referencing and altitude location
- total stations
- maps, plans, IT based maps and other information sources.

Learners will also understand the process of surveying techniques and the importance of reconnaissance, observation, measurement, recording presentation, booking systems and symbols, site problems, obstacles and solutions, sources of error, adjustments and degrees of accuracy, selection of the most appropriate system for given site conditions

Learning outcome

2. Measure site dimensions and levels

Topics

- 2.1 Use a range of survey equipment safely
- 2.2 Record and collate site readings

2.3 Present survey data in an appropriate format

In this outcome the learner must be able to demonstrate their ability to accurately measure the dimensions and levels of specified sites. They should be provided with a range of survey equipment to use in order to develop their awareness, familiarity and all round skill levels. They will need to develop an understanding of the benefits and limitations of tools/equipment used. Learners must accurately record and collate the site readings and then present the survey data using an appropriate and conventional format. This can be accomplished by delivering the outcome around a single specified site, so that project progression may be recognised.

Topic 1.1

Learners will use survey equipment, covering safe site operations and behaviour and risk assessment. A sensible datum should be chosen. The equipment may include ranging rods/poles, tapes, compass, optical equipment, height measuring devices and electronic measuring devices, Global Positioning Systems (GPS), Geographical Information Systems (GIS), optical or laser levels and theodolites of various types and associated equipment.

Topic 1.2

Learners will undertake a site survey and take appropriate readings.

Topic 1.3

Learners will use survey data to produce base and location plans, indicating contour or falls if appropriate, showing illustrations and section views for specified sites using standard conventions.

Learning outcome:

3. Understand the presentation of survey data

Topics

- 3.1 Purpose and application of different survey types, metric scales, units of measurement, grid references and bearings
- 3.2 process of laying out, plotting and drafting survey drawings from field data

Learners should also be able to review the use of specified drafting systems of plotting surveys. Where facilities in centres are limited, site visits will be helpful and internet research will be particularly useful for information about the more recent introductions. Learners will require access to drafting materials for this unit.

Topic 3.1

Learners will understand the purpose and application of types of survey plan, use of metric scale and units of measurement, bearings and grid references.

Topic 3.2

Learners will understand the processes for laying out, plotting and drafting including standard techniques, standard conventions, symbols and signs, lettering symbols, position, size and style, title blocks and labelling, orientation and types of north, radial and trigonometric methods of plotting, terminology. Learners will also understand how to calculate levels and interpolate contours onto survey plans and how to calculate true scale, reduce error, make adjustments and

the importance of accuracy. Learners will understand that survey drawings could be produced manually or using Computer Aided Design (CAD)

Learning outcome

4. Set out on the ground from plans, including shapes and levels

Topics

- 4.1 Mark out sites from plans
- 4.2 Mark out shapes
- 4.3 Set out levels and falls

Topic 4.1

Learners will mark out sites from plans of different scales, so that they become familiar with the process of conversion, the position of structures, features and plants. They will use suitable equipment.

Topic 4.2

Learners will mark out accurate right angles and mark out rectangles, circles, hexagons, ellipses and irregular shapes to the correct dimensions. The learner will be familiar with setting out processes in constructing right angle by intersecting arcs and by Pythagoras' theorem (3, 4, 5 triangle).

Topic 4.3

Learners will identify datum point and set out levels and falls using scaled plans ensuring specified orientation, setting out line to given length, establishing level(s) to given parameters.

Guidance for delivery

This unit is designed to equip the learner with the skills and knowledge required to collect, record and collate site survey data and to produce a site plan. It also covers setting out of borders, features structures and plants from data on a scaled plan. As such it can be applied to most horticultural situations, including landscape designers and constructors, parks and gardens staff and nurseries and garden centres.

The unit may be delivered by using a wide range of techniques, including lectures, video or DVD, supervised practical work, site visits and research. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities. When carrying out a survey, learners must ensure keeping field books neat and clear, sketch plans to record dimensions and the position of existing features and plants should be large enough to avoid confusion/ambiguity, and standard conventions for recording rise and fall should be used for recording levels.

Suggested learning resources

Books

Bhavikatti, S.S. 2008. Surveying and Levelling. New Delhi: I K International.

Knight, B.H., Brend, H.J. 1968. Surveying and Levelling for Students. 4th ed. Glasgow: Maclaren and Sons.

Subramanian, R. 2008. Surveying and Levelling (Oxford Higher Education). New Delhi: OUP India.

Tate, T. 2008. Principles of Geometry, Mensuration, Trigonometry, Land Surveying and Levelling. Charleston: Bibliobazaar.

Unit 332

Historical influences on the development of gardens

UAN:	F/507/4702
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is for learners to develop the skills and knowledge to appreciate the historical influences on plants and gardens and their development through history. They will apply this knowledge to garden design plans.

Learning outcomes

In this unit, learners will be able to:

1. Understand the styles of gardens through history
2. Use knowledge of garden history to produce contemporary designs
3. Understand British gardens
4. Understand the introduction of plants into the UK

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the styles of gardens through history

Topics

- 1.1 Development of landscape and garden styles through time
- 1.2 Influential landscape and garden designers
- 1.3 Influences on the developments of landscape and garden design

Topic 1.1

Learners will know the styles and the associated built and soft landscape features of the following gardens: early civilisations (Egyptian, Roman), Chinese and Japanese, Hispanic and Arabic, Italian, French, New world, British.

Learners will understand how garden styles developed through time.

Topic 1.2

Learners will know the characteristics of the work of Sir Francis Bacon, Andre Le Notre, Charles Bridgeman, London and Wise, William Kent, Lancelot (Capability) Brown, Humphry Repton, John Claudius Loudon, Joseph Paxton, William Robinson, Gertrude Jekyll and Edwyn Lutyens, Beatrix Farrand, 'Vita' Sackville West, Sir Geoffrey Jellicoe, Roberto Burle Marx, Rosemary Verey, John Brooks.

Topic 1.3

Learners will understand the timeline of influences of art, architecture, social context and philosophies, faiths and religions, scientific understanding and new plant introductions on gardens.

Learning outcome:

2. Use knowledge of garden history to produce contemporary designs

Topics

- 2.1 Produce garden design proposals that evoke the spirit of historical styles

Learners do not need to produce scale drawings but their plans should be clear and presented in an appropriate format.

Topic 2.1

Learners will incorporate historical styles into garden design proposals. They will consider design principles/concepts including balance and symmetry, repetition, proportion, focal points, views and borrowed landscape. They will include appropriate built and soft landscape features, and consider plant and feature maintenance. The proposed garden ideas must be clearly conveyed.

Learning outcome:

3. Understand British gardens

Topics

- 3.1 The main gardens of historic interest in the UK
- 3.2 The influences of the major 20th century design movements on British gardens
- 3.3 The influences of the media, garden shows, art and sculpture on contemporary garden design

Topic 3.1

Learners will know a range of historically significant gardens, parks and botanical collections within the UK. They will know the range of plants used and the ways in which plants have been displayed.

Topic 3.2

Learners will understand influences of the major 20th century design movements, to include arts and crafts movement, modernism, post-modernism.

Topic 3.3

Learners will understand the influences of TV and printed media, garden shows, art and sculpture on contemporary garden design. Consideration must be given to popularity, styles, trends, traditions, plant hybridisation, plants and plant usage, hard landscape features/materials, costs, gardening aids, tools/equipment/machinery.

Learning outcome:

4. Understand the introduction of plants into the UK

Topics

- 4.1 The work of the influential plant hunters
- 4.2 The plants collected from the main regions of the world
- 4.3 The contemporary roles of plant collections, herbaria, plant botanists and their work in biodiversity and environmental issues

Topic 4.1

Learners will know the work of:

- John Tradescant (senior and junior)
- Sir Joseph Banks
- Francis Masson
- David Douglas
- William Lobb
- Robert Fortune
- Sir Joseph Hooker
- Ernest Wilson
- George Forrest
- Frank Kingdon-Ward.

Topic 4.2

Learners will know significant plants collected from:

- Asia, including China and Japan

- Australia and New Zealand
- Africa
- North and South Americas
- Europe and Mediterranean regions.

Topic 4.3

Learners will understand the numerous and varied contemporary roles of:

- plant collections
- herbaria
- plant illustrations
- botanists in biodiversity
- the environmental issues of the day.

Learners will know plant and garden conservation (historical and botanical), bio-diversity, protection of endangered species, Millennium seed-bank, sources of energy (biomass), carbon dioxide extraction, medicinal uses, construction materials, prevention of soil erosion, food

Guidance for delivery

This unit is designed to enable the learner to develop the skills and knowledge required to appreciate historical influences on garden design, on the introduction of cultivated plants and to research the history of parks and gardens. This knowledge may then be applied to the development of appropriate designs for a variety of situations and to the sympathetic restoration of historical sites.

The unit may be delivered by a wide range of techniques, including lectures, video or DVD, discussions, and research. Site visits will be of significant help to the learners, particularly after initial work in the centre. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues, including impact and the disposal of debris.

The content of the unit lends itself to undertaking off site visits to gardens and parks of note within the local area, thus enabling the learner to better appreciate and visualise design styles, features, plants and plantings covered during the formal lessons back at the centre. It is important that those seeking employment in this sector should have an appreciation of historic garden styles and their influence on the British garden landscapes, in order to be better placed to select the appropriate maintenance and management strategies required. Lessons at the centre should utilise a 'pictorial' delivery style to create and maintain interest in a very visual topic. Learners will require access to suitable library facilities and the Internet for research.

Suggested learning resources

Books

- Bisgrove, R. 1992. *The National Trust Book of the English Garden*. London: Penguin Books.
- Brown, J. 1999. *The English Garden through the 20th Century*. Suffolk: Garden Art press.
- Campbell-Culver, M. 2001. *The Origin of Plants*. London: Headline Book Publishing.
- Fleming, L., Gore, A. 1988. *The English Garden*. New Orleans: Spring Books.
- Hessayon, D.G. 1986. *The Armchair book of the Garden*. Andover: Expert Publishing.
- Landsberg, S. 1998. *The Medieval Garden*. London: British Museum Press.
- Lyte, C. 1983. *The Plant Hunters*. London: Orbis Books.
- Titchmarsh, A. 2003. *Royal Gardeners*. London: BBC Books.

Unit 333

Computer-aided design in horticulture

UAN:	J/507/4703
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit aims to provide learners with an understanding of how to undertake computer-aided design in the land based industries and how these can be put into practice. Learners will be able to develop the skills and knowledge to produce professionally presented computer generated plans for the land based industries. The learner will produce, edit, modify and print two-dimensional drawings. Learners will also research suitable packages for use within the land based industries and the hardware requirements necessary to operate them.

Learning outcomes

In this unit, learners will be able to:

1. Produce two-dimensional drawings using a Computer-Aided Design package
2. Modify and edit two-dimensional drawings using a Computer-Aided Design package
3. Understand the production and modification of two-dimensional drawings using a Computer-Aided Design package
4. Understand the usefulness of Computer-Aided Design (CAD) packages in the land based industries

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Produce two-dimensional drawings using a Computer-Aided Design package

Topics

- 1.1 Implement graphic illustrative techniques
- 1.2 Select appropriate graphic styles
- 1.3 Produce two-dimensional drawings
- 1.4 Produce hard copies of drawings

Topic 1.1

Learners will Implement graphic illustrative techniques incorporating conformity and consistency of selected shapes for 2-D display.

Topic 1.2

Learners will select appropriate graphic styles to include: line styles and types, hatching and patterns, to meet specification of contract, accuracy of information, presentation style and customer expectation.

Topic 1.3

Learners will produce a two-dimensional drawing to illustrate aspects at an appropriate scale for a site and based on a customer brief for a landscape or garden design.

Topic 1.4

Learners will produce hard copies of drawings using appropriate paper size to be selected for the contract site and scale to accurately represent the detail required

Learning outcome:

2. Modify and edit two-dimensional drawings using a Computer-Aided Design package

Topics

- 2.1 Modify two-dimensional drawings
- 2.2 Edit two-dimensional drawings

Topic 2.1

Learners will use a range of editing tools to significantly modify two-dimensional drawings to meet the revised needs of a client.

Topic 2.2

Learners will use the editing tools and processes to manipulate the scale, line styles, colour, layers, symbol and text sizes and fonts to develop a final presentation in different styles using the same initial measurements.

Learning outcome:

3. Understand the production and modification of two-dimensional drawings using a Computer-Aided Design package

Topics

- 3.1 Techniques and styles
- 3.2 Editing and manipulation
- 3.3 Use of drawing aids,
- 3.4 Techniques for plotting/printing plans

Topic 3.1

Learners will understand the techniques and styles available for use with drawings of a site, to include:

- Plan
- cross section
- elevation and constructional details suitable for a proposed landscape or garden design.

Topic 3.2

Learners will understand the use of drawing aids and efficiently use these tools within a Computer-Aided Design package, including grids, constraints and other tools to aid accuracy.

Topic 3.3

Learners will understand and undertake techniques for plotting/printing plans, a CAD presentation to be plotted/printed to three different sizes using different scales and paper sizes.

Learning outcome:

4. Understand the usefulness of Computer-Aided Design (CAD) packages in land based industries

Topics

- 4.1 Computer-Aided Design (CAD) software packages
- 4.2 Function of components of computer hardware
- 4.3 Benefits of CAD for presenting in a professional format
- 4.4 Health and safety implications of working on CAD

In this outcome learners will understand the important components of the computer which link directly into the ability to operate CAD systems efficiently. The health and safety implications of using the computer with a CAD system operating will be fully assessed and evaluated by the learner.

Topic 4.1

Learners will understand the use and suitability of a Computer-Aided Design software package for the land based industry to include the cost, flexibility, computer requirements, training requirements and presentational possibilities.

Topic 4.2

Learners will understand the function of components of computer hardware and relate the components of computer hardware to the requirements specifications of the final presentation and a computer operating system. Computer hardware to include:

- RAM
- ROM
- monitor types
- mouse types
- graphics tablets upgrades.

Topic 4.3

Learners will understand the benefits of CAD and explore its flexibility, ease of change/modifications to meet customer requirements, professional appearance and speed of operation. They will also understand how the CAD system may link with established data information sources such as GIS and GPS.

Topic 4.4

Learners will understand the health and safety requirements concerning computer use within the work place including

- the correct background lighting
- the correct adjustable seating and body posture
- hours of use in front of a monitor
- antiglare filters to avoid eyestrain
- tiltable monitors.

Guidance for delivery

This unit is designed to provide the Learner with a good understanding of using a computer with a modern operating system. Access to appropriate, current and industry specific drawing software is essential to deliver this unit together with the ability to print to a range of scales and paper sizes. Storage and backup of drawings must be catered for to support the production of an electronic or hard copy of the learner's portfolio of work.

Suggested learning resources

Books

Buitrago, J. 2008. *Computer Graphics for Landscape*. New York: Delmar.

Kalay, Y.E. 2004. *Architecture's New Media: Principles, Theories, and Methods of Computer-aided Design*. Cambridge (USA): MIT Press

Unit 334

Prepare landscape and garden design briefs

UAN:	L/507/4704
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit aims to provide learners with an understanding of how to prepare landscape and garden design briefs and how these can be applied in practice.

The learner will be able to develop the skills and knowledge to negotiate with the client, determine the client's needs and prepare a design brief, letter of engagement and design service. The learner will also learn how to assess the characteristics of sites, including site problems, and prepare a site evaluation and analysis report.

Learning outcomes

In this unit, learners will be able to:

1. Understand procedures to produce a fee bid and form of agreement
2. Prepare a fee bid and form of agreement to meet client's requirements
3. Understand site evaluation
4. Undertake site evaluation and analysis
5. Assess and evaluate landscape and garden site problems

Scope of contents

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand procedures to produce a fee bid and form of agreement

Topics

- 1.1 The range of techniques used to determine clients' requirements
- 1.2 The purpose and components of a garden designer's fee bid
- 1.3 The main components of a garden design contract,
- 1.4 The documentation to aid the process of producing a fee bid and form of agreement

Topic 1.1

Learners will know a range of techniques used to determine client's requirements including:

- Questionnaires
- Interviews
- site investigations
- site surveys
- site inventories
- functional requirements
- desk top
- archival and map research
- site opportunities
- constraints
- attractors and detractors.

Topic 1.2

Learners will understand the purpose and components of a garden designer's fee bid including:

- designer and company particulars
- client brief
- letter of confirmation
- methodology statements
- explanation of the designer's services
- charges
- fees and methods of payment
- presentational style.

Topic 1.3

Learners will know the main components of a garden design contract including arrangements for work. Main components of a contract include:

- details of interested parties
- description of the work to be done

- permissions
- consents and regulations approval
- availability and use of facilities
- price and full costs of the work
- payment details
- access
- guarantees
- insurances and indemnities
- working hours
- occupation
- security of the premises and disputes resolution.

Learners will also know contractual conditions, clauses and statements, including:

- designer's responsibilities
- customer's responsibilities
- health and safety requirements and expectations
- change to work/design details
- extending the working period
- payment details
- defects liability period
- bringing the contract to an end
- insolvency
- law of contract and other legal rights.

Topic 1.4

Learners will understand the use of promotional company leaflets when dealing with clients, benefits of letters and forms of agreement.

Learning outcome:

2. Prepare a fee bid and form of agreement to meet client's requirements

Topics

- 2.1 Produce a questionnaire and site summary checklist for use on site visits
- 2.2 Produce a client brief and letter of engagement
- 2.3 Produce a design service contract

In this outcome learners will need to accurately produce the various documentation necessary to:

- facilitate clarity in negotiations with the client
- determine the client's needs
- identify the opportunities and constraints of the site.

Learners will be able to produce

- a client questionnaire
- a site summary checklist to use on an actual or simulated site visit
- a brief

- a letter of engagement
- a design service contract that must include details and arrangements for the work.

Every opportunity to work on 'real' projects should be taken, so that learners acquire a thorough understanding of the processes, procedures and possible pitfalls relating to these tasks.

Topic 2.1

Learners will produce materials that are appropriate for use when visiting clients to record client's requirements and site data.

The client questionnaire to include

- client's details
- approximate garden size
- client's functional requirements
- client's personal preferences
- specific plants, materials, and features that are required or disliked,
- architectural details
- budget available and expected costs.

Site summary checklist to include

- climatic and topographical details
- plant health
- landscape structural defects
- site features
- changes in level
- site drainage and soil conditions including texture, structure, pH
- position of services
- access routes
- hazards
- ownership, boundary and neighbour issues
- legislative and planning issues.

Topic 2.2

Learners will produce a brief setting out client's requirements, and a letter of engagement listing services to be provided, deadlines to be met, costs/fees and payments, and conditions of the contract made clear.

Topic 2.3

Learners will produce a design service contract including arrangements for work. It must include names and addresses of all parties, description of the work, permissions and approvals, price/fee and full cost, payment details, access and working period, deadlines for completion, insurances and indemnities, disputes, dates and signatures.

Learning outcome:

3. Understand site evaluation

Topics

- 3.1 Field-based methods of measuring and recording site characteristics
- 3.2 Researching site and land classification characteristics
- 3.3 The purpose and procedure of an Environmental Impact Assessment.

Topic 3.1

Learners will understand field-based methods used to assess site details including

- location, topography, aspect, microclimate
- plant species and age, wildlife value, , dimensions and condition
- site uses and services
- soil texture, structure, depth, pH
- drainage and irrigation requirements
- sources of noise, dust and pollution.

Learners will also understand

- the purposes of a site evaluation.
- the methods used to analyse and present site characteristics in terms of positive and negative effects, attractors and detractors including written and graphic reports, a full site survey and photographic evidence.

Topic 3.2

Learners will understand methods of researching

- aesthetic features
- space, circulation and linkage
- boundaries, ownership, access, rights of way, legal and planning restrictions,
- historical, cultural, current land association and use
- geographic and architectural associations
- tree preservation orders and local planning laws.

Topic 3.3

Learners will understand the purpose and procedure for an Environmental Impact Assessment and when it is appropriate for this to be undertaken.

Environmental Impact Assessment (EIA):

- an assessment of possible impact could be positive and/or negative.
- Consideration given to natural, social and economic aspects of a project.
- Procedure to ensure that environmental consequences of proposed works are identified and assessed and may involve public consultation.

To note for large projects: The EIA Directive (EU legislation) introduced in 1985 and amended in 1997

Learning outcome:

4. Undertake site evaluation and analysis

Topics

- 4.1 Interpret the characteristics of a site
- 4.2 Produce site evaluation and analysis reports including graphic and written formats

Topic 4.1

Learners will identify and interpret physical, biological, cultural, environmental and edaphic characteristics of a site, including

- location, topography, aspect, climate and microclimate
- plant species, diversity, wildlife value, age class, dimensions and health
- site uses and services
- soil texture, structure, depth, pH nutrient status
- drainage and irrigation requirement
- sources of noise, dust and pollution.

Topic 4.2

Learners will produce site evaluation and analysis reports that are sufficiently detailed to facilitate future work on the site. They will contain detail in graphic and written formats, eg plans/ maps/ charts/photographs/images which will be annotated.

Learning outcome:

5. Assess and evaluate landscape and garden site problems

Topics

- 5.1 Assess the causes of failure in hard and soft landscape features
- 5.2 Evaluate the causes of aesthetic problems and a range of possible solutions
- 5.3 Evaluate the causes of site-based environmental problems and a range of possible solutions.

Topic 5.1

Learners will assess the causes of failure in hard and soft landscape features which may include:

- sub-grade failure
- incorrect construction/maintenance techniques
- poor or incorrect initial choice of materials
- change of use
- change of environmental conditions
- adverse weather conditions
- pest and disease problems
- nutrition problems, unsuitable plant selection for prevailing conditions
- incorrect planting
- spacing
- establishment and/or maintenance techniques
- damage from trees
- change of ownership
- no longer suitable.

Topic 5.2

Learners will evaluate the causes of aesthetic problems, which may include:

- issues beyond the site boundaries including near and distant unpleasant/unsightly view(s)
- neighbouring boundaries
- internal issues including utility areas, services, boundary structure and access points

- architectural issues including the building style, fittings and decoration, garages, greenhouses, sheds and outhouses
- lack of unity
- compatibility
- scale and proportion
- colour
- texture
- harmony
- balance
- symmetry/asymmetry
- form
- shape
- space
- enclosure
- movement
- rhythm
- focal points
- conformity in soft and hard landscape features.

Learners will explore a range of solutions.

Topic 5.3

Learners will evaluate the causes of site-based environmental problems which may include:

- drainage issues
- irrigation requirements
- microclimatic conditions
- soil based problems
- pollution based problems
- previous land use
- cultural issues such as vandalism, overuse, excessive wear and tear
- hostile environments such as coastal, urban and road side areas, poor wildlife value.

Learners will explore a range of solutions.

Guidance for delivery

This unit is designed to equip the learner with the skills to negotiate with the client, determine the client's need and to prepare a brief, letter of engagement and design service contract. The learner will also develop the skills to assess the characteristics of sites, produce a site evaluation and analysis report and obtain all the information required to be able to specify work.

Wherever possible a range of 'real' sites and projects should be used to enable the learner sufficient practice and to experience a wide range of sites displaying different characteristics. This experience will help the learner to develop a thorough understanding of the processes, procedures and possible pitfalls relating to these tasks and a deeper understanding of the opportunities and constraints relating to specific sites.

The unit may be delivered by a wide range of techniques, including lectures, video or DVD, supervised practical work, discussions, site visits and research. The delivery of this unit may be integrated with the delivery of other units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities.

Suggested learning resources

Books

- Alexander, R. 2009. *The essential garden design workbook*. 2nd ed. Portland: Timber Press.
- Bertauski, T. 2006. *Plan graphics for the landscape designer*. 2nd ed. Harlow: Pearson Education.
- Clamp, H. 1986. *Spon's Landscape Contract Manual: A Guide to Good Practice and Procedures in the Management of Landscape Contracts*. London: Spon Press.
- Derek Lovejoy Partnership. 1997. *Spon's Landscape Handbook*. Oxford: Taylor and Francis.
- Lin, M. 1993. *Drawing and designing with confidence, a step by step guide*. New York: Van Nostrand Reinhold International.
- Reid, G.W. 2002. *Landscape Graphics*. 2nd ed. New York: Watson-Guption Publications.
- Reid, G.W. 2007. *From concept to form in landscape design*. 2nd ed. Oxford: Wiley Publishing.
- Lauer, D., Pentak, S. 1994. *Design basics*. 4th ed. Andover: Thompson Learning.

Websites

- | | |
|--|--|
| Association of Professional Landscapers (APL) | www.landscaper.org.uk |
| BALI - British Association of Landscape Industries | www.bali.co.uk |
| Society of Garden Designers | www.sgd.org.uk |

Unit 335

Specification, programming and monitoring of landscape projects

UAN:	R/507/4705
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to undertake specification, programming and monitoring of landscape projects and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

The learner will be able to develop the skills and knowledge required by those working with landscape contracts and can be assessed in the context of landscape works or landscape maintenance. It includes the preparation of landscape specifications for proposed projects and estimating and costing projects. The interpretation of contracts, managing contracts and monitoring contracts against specification are also covered.

Learning outcomes

In this unit, learners will be able to:

1. Prepare bill of quantities and estimate landscape quantities
2. Understand the estimation of costs for landscape projects
3. Monitor landscape projects

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Prepare bill of quantities and estimate landscape quantities

Topics

- 1.1 Collect and collate information for a bill of quantities
- 1.2 Produce specifications
- 1.3 Estimate quantities for hard and soft landscape works

In this outcome learners will develop skills and knowledge in specifying landscape projects. Demonstrating their ability to prepare a written landscape specification and estimate costs for the specified project, the specifications must be deemed practical and workable, inclusive of the estimation of resources/materials required. This will include the identification and use of the correct formulae for such calculations. Learners must also produce clear and concise specification clauses using appropriate terminology for the maintenance or construction of work carried out for a specified project. Learners should study a range of projects in order to practice and develop the required level of skill and understanding of the techniques and data involved.

Topic 1.1

Learners will collect and collate information required to set out a Bill of Quantities for ground works, hard landscape construction, soft landscape installation using a range of information sources.

Topic 1.2

Learners will produce specification for ground works including hard and soft landscape installation. Learners will specify

- materials, such as: aggregates, concrete, mortar, stone, soils, composts, mulches and top dressings, paving and walling units
- coverage rate per square metre of materials to include aggregates, paving and walling units, concrete, mortar, soils, composts, mulches and top-dressings,
- minimum distances for planting trees from buildings and services
- minimum gradients for pedestrian surfaces, storm water and landscape drains and angle of repose for loose soils and materials
- minimum depths of services and types of indicator warning tape
- irrigation, drainage and water pump dimensions, requirements and calculations for garden and landscape features
- timber sizes, treatment and species
- brick and block dimensions, standard mixes, ingredients and calculations for various built surfaces and structures according to use and soil type and their limitations.

Topic 1.3

Learners will use correct formulae and standard units required for calculating landscape resources within a the Bill of Quantities (construction materials, labour, soils, plants, seed, and other consumables), areas and volumes (regular and irregular shapes).

Learners will consider statutory requirements and relevant legislation affecting landscape operations when producing the specifications.

Learning outcome:

2. Understand the estimation of costs for landscape projects

Topics

- 2.1 Procedures for calculating costs
- 2.2 Sources of supply and where to obtain quotations, competitive prices and estimates
- 2.3 Produce Bills of Quantity for materials, construction and resource estimates

Learners may work with actual or simulated projects, but tutors should make these as real as possible to aid understanding.

Topic 2.1

Learners will understand the procedures relating to measured work:

- prime cost sum
- allowances
- labour rate.

They will also consider the non-work items such as:

- Preliminaries
- Overheads
- Profit
- Discounts
- Adjustments
- inflation
- depreciation
- VAT.

Learners will also understand the process for determining a rate by using published pricing schedules, working up a rate, computer based techniques to produce, cost and quote for landscape work.

Learners will understand how to present costs, including schedules, fee bid and letter, form of tender and quotation.

Topic 2.2

Learners will know a range of sources of published estimating data for both manual and mechanical work including:

- turf work, establishment and maintenance
- hard landscape construction, (walling and paving)
- border maintenance
- planting and establishment of soft landscapes
- hedge maintenance
- fence construction

- path and edging maintenance
- groundworks.

Topic 2.3

- Learners will produce Bills of Quantity to include:
- hard and soft materials
- machinery
- labour
- time requirements
- taking off measurements
- squaring dimensions and calculating quantities
- abstracting
- writing a bill.

Learning outcome:

3. Monitor landscape projects

Topics

- 3.1 Processes to review a landscape project
- 3.2 Monitor landscape operations

In this outcome learners will develop their skills and knowledge of monitoring landscape projects. Learners must identify and use efficient systems in order to plan and prepare a sequence of operations for a specified landscape project using contract data. They must carry out an assessment to ensure that landscape construction or maintenance work meets the agreed standard and then monitor the progress/operations of a project to ensure work is carried out in an appropriate and safe manner. Projects should be as near to real work situations as possible.

Topic 3.1

Learners will understand the processes to review a landscape project to ensure work is carried out in an appropriate and safe manner, ensuring quality and to established deadlines.

Topic 3.1

Learners will monitor landscape operations against specifications, at appropriate frequencies and durations, ensuring that the project is adhering to legislation, risk assessments and environmental impact assessments.

Guidance for delivery

This unit is designed to equip the learner with the skills and knowledge required by those working with landscape contracts and can be assessed in the context of landscape works or landscape maintenance. It includes the preparation of landscape specifications for proposed projects and estimating and costing projects. The interpretation and monitoring of contracts against specification is also included.

The unit may be delivered by a wide range of techniques, including lectures video or DVD, supervised practical work, discussions, site visits and research. Learners will require access to specialised literature and other resources. The delivery of this unit may be integrated with the delivery of other

units where this is feasible. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities.

Suggested learning resources

Books

- Chadwick, R.M. 1990. Spon's Grounds Maintenance Contract Handbook. London: Taylor and Francis.
- Langdon, D. 2009. Spon's External Works and Landscape Price Book 2010. London: Taylor and Francis.
- Clamp, H. 1986. Spon's Landscape Contract Manual: A Guide to Good Practice and Procedures in the Management of Landscape Contracts. London: Spon Press.
- Cobham, R. 1990. Amenity Landscape Management: A Resources Handbook. London: Routledge.
- Derek Lovejoy Partnership. 1997. Spon's Landscape Handbook. London: Taylor and Francis.

Unit 336

Establish and manage interior plant displays

UAN:	D/507/4707
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to enable learner to develop the skills and knowledge to plan and establish interior plant displays, in a range of temporary and permanent situations, and manage the plant displays to ensure continued healthy development.

This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learning outcomes

In this unit, learners will be able to:

1. Understand the establishment and management of interior plant displays
2. Understand the identification and control of pests and diseases of interior plant displays
3. Establish and manage plants in a permanent indoor setting
4. Establish and maintain temporary interior plant displays

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome

1. Understand the establishment and management of interior plant displays

Topics

1.1 Mulches and growing media for interior displays

1.2 Environmental factors and the interior environment

1.3 Maintenance of plants in interior displays

1.4 Irrigation and feeding of interior displays

Topic 1.1

Learners will understand the relationship between plant health, environmental factors and the interior environment to include

- environmental factors: light (intensity, quality and duration, direct and diffuse light, aspect), temperature range and fluctuations, air movement, humidity,
- problems associated with human use of the environment: litter, dust, plant damage and theft, pollution, site compaction, artificial lighting, draughts, heating and ventilation systems
- interior environments: purpose built display glasshouse (alpine house), conservatories, office buildings (atria and offices), shopping centres, leisure centres, marquee and restaurant
- monitoring and controlling the growing environment: computerised environmental controls, measuring instruments, light meters, pH and nutrient test kits, thermometers, hygrometers.

Topic 1.2

Learners will know the range of mulches and growing media commonly used in the interior plant display industry to include:

- mulches such as bark, cocoa shells, gravels
- growing media such as soil-based, peat-based, peat alternative, hydroponics systems.

Topic 1.3

Learners know the maintenance needs commonly associated with the upkeep of a range of interior plant displays. Learners will understand the importance of individual plant species requirement and the impact of seasonality and growth to include:

- categories of interior plant display; alpine, tropical/sub-tropical, temperate, cacti and succulents, permanent, temporary
- maintenance needs; thinning, dead-heading, pruning/stopping/pinching (shaping, removal of dead, dying, diseased, weak growth), trimming, training, tying-in, support, misting, feeding, irrigation, plant replacement.

Topic 1.4

Learners will understand the suitability of different irrigation and feeding methods commonly used for the upkeep of a range interior plant displays to include:

- irrigation and feeding methods; hand watering, automatic surface/sub-surface irrigation, automatic overhead irrigation and misting, hydroponics, top-dressings, liquid feeding

- problems associated with irrigation and feeding; lime scale, conductivity and pH imbalances, disease spread, leaching, health and safety

Learning outcome:

2. Understand the identification and control of pests and diseases of interior plant displays

Topics

2.1 Pests and pest control of interior plant displays

2.2 Disease and disease control of interior plant displays

Topic 2.1

Learners will know pests and understand methods of control within the interior environment to include:

- pests: rodent, chewing insects, sap sucking insects, mites
- control methods: physical, cultural, chemical, biological, integrated

Topic 2.2

Learners will know fungal diseases and understand their control within the interior environment by physical, cultural, chemical and integrated methods.

Learning outcome:

3. Establish and manage plants in a permanent indoor setting

Topics

3.1 Evaluate site and select plants for permanent interior displays

3.2 Prepare and plant up a permanent interior displays

3.3 Maintain a permanent interior plantings

Topic 3.1

Learners will evaluate the growing environment of sites suitable for establishing a permanent plant display such as retail areas (indoor shopping centres etc), office buildings (atria and similar), display glasshouses (such as alpine houses). Environmental conditions should be investigated including; light (intensity, quality and duration, direct and diffuse light, aspect), temperature range and fluctuations, air movement, humidity, soil/growing media characteristics. Implications relating to site use and access must be understood.

Learners will understand the limits and tolerances of plants from each of the following categories, to a range of environmental conditions:

- alpine
- tropical/sub-tropical
- temperate
- cacti and succulents

Learners will know the growth habit of the plants, for example height and spread, branching, creeping, climbing.

Topic 3.2

Learners will prepare a site for planting including primary and secondary ground cultivations, installation of drainage and irrigation/feeding systems, growing media selection/amelioration and fertiliser application.

After preparing the site learners will plant up and establish a permanent indoor display including plant selection, grouping/design, spacing, depth of planting, firming, irrigation, provision of support.

Topic 3.3

Learners will maintain an established indoor display including

- monitoring growing conditions, pest, disease and disorder
- weed control, irrigation, plant replacement and thinning, dead-heading, pruning/stopping/pinching (shaping, removal of dead, dying, diseased, weak growth), trimming, training, tying-in, additional feeding.

Learning outcome:

4. Establish and manage temporary interior plant displays

Topics

4.1 Evaluate site and select plants for temporary interior displays

4.2 Plant a temporary interior displays

4.3 Maintain a temporary interior displays

Topic 4.1

Learners will evaluate the growing environment of sites suitable for establishing a temporary plant display which have differing environmental conditions such as an office, hotel entrance area, marquee or restaurant.

Learners will know the limits and tolerances of a range of environmental conditions, suitable for planting in temporary interior displays. The growth habit of the plants should be known for example height and spread, branching, creeping, climbing.

Learners will select plants that are suitable for a given interior location and container.

Topic 4.2

Learners will prepare and plant up the container and administer after planting care.

- Container preparation: growing media, nutrients, cleaning, installation of irrigation/hydroponic system
- Planting: groupings, position, spacing, depth, firming, provision of support
- Aftercare: removal of label, damaged foliage, watering, application of mulch

Topic 4.3

Learners will carry out the monitoring and maintenance of a temporary interior plant display including the following where appropriate:

- maintenance needs; foliage and planter cleaning, dead-heading, pruning/stopping/pinching (shaping, removal of dead, dying, diseased, weak growth), trimming, training, tying-in, support, irrigation, additional feeding
- monitoring and reporting on the growing environment; light, humidity, temperature
- monitoring and reporting on ill health; damage by public, pest, disease and disorder (incorrect light, incorrect humidity, water stress, nutrient disorders).

Guidance for delivery

This unit involves the learner in all aspects of planning, establishing and maintaining interior plant displays. The range of display areas should cover examples of both permanent and temporary types, and may include specialist displays such as alpine houses and those in botanical collections as well as those within retail malls and office areas.

Health and safety considerations must be adhered to including the wearing of appropriate Personal Protective Equipment (PPE), working within glazed areas and working in confined areas.

A clear understanding of the full spectrum of management and control options should be understood. An integrated approach to the management of problems is essential, especially in publicly accessed areas.

Suggested learning resources

Books

- Derek Lovejoy Partnership. 1997. Spon's Landscape Handbook. Oxford: Taylor and Francis.
- Phillips, R., Rix, M. 1998. Conservatory and Indoor Plants. London: Pan Books.
- Beckett, K. The RHS Encyclopaedia of House Plants. New York: Simon and Schuster Ltd.
- Clamp, H. 1995. Spon's Landscape Contract Handbook: A Guide to Good Practice and Procedures in the Management of Lump-sum Landscape Contracts. Oxford: Taylor and Francis.
- Cobham, R. 1990. Amenity Landscape Management: A Resources Handbook. Oxford: Routledge.

Unit 337

Manage advanced nursery stock production

UAN:	H/507/4708
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to manage advanced nursery stock production and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

The learner will be able to prepare and plan for nursery stock production in containers, in protected and outdoor situations. The learner will also be able to establish and maintain nursery stock, both on the nursery and in the retail situation that is often present on nurseries that have retail sales areas.

Learning outcomes

In this unit, learners will be able to:

1. Understand how to plan nursery stock production activities
2. Establish container-grown nursery stock
3. Manage the development of nursery stock
4. Understand field production of nursery stock
5. Manage the health and growth of plants in nursery sales environments

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand how to plan nursery stock production activities

Topics

1.1 Suitability of sites for nursery stock production

1.2 Facilities and resources required for nursery stock production

1.3 Planning process for nursery stock production

Topic 1.1

Learners will understand if a site is appropriate for nursery stock production. Considerations of the following features will be required:

- Size
- Aspect
- Shelter
- Services
- planning permissions
- market(s)
- labour availability
- financial implications
- orientation
- rainfall
- access
- slopes
- light
- climate microclimate for field production
- also soil type and structure, texture, depth, drainage, pH, soils free from contaminants.

Topic 1.2

Learners will understand the structures and resources which are required for nursery stock production. Structures include:

- glasshouses
- propagation houses polythene/net tunnels
- outdoor container beds and other growing on facilities
- despatch yards storage sheds
- barns
- potting sheds
- offices
- wastes storage
- chemical storage
- welfare areas.

Resources include:

- areas for storage and preparation of growing media
- equipment for preparation of growing media
- fertiliser
- areas for potting
- potting equipment
- containers
- equipment and materials for support
- training and development of growth
- irrigation equipment
- tanks/reservoirs
- power supply
- generator
- compressor
- equipment for liquid feeding
- feed mixing
- water softening
- equipment and materials for the storage and application of pesticides and ancillary equipment
- transport and handling equipment and materials (trolleys, tractors, trailers, forklift, conveyors, crates, barrows)
- waste handling and disposal equipment and materials
- equipment and materials (including computers) for monitoring of the growing environment and for administration of the nursery
- human resources for horticultural and administrative activities.

Topic 1.3

Learners will understand a nursery stock production system from propagation to despatch. This includes growing systems, crop duration, plant range, crop/plant numbers (density) to be produced, facilities, site preparation, environmental control (outdoors, protected), crop establishment, crop manipulation, maintenance of crop growth, pest and disease control, disposal of waste (green waste composting, plastic recycling, container cleaning and reuse), reduction of environmental impact, costs, market(s) and market research, date(s) for availability, labour availability.

Learning outcome:

2. Establish container-grown nursery stock

Topics

2.1 Determine that sites and resources are available and ready for potting nursery stock

2.2 Perform potting up, potting on and standing down/setting out of nursery stock

Outcome 2 requires learners to plan and prepare for both potting up/off and potting on of nursery stock, as well as standing down (setting down) the crop after potting on the ground and/or on benches. This should include a clear understanding of hygiene requirements, space and accuracy in positioning to allow for future growth, maintenance and development of the crops. In order to enhance practical skills, learners must (by hand) pot up/off (rooted cuttings) a minimum of twenty

five (25) plants and pot on a minimum of twenty five (25) plants. They must also stand down (set down) those plants.

Topic 2.1

Learners will determine that the site is prepared for the potting process. This will include assessing if the following are appropriate for the potting of a named crop: potting area, potting bench, potting machine, transport equipment, area for growing on.

Learners will determine that they have the appropriate resources for the potting process, for example:

- containers
- growing media
- plant material
- containers and materials for waste clearance and disposal
- labels
- support and training materials
- pruning/trimming tools/equipment
- related tools and equipment
- transport equipment
- labour.

Learners will determine that the facilities and equipment are arranged ergonomically to achieve the optimum quality and performance.

Topic 2.2

Learners will carry out potting up/off container grown stock, potting on container grown stock. This may include:

- selecting containers
- growing media
- fertilizer/feed
- support
- potting depth
- plant/container cleaning
- pruning/trimming
- label
- irrigation method(s)
- stand down/set out stock
- on benching and/or ground as necessary (outdoors/under protection)
- straight lines
- spacing.

Learning outcome:

3. Manage the development of nursery stock

Topics

3.1 Manage the growth of nursery stock to ensure development to market requirements

3.2 Identify, control and dispose of unwanted plant growth to meet environmentally sound practice Manage the collection and dispatch of plants

Outcome 3 covers the growth and development of crops. Learners should be able to plan the management of particular examples of nursery stock growing in containers (eg evergreen shrubs, herbaceous perennials, hedging or fruit trees) and undertake activities relating to their growth and development to target/sales period. The maintenance of health will include recognition of pests, diseases and disorders. If learners are to undertake chemical control of problems then she/he must hold appropriate the qualifications to apply pesticides. Learners will also need to have the opportunity to manage the preparation and collection plants for despatch against a brief.

Topic 3.1

Learners will understand why standards and uniformity are important when supplying customers with nursery stock with reference to British Standards (BS) 3936 Nursery Stock Specifications.

Learners will perform methods to control and manage the growth of nursery stock to achieve a given standard, (which may be based on plant type, habit, size, shape, container size). Consideration of control measures may be influenced by:

- stage of development
- season
- pest, disease and disorders
- irrigation
- nutrition provision of optimum environmental conditions (light, water/moisture/humidity, temperature)
- weather and seasonal protection.

Topic 3.2

Learners will determine when plant growth methods need to be employed to control unwanted plant growth. Unwanted plant growth may include:

- excessive weed growth in and around the crop excessive growth of the crop
- badly positioned plants within the container
- damaged or diseased growth, suckers and non-typical growth (reversion).

Learners will perform pruning, control the growing environment, irrigation control, and nutrient control. They will understand the application of PGR (Plant Growth Regulators). Learners will dispose of waste in accordance with environmental policy and current legislation.

Topic 3.3

Learners will perform the collection of plants for customer orders and understand the processes of preparation of plants for sale. Systems may include using material handling equipment, compact tractors, trailers, rollers, conveyers etc. The use of computer stock control/order processing systems may be used to demonstrate efficient material handling.

Learners will perform the collection of plants that meet the specification (type, quantity and standard) determined by the order or picking list. The plant order will be prepared for sale in accordance with the despatch system and customer requirements. This may include:

- weeding
- pot cleaning

- top dressing
- pruning
- tying in
- labelling (picture and descriptive)
- pre pricing
- irrigation
- packaging quality check/control and loading onto transport.

Learner will be able to identify methods of transport and transport systems and requirements.

Learning outcome:

4. Understand field production of nursery stock

Topics

4.1 Equipment available for the field production of nursery stock

4.2 Production systems of field grown stock

4.3 Formula for specifying nursery stock

4.4 Management of field-grown nursery stock

Outcome 4 is about the understanding of field growing of nursery stock. If the centre does not undertake the activity, a visit to a field producer of trees or shrubs should be carried out if possible. Specification of nursery stock refers to the size and growth patterns of crops (eg calliper size, undercutting, transplanting). Learners will need to identify and review the equipment and facilities available for the field production of nursery stock together with explaining the production and management systems available for propagation stock, bare-root deciduous and evergreen woody stock plants for sale and containerization.

Topic 4.1

Learners will know a range of equipment which is used for field production of nursery stock, these include:

- soil cultivation equipment (tractor operated, pedestrian operated, manual)
- equipment for the management of weeds, pests and diseases on a field scale
- equipment for the management of growth and development of stock (support, training, undercutting, irrigation)
- equipment for lifting/harvesting, transport and handling equipment.

Topic 4.2

Learners will understand field grown systems used to produce propagation stock such as rootstocks, by layering and stock beds for cutting and scion material for vegetative propagation.

Learners will know other methods of propagation in the field such as budding, field grafting, propagation of seedlings and the production of hardy herbaceous plants in the field.

Learners will understand methods of field production of trees and shrubs including: bare-root, root wrapped, rootballed and containerised.

Learners will understand the differences in their production and handling.

Topic 4.3

Learners will understand the standardisation (Reference to British Standards (BS) 3936) of nursery stock grown in the field and why it is important (ref: Topic 3.1). They will know The British Standard formula for grading field grown nursery stock.

Topic 4.4

Learners will understand establishment and maintenance of field grown crops. This may include:

- planting methods
- plant size
- shape
- habit
- irrigation
- application of feeds
- management and control of weeds
- excessive and badly positioned plant growth,
- pest, disease and disorder monitoring and control
- damaged growth
- suckers and non-typical growth
- transplanting and undercutting
- weather and seasonal protection
- methods of reducing environmental impact and waste management
- losses and contingency plans.

Learning outcome:

5. Manage the health and growth of plants in nursery sales environments

Topics

5.1 Maintain plants in a nursery sales situation

5.2 Identify and respond to pests, diseases and disorders

Topic 5.1

Learner will perform methods to maintain plants:

- Irrigation
- Feeding
- Pruning/ trimming
- Supporting/ tying
- Weeding
- Dead-heading
- Stock rotation and display
- Provision of adequate space

Topic 5.2

As appropriate to plant crop, identify and carry out appropriate action for:

- Insect pests
- Molluscs
- Rodents
- Mites
- Fungal problems
- Problems of excessive and under watering
- Lack of feeding-nutrient deficiencies
- Physical damage
- Frost and other weather-related problems

Guidance for delivery

The unit is primarily concerned with the planning and production of container grown nursery stock, but an understanding of field-grown stock is required in Outcome 4.

Emphasis should be placed upon safe working practices and the safety of self and others, including the general public, at all times. Learners will need to be aware of Personal Protective Equipment (PPE) requirements and that of the Food and Environment Protection Act 1990 (as amended 1995) (FEPA) and Control of Substances Hazardous to Health (2002) (COSHH) legislations.

The unit may be delivered by a wide range of techniques including lectures, supervised practical work, discussions, video or DVD, site visits and research. The delivery of this unit may be integrated with the delivery of other units where this is feasible and every opportunity should be taken to show how the knowledge acquired in this unit may be applied to practical horticultural tasks. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities.

Learners would greatly benefit from the opportunity to visit renowned commercial nursery stock producers, in order to better appreciate the facilities, resources, scale of operation, growing and planning techniques available.

Suggested learning resources

Books

Adams, C.R., Early, M.P. 2004 Principles of Horticulture. Oxford: Butterworth-Heinemann. ISBN 9780750686945.

Brown, L. 2008. Applied Principles of Horticultural Science. Oxford: Butterworth-Heinemann. ISBN 9780750687027.

Dawson, P. 2006. A Handbook for Horticultural Students. Rushden: Dawson Books. ISBN 0-9525911-11

Lamb, K., Kelly, J., Bowbrick, P. 1995. Nursery Stock Manual: Grower Manual 1. London: Grower Books. ISBN 0901361 801.

BS3936 – British Standards Institute

Websites

www.GoHelios.co.uk

National Plant Specification

Unit 338

Principles of organic crop production

UAN:	K/507/4709
Level:	3
GLH:	60

What is this unit about?

This unit aims to provide learners with an understanding of the principles of organic crop production and how this can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

The learner will be able to develop knowledge of the principles of organic crop production methods. They will cover the philosophy behind organic crop production and growing systems employed in them

Learning outcomes

In this unit, learners will be able to:

1. Understand the principles of organic crop production
2. Understand the importance of soil fertility in an organic system
3. Understand growing methods and markets for organic crops
4. Understand methods of pest, disease and weed management in organic systems

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the principles of organic crop production

Topics

- 1.1 The history, philosophy and aims of the organic movement
- 1.2 The roles of relevant organisations within the organic movement
- 1.3 Systems related to organic production
- 1.4 Organic standards and certification

Topic 1.1

Learners will understand history, philosophy and aims of the organic movement. The issues include:

- historical relevance of ancient and traditional agricultural and horticultural practice
- organisational influences eg The Soil Association, Garden Organic (formerly HDRA)
- the influence of individuals eg Sir Albert Howard, Eve Balfour, Lawrence D Hills, HRH Prince Charles
- the law of return (Howard)
- the importance of underlying scientific principles
- characteristics of organic systems
- the consequences of artificial chemical use in non-organic crop production.

Topic 1.2

Learners will understand the aims and roles of relevant organisations within the organic movement. Learners will focus their research on current developments in the organic production movement.

Topic 1.3

Learners will understand the three main systems related to organic production: biodynamics, agroforestry and permaculture. They will understand their benefits, uses and advantages, as well as production techniques they use (including the 'no dig' growing technique).

Topic 1.4

Learners will understand organic standards and certification. They will know the roles of:

- The International Federation of Organic Movements (IFOAM)
- Advisory Committee on Organic Standards (ACOS)
- the Soil Association, the European Union (EU).

Learning outcome:

2. Understand the importance of soil fertility in an organic system

Topics

- 2.1 The concept of 'the living soil' including its physical, chemical and biological components
- 2.2 The causes of soil erosion and preventative measures that can be taken
- 2.3 Soil fertility and how it can be built up and maintained

2.4 The process of conversion of a site to organic production

Topic 2.1

Learners will understand the concept of 'the living soil', that is

- importance of analysis, soil structure, soil texture and fertility
- humus, decomposition of organic material by primary and secondary decomposers
- the action of macro, meso and micro soil organisms, to include: earthworms, protozoa, bacteria-feeding nematodes, mycorrhizae
- non biological soil reactions.

Topic 2.2

Learners will understand the causes of soil erosion, to include climatic conditions and cultivation. They will know preventative measures to be used to minimise soil erosion, to include soil conservation, wind reduction, terracing, minimal tillage/no tillage, contour cultivation, mulches and fabrics, surface consolidation, cover crops, green manures.

Topic 2.3

Learners will understand how soil fertility can be built up and maintained using the following techniques:

- cultivation
- crop rotation
- intercropping
- rooting depths
- provision of organic matter, composts, mulches and supplemental nutrition
- creation of ideal conditions (carbon, nitrogen, nitrogen fixers, fertility builders, rhizobia, aerobic and anaerobic bacterium)
- composting systems, soil improvers (animal manures, green manures, worm products).

Topic 2.4

Learners will understand the process of conversion of a site to organic production and what it entails. They will know that The Soil Association (Certification Limited) is the most recognised organic trademark in organic production. They will understand that the process of conversion usually happens over two years (three for perennial crops to build fertility and adapt production methods). The steps to certification/conversion are: 1) application 2) inspection 3) certification.

Learners will also understand other factors affecting the process of conversion:

- registration procedures
- timing
- inspection
- derogation
- record keeping
- labelling regulations
- organic seeds and plants
- past crop records (including feed and chemical applications)
- size of holding

- crops grown
- date for organic production
- current and future crop records kept to demonstrate compliance with organic standards
- approved organic inputs
- Organic Farmers and Growers.

Learning outcome:

3. Understand growing methods and markets for organic crops

Topics

3.1 Growing, harvesting and storage methods for organic crops

3.2 Sourcing of seeds and material inputs for organic systems

3.3 Markets available for organic produce

3.4 Management of marketing for organic crops

Topic 3.1

Learners will understand the growing methods for a selection of crops. Edible crops production methods must cover plant types belonging to each of the following groups:

- Roots
- Brassicas
- Alliums
- Cucurbits
- Salads
- top fruit
- cane fruit and soft fruit.

They will also understand methods of care for the crop, eg irrigation, training, pruning (as appropriate), provision of support (as appropriate), weed control, pest and disease control.

Learners will understand harvest and storage requirements for crops and the importance of adherence to relevant legislation and codes of practice, organic standards, quality standards, health and safety, use of Personal Protective Equipment (PPE), food integrity and food safety.

Topic 3.2

Learners will understand the ways of sourcing seeds and material inputs, to include approved organic inputs, certified inputs, use of derogation in certain circumstances where certified inputs are not available and other suitable ethical sources.

They will also understand the role of the Centre for Organic Seed Information (COSI) and the Heritage seed scheme for vegetables.

Topic 3.3

Learners will know the markets available for the organic produce to include wholesalers, distributors, supermarkets, community-supported agriculture (CSA), farm shops, and retailers. They will also know ways of direct marketing, to include box schemes, farmers' and community markets.

Topic 3.4

Learners will understand factors affecting marketing of organic crops, taking the following into consideration: business planning and development, marketing strategy, economic situation, identification of business opportunities, proximity to markets.

They will also understand other considerations when managing the marketing of organic crops, eg facilities, machinery, equipment, labour, materials, transport, packaging, presentation, point of sale materials, processing customer requirements, customer led demand for produce, crop types.

Learners will understand the importance of the approval to use recognised organic food symbol eg the Soil Association Organic Symbol (recognised trade mark).

Learning outcome:

4. Understand methods of pest, disease and weed management in organic systems

Topics

4.1 Pest and disease management in organic systems

4.2 Weed control strategies

4.3 Benefits and limitations of a diverse ecology and how this may be developed

Topic 4.1

Learners will understand pest and disease management in organic systems taking into consideration the following issues:

- balance of damage caused against the impact of control measures
- the importance of
 - biodiversity
 - preferred habitats of beneficial organisms
 - predators and parasites
 - bacterium and fungal agents
 - insects and their lifecycles
- issues surrounding monocultural environments, crop rotation, variety selection and the right plant/right place
- control measures
 - cultural, eg crop rotation, companion planting, the use of indicators and distracters, use of green manures
 - biological, eg use of predators and parasites
 - permissible biocides.

Topic 4.2

Learners will know major perennial, annual and ephemeral weed species, and assess the value of weeds as indicator species in respect of soil characteristics, quality and nutrient availability.

Learners will understand the methods of weed control, eg cultural (crop rotation, tillage, direct control, mulching, exhaustion), removal (thermal, mechanical and manual).

They will also understand the cultivation techniques, to include:

- stale seed bed

- double/single digging/no dig.

Topic 4.3

Learners will understand the benefits and limitations of a diverse ecology and how this may be developed, taking into consideration the following issues:

- relevant legislation and codes of practice, environmental grants
- habitat diversity, development, maintenance and enhancement
mixed plantings rather than monocultures
- working with natural systems to build a well balanced fertile soil
- use of bulky organic materials to improve soil structure and nutrient recycling by micro-organisms
- minimum reliance on outside inputs and avoidance of chemically produced and environmentally harmful fertilisers and pesticides
- encouraging natural balance of predators, such as ladybirds, lacewings, blue tits and hedgehogs
- avoidance of genetically modified material (GMO)
- waste management (reduce, re-use, recycle).

Guidance for delivery

The learner will be able to understand the underlying principles of organic crop production, the importance of soil fertility and nutrition. They will gain an appreciation and understanding of methods of soil cultivation, sowing, planting and mechanical weed control in organic production systems. Learners will understand growing methods and methods of pest, disease and weed management in organic systems. Finally, learners will develop an understanding of the markets for organically grown produce. In order to meet this outcome, learners will need to have access to specialist learning resources. It would be useful for learners to visit an organic enterprise to discuss some of the aspects covered by this outcome.

The unit may be delivered by a wide range of techniques, including lectures, video or DVD use, supervised practical work, discussions, identification of pests, diseases, disorders, biological control agents and weed, site visits and research. Learners will require access to specialised literature and other resources. The delivery of this unit may be integrated with the delivery of other units where this is feasible and every opportunity should be taken to show the link to horticultural practices. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities.

Suggested learning resources

Books

Blake, F. 1994 Organic Farming and Growing: A Guide to Management. The Crowood Press
Davies, G. & Lennartsson, M. 2006 Organic Vegetable Production: A complete Guide. The Crowood Press
Mollison, B. & Slay, R. 1994 Introduction to Permaculture, 2ND Edition. Tagari Publications
HDRA, 2005 Encyclopaedia of Organic Gardening. Dorling Kindersley
Readman, J. 2004 Managing Soil Without Using Chemicals. Dorling Kindersley
Pears, P. & Stickland, S. 1999 RHS Organic Gardening
Pears, P. & Sherwood, B Pests and How to Control Them
Greenwood, P. & Halstead, A. RHS Pest & Diseases. Dorling Kindersley
Littlewood, M. 2007 Organic Gardener's handbook. Dorling Kindersley
Littlewood, M. Companion Planting Chart. Garden Organic
Garden Organic fact sheets: Disease Control, Pest Control, Weed Control

Journals

The Living Earth
Organic Farming
The Organic Way
Permaculture Magazine

Websites

www.soilassociation.org	Soil Association
www.gardenorganic.org.uk	Garden Organic
www.rhs.org.uk	Royal Horticultural Society
www.biodynamics.or.uk	Biodynamic Agricultural Association
www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.wales.gov.uk	Welsh Assembly Government
www.scotland.gov.uk	Scottish Executive Environment and Rural Affairs Department
www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)

Unit 339

Customer care and retail merchandising

UAN:	D/507/4710
Level:	3
GLH:	60

What is this unit about?

This unit aims to provide learners with an understanding of the importance of customer care and the principles of retail merchandising in the land based sector. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training. This unit has been specifically developed for 14-19 year old learners in full-time education acquiring additional knowledge of retailing.

The learner will develop their customer service skills. The learner will understand how items are effectively displayed, along with how they are promoted and marketed. They will consider the principles of stock control and storage.

Learning outcomes

In this unit, learners will be able to

1. Deliver effective customer service
2. Understand how to display items for sale
3. Understand methods of promotion and marketing
4. Understand the principles of ordering, pricing and controlling retail stock

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome

1. Deliver effective customer service

Topics

- 1.1 Review the needs of different customer groups
- 1.2 Demonstrate effective customer service skills
- 1.3 Evaluate customer service in a given land based outlet

In this outcome, the focus is on customer service skills. It is anticipated that delivery of this unit will be through a mix of formal lectures, visits to appropriate outlets, and the opportunity to practise customer service skills in a real or simulated situation. Work placement in an appropriate setting would also help learners to develop effective customer service skills. It will be important to explore the potential impact of good and poor customer service on the business's current and future customers, and thus on the success of the business.

Topic 1.1

Learners will know different customer groups and review their needs, to include: individuals, businesses. They will also know customer classification e.g. age, sex, socio-economic group.

Topic 1.2

Learners will demonstrate effective customer service skills when dealing with customers, to include

- effective communication (e.g. addressing customers face to face, appropriate telephone manner, effective written communication, use of social media)
- courtesy and helpfulness
- appropriate dress and body language
- product knowledge.

Topic 1.3

Learners will evaluate customer service in a given land based outlet taking the following into consideration: customer expectations, service standards, approach to customers, policies (e.g. refunds, complaints), after sales service, advice and assistance, compliance with Data Protection Act 1998

Learning outcome

2. Understand how to display items for sale

Topics

- 2.1 Customer flow and space layout of a given land based outlet
- 2.2 Product display systems
- 2.3 Influence of legislation on goods displayed

In this outcome, after appropriate classroom based activity, the learner will need access to land based retail outlets to enable them to carry out the required analysis and evaluation of customer

flow, space layout and display systems. It may be helpful to visit a larger outlet, possibly one that is part of a national chain, and a smaller independently owned one for comparison and to stimulate debate about the key factors. The study of relevant legislation may be assisted by considering case study examples of where this has been breached and the consequences of this to the business.

Topic 2.1

Learners will understand customer flow of a given land based outlet in relation to the direction of customer movements, and clarity of store layout aiding customer flow, e.g. store design and plan including position of entrance and exit, signage location and clarity, location of tills, aisle widths, access for customers including those with disabilities location of promotional offers.

Topic 2.2

Learners will understand product display systems of a given land based outlet in relation to product groupings (e.g. by category of product, by species, according to perishability, seasonality, special promotions), types of display, location of displays.

Topic 2.3

Learners will understand how relevant legislation influences the display of goods in a land based outlet. Relevant legislation would include: Sale of Goods Act 1968 (as amended 1979 & 1994), Trades Description Act 1968, Weights and Measures Act 1985, Consumer Protection Act 1987 (as amended 1994), Price Marking Order 2004.

Learning outcome

3. Understand methods of promotion and marketing

Topics

- 3.1 Methods of promotion
- 3.2 Marketing strategies for given land based outlets
- 3.3 Recommend improvements to a given marketing strategy

This outcome requires learners to review promotional methods and marketing strategies for a selected land based outlet. This could be the same outlet or a different one to those studied for outcomes 1 and 2. It may be helpful to study a larger outlet where there is often more evidence of formal strategies. The evaluation of and recommendation of improvements to, a marketing strategy should be carried out in the context of a specific business objective.

Topic 3.1

Learners will know different methods of promotion available to land based businesses, to include advertising in different media, (e.g. radio, newspaper, internet, television), public relations and sponsorship, special offers and discounts, direct mailing.

Topic 3.2

Learners will understand marketing strategies for given land based outlets to include strategies relating to

- product (e.g. product design, product range, packaging)
- price
- promotion (e.g. advertising, Public Relations and sponsorship, special offers and discounts, direct mailing)

- place (e.g. location, transportation, home delivery).

Topic 3.3

Learners will give recommendations to support a given objective, e.g. increase market share, increase sales, increase customer base

Learning outcome

4. Understand the principles of ordering, pricing and controlling retail stock

Topics

- 4.1 Buying and ordering processes
- 4.2 Stock control and storage methods
- 4.3 Pricing methods

Topic 4.1

Learners will understand buying and ordering processes used in land based outlets, to include methods of payment, credit arrangements, methods of ordering, documentation, locating suppliers, stock delivery.

Topic 4.2

Learners will understand different methods of controlling stock, to include stock rotation, planning to meet demand, monitoring stock.

They will also understand the methods of storing products to include: perishable and non perishable items, security, storage of plant health products, minimising wastage, compliance with relevant legislation and guidelines, e.g. DEFRA Code of Practice for Suitably Qualified Persons and Guidance for the Registration of Retail Premises 2008.

Topic 4.3

Learners will know different pricing methods to include: cost based, competitor based and offers and discounts.

Guidance for delivery

This unit is designed to provide learners with an understanding of the important skills for those working in and managing land based retail outlets. Centres are encouraged to find a selection of appropriate outlets which could be used for comparison and case study material. Examples may include farm retail shops, horticultural suppliers and garden centres.

As learners will be visiting other businesses and organisations, there should be an emphasis on safe working practices and appropriate risk assessments should be undertaken.

At level 3 learners will have significant experience as customers of retail outlets. This perspective and experience will be helpful in developing their understanding of customer service and marketing methods in the land based sector. It will be important that teaching and delivery focuses on the application of knowledge and skills to outlets in the land based sector that are as relevant as possible to learners' interests.

Suggested learning resources

Books

Leland, K., Bailey, A. 2006. Customer Service for Dummies. Sussex: Wiley Publishing.
Ferrel, O.C. et al. 2005. Marketing: Concepts and Strategies. 5th ed. Geneva: Houghton Mifflin.
Hall, D. et al. 2008. Business studies. 4th ed. St Albans: Causeway Press Ltd.
Needham, D., Dransfield, R. 1994. Business Studies Second Edition. 2nd ed. Cheltenham: Nelson Thornes

Websites

www.bized.co.uk	Business education website
www.businesslink.gov.uk	Business Link website
www.marketingteacher.com	Marketing resources
www.thetimes100.co.uk	Case study materials and resources

Unit 340

Water management

UAN:	H/507/4711
Level:	3
GLH:	60

What is this unit about?

The purpose of this unit is to provide learners with an understanding of how to manage soil water and apply this knowledge in practice.

The learner will understand the essential requirements for effective use and management of water in horticultural situations and be able to maintain irrigation and drainage systems. The learner will also understand the legal requirements and codes of practice applicable to irrigation and drainage.

Learning outcomes

In this unit, learners will be able to:

1. Understand the requirements of soil water management for horticultural use
2. Maintain irrigation systems
3. Install and maintain drainage systems
4. Understand sources of water and legal requirements applicable to irrigation and drainage of horticultural facilities

Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Learning outcome:

1. Understand the requirements of soil water management for horticultural use

Topics

- 1.1 Fundamentals of soil water
- 1.2 Factors affecting ground water movement
- 1.3 Recording rainfall and water usage

Topic 1.1

Learners will understand the fundamentals of soil water, to include:

- water infiltration
- penetration
- drainage
- evapotranspiration
- saturation point
- field capacity
- permanent wilting point
- available and unavailable water
- hygroscopic water
- gravitational water
- soil moisture deficit
- evaporation and transpiration
- capillary action
- pore space
- infiltration rate
- hydraulic conductivity.

Topic 1.2

Learners will understand factors affecting infiltration, penetration and water loss to include:

- soil texture
- soil structure
- organic matter content
- compaction
- topography
- plant cover (species and density)
- shelter/exposure
- season
- rainfall
- temperatures and other climatic and environmental factors.

Topic 1.3

Learners will know how to record rainfall for an identified area using available weather data eg current data from the Meteorological Office, on-site recording. They will know how to record water usage using meter readings.

Learning outcome:

2. Maintain irrigation systems

Topics

- 2.1 Diagnose faults and problems with installed irrigation systems
- 2.2 Carry out routine and seasonal maintenance

In this outcome learners will cover the maintenance, fault finding and repair of installed irrigation systems. Learners will need to understand the equipment and layout before they can diagnose faults. Learners should also carry out the seasonal shut down and starting of a specified irrigation system either within a protective structure or outdoors.

Topic 2.1

Learners will diagnose faults and problems within a range of irrigation systems, systems may include:

- static and mobile systems
- within protective structures and outdoors
- capillary beds/benches (sub-irrigation)
- drip irrigation
- overhead systems
- sprinkler systems
- mist and fog units.

They will also diagnose faults and problems in the system components, such as:

- control/sequencing equipment
- pumps
- pipes
- tubes
- filters
- sprinkler heads/atomisers/nozzles.

Problems which may include:

- blockages
- algal growth
- wet/dry areas
- incorrect rate of application
- wind blow
- pump problems
- problems associated with source
- pressure

- contamination
- nozzle/sprinkler head faults/damage/blockage/calibration
- limescale build up
- burst pipes

Topic 2.2

Learners will carry out routine repair or maintenance which may include:

- isolation of the system
- safety procedures
- cleaning
- replacement of nozzles
- clearing blockages
- dealing with leaks
- mobile systems
- capillary beds
- fixed and automated systems

Learners will understand the need for seasonal shut down and starting of irrigation systems.

Learning outcome:

3. Install and maintain drainage systems

Topics

- 3.1 Principles of drainage systems
- 3.2 Install pipe drainage systems
- 3.3 Diagnose faults and problems with installed drainage systems
- 3.4 Including routine maintenance or repair to drainage systems

Within this outcome learners will develop skills and knowledge involved in the installation and description of varied drainage systems. Learners will need to contribute to the installation of specified pipe drainage system. These can be tiles or plastic pipe. Learners should be able to install a section of pipe. They should be able to establish an appropriate fall and lay pipes with a suitable backfill material. Learners will be able to demonstrate joining two or more pipes together. The ability to diagnose faults and problems with installed drainage systems and carry out routine maintenance or repair to drainage systems is an essential component to this outcome.

Topic 3.1

Learners will understand systems and principles of land drainage, the range of methods available, advantages and disadvantages of each including:

- sub-soiling
- open ditches
- mole ploughing
- pipe drainage, including silt traps and outfalls, mains, laterals and backfill.

Learners will understand typical layouts, dimensions, soil types, principles of maximum, minimum and optimum falls of drains, characteristics of suitable backfill

Topic 3.2

Learners will undertake installation of a part of a pipe drainage system to given specifications, by hand and/or machine, pipes can be tiles or plastic, installation of a sections of pipe; establishment of a fall, lay pipes, installation of outfalls to suitable locations, backfill materials identified/used

Topic 3.3

Learners will diagnose the common faults and problems associated with drainage systems including:

- blockages to pipes
- outfall, ditches, and soakaways: breakages to pipes, silt, vermin, collapse of mole channels, compaction of the soil

Topic 3.4

Learners will undertake routine maintenance or repair of a drainage system which may include:

- repairs to open ditch and piped drainage systems
- clearing silt from silt traps
- clearing ditches
- repairing outfalls
- clearing blockages.

Learning outcome:

4. Understand sources of water and legal requirements applicable to irrigation and drainage of horticultural facilities

Topics

- 4.1 Water sources
- 4.2 Record keeping
- 4.3 Legal requirements and legislation

Topic 4.1

Learners will know sources of water used in horticulture, to include:

- Mains
- Boreholes
- Ponds
- reservoirs
- lakes
- tanks
- captured rain water
- recycled/grey water

Topic 4.2

Learners will understand the importance of keeping accurate records required for a particular horticultural situation, to include:

- timings/dates
- quantities

- abstraction/impounding.

Topic 4.3

Learners will understand the legal requirements and legislation associated with water management including:

- Health and safety
- environmental impact assessment
- ground water
- abstraction
- pollution
- quality and quantity adherence to current legislation and best practice.

Learners will know relevant current legislation to include:

- Environmental Act 1995, Water Act 1965 (as amended)
- Conservation Regulations (1994) (as amended)
- Countryside and Rights of Way Act 2000
- The Water Resources (Abstract and Impounding) Regulations 2006
- Sustainable Urban Drainage Systems (SUDS) Regulations 1997 (as amended).

Learners will also know where to gain advice and guidance through;

- Environment Agency for abstraction and impounding licence(s) (temporary/permanent)
- water rights trading
- Department for Environment, Food and Rural Affairs (Defra)
- Welsh Assembly Government
- Scottish Executive Environment and Rural Affairs Department (SEERAD)
- Department of Agriculture and Rural Affairs (Northern Ireland).

Guidance for delivery

Although no prior learning is expected to undertake this unit it will complement many existing units such as soil science, sports turf maintenance and crop production. This unit enables learners to develop knowledge of soil water relationships and managing the soil water balance. It also covers practical tasks relating to drainage and irrigation. It is applicable to a range of horticultural situations, such as nurseries, sport turf, parks and gardens and should be taught and assessed in the context of the learner's area of study.

The unit may be delivered by a wide range of techniques, including lectures, supervised practical work, discussions, video or DVD, site visits and research. The delivery of this unit may be integrated with the delivery of other units where this is feasible and every opportunity should be taken to show the links to horticultural practices. All methods should reinforce the importance of health and safety and environmental issues. Risk assessments must be undertaken prior to practical activities.

Suggested learning resources

Books

Adams, W.A., Gibbs, R.J. 1993. *Natural Turf for Sport and Amenity*. Oxford: CAB International. ISBN 0851987206

Ingram, D.S. et al. 2002. *Science and the Garden*. Oxford: Wiley Blackwell.

Brickwell, C. 2002. *The RHS Encyclopaedia of Gardening*. Essex: Dorling Kindersley Publishers.

Websites

www.ukia.org	United Kingdom Irrigation Association
www.irrigationtutorials.com	Irrigation Tutorials
www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.wales.gov.uk	Welsh Assembly Government
www.scotland.gov.uk	Scottish Executive Environment and Rural Affairs Department
www.dardni.gov.uk	Department of Agriculture and Rural Affairs (Northern Ireland)
www.environment-agency.gov.uk	The Environment Agency
www.iog.org	The Institute of Groundsmanship
www.bali.co.uk	British Association of Landscape Industries
www.the-gtc.co.uk	The Greenkeepers Training Committee
www.planningportal.gov.uk	Planning Portal (UK Government)

Appendix 1 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on www.cityandguilds.com.

City & Guilds Centre Manual

This document provides guidance for organisations wishing to become City & Guilds approved centres, as well as information for approved centres delivering City & Guilds qualifications. It covers the centre and qualification approval process as well as providing guidance on delivery, assessment and quality assurance for approved centres.

It also details the City & Guilds requirements for ongoing centre and qualification approval, and provides examples of best practice for centres. Specifically, the document includes sections on:

- the centre and qualification approval process
- assessment, internal quality assurance and examination roles at the centre
- registration and certification of candidates
- non-compliance and malpractice
- complaints and appeals
- equal opportunities
- data protection
- management systems
- maintaining records
- internal quality assurance
- external quality assurance.

Our Quality Assurance Requirements

This document explains the requirements for the delivery, assessment and awarding of our qualifications. All centres working with City & Guilds must adopt and implement these requirements across all of their qualification provision. Specifically, this document:

- specifies the quality assurance and control requirements that apply to all centres
- sets out the basis for securing high standards, for all our qualifications and/or assessments
- details the impact on centres of non-compliance

The **centre homepage** section of the City & Guilds website also contains useful information on

Walled Garden: how to register and certificate candidates on line

Events: dates and information on the latest Centre events

Online assessment: how to register for e-assessments.

Useful contacts

UK learners

General qualification information

E: learnersupport@cityandguilds.com

International learners

General qualification information

E: intcg@cityandguilds.com

Centres

Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results

E: centresupport@cityandguilds.com

Single subject qualifications

Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change

E: singlesubjects@cityandguilds.com

International awards

Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports

E: intops@cityandguilds.com

Walled Garden

Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems

E: walledgarden@cityandguilds.com

Employer

Employer solutions, Mapping, Accreditation, Development Skills, Consultancy

E: business@cityandguilds.com

Every effort has been made to ensure that the information contained in this publication is true and correct at the time of going to press. However, City & Guilds' products and services are subject to continuous development and improvement and the right is reserved to change products and services from time to time. City & Guilds cannot accept liability for loss or damage arising from the use of information in this publication.

If you have a complaint, or any suggestions for improvement about any of the services that we provide, email: feedbackandcomplaints@cityandguilds.com

About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group is a leader in global skills development. Our purpose is to help people and organisations to develop their skills for personal and economic growth. Made up of City & Guilds, City & Guilds Kineo, The Oxford Group and ILM, we work with education providers, businesses and governments in over 100 countries.

Copyright

The content of this document is, unless otherwise indicated, © City & Guilds Limited and may not be copied, reproduced or distributed without prior written consent. However, approved City & Guilds centres and candidates studying for City & Guilds qualifications may photocopy this document free of charge and/or include a PDF version of it on centre intranets on the following conditions:

- centre staff may copy the material only for the purpose of teaching candidates working towards a City & Guilds qualification, or for internal administration purposes
- candidates may copy the material only for their own use when working towards a City & Guilds qualification

The Standard Copying Conditions (see the City & Guilds website) also apply.

City & Guilds

5-6 Giltspur Street

London EC1A 9DE

www.cityandguilds.com
