

Unit 15: Understanding Water Pollution Control and Management

Unit code	L/601/0138
QCF Level 3:	BTEC National
Credit value:	10
Guided learning hours:	60

● Aim and purpose

This unit aims to introduce learners to skills and knowledge in water pollution and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

● Unit introduction

Water pollution is something we should all be concerned about. Pollution is ruining many lakes, streams, rivers and ponds and affecting water supplies, and the animals and people that rely on this water for drinking, leisure or employment. The pollution of water can be very quick and items put down a drain, such as detergents and cleaning products as well as industry based products, can cause pollution.

Water pollution can disable and kill animals as well as destroy whole food chains within water habitats. Some of the worst incidences of water pollution have been large oil spills along coastlines from ocean going vessels. These spills are far worse than we think with animals, tourism and finances all affected.

In addition, in many areas of the world, water is a scarce resource and if polluted the amount of available drinking water is greatly reduced, crops fail and herds die. Unfortunately, some processes used to clean and filter water can also be harmful to the environment.

This unit gives learners knowledge of the nature of water pollution, the impact of water pollution, how to protect the world's water resources and the current legislation that businesses and organisations must adhere to, with particular emphasis on the UK situation.

● Learning outcomes

On completion of this unit a learner should:

- 1 Understand the hydrological cycle
- 2 Know the most common types of water pollutant in the UK
- 3 Be able to investigate the environmental impact of a selected enterprise in relation to water resources
- 4 Understand current relevant water pollution and abstraction legislation.

Unit content

1 Understand the hydrological cycle

The hydrological cycle: main components and how water moves above, and below the earth's surface; influence of vegetation, soils and underlying geology on movement on water; physical and chemical characteristics of water; basic hydrology eg interpretation of hydrographs, rainfall variation, soil water capacity; methods of water flow measurement in channels; changes in water quality throughout the length of a river; diurnal changes in water quality and practical ramifications eg methods of predicting oxygen shortages; potential ramifications of climate change

2 Know the most common types of water pollutant in the UK

Types and sources of water pollution: surface water pollution eg oil spills, chemical spills ;ground water pollution eg pesticide run off, leaching from farm land; oxygen depleting pollution eg excess nutrients, material build up; nutrient pollution eg excess fertiliser, waste water; microbiological pollution eg human diseases, animal diseases; suspended matter pollution eg industrial waste, insoluble pollutants; chemical pollution eg metals, solvents, pesticides, petroleum based products; effects of pollutants; most common sources of water pollution in the UK (agricultural, industrial, domestic sewage, oil spillages, other land-use activities eg forestry, natural); sources, causes, effects and management of acidification and eutrophication of aquatic habitats; sources of information regarding water pollution; point and diffuse pollution sources; data sources and analysis for water resources (chemical, physical and biological); health and safety and environmental issues relating to water pollution

3 Be able to investigate the environmental impact of a selected enterprise in relation to water resources

Environmental impact: effects of enterprises on the environment eg effects of fish on their environment, combined effect of fish farm effluents on the recipient watercourse; detection and measurement of organic and inorganic pollutants eg visual methods, physico-chemical analyses, use of biotic indices; data analysis eg calculations of population sizes; methods of preventing pollutants affecting water resources eg intercepting ditches and pipes, good planning, suitable design of effluent control systems; methods used to reduce immediate environmental damage eg use of absorbent mats, booms; use of environmental impact assessment and environmental statements; health and safety

4 Understand current relevant water pollution and abstraction legislation

Relevant legislation: current legislation covering water pollution, water abstraction and effluent discharge eg Environment Act 1995, The Water Act 2003; roles of local and national government departments and agencies; legislative methods used to protect water catchments; process of application for water abstraction and discharge licences

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 explain the main components of the hydrological cycle [IE]	M1 examine possible changes to the water quality of a selected river as it travels from source to mouth	D1 discuss the process of acidification, its management and effects on aquatic life
P2 explain the process of the hydrological cycle in the context of a specified area		
P3 describe common types of water pollutant in the UK	M2 explain the process of eutrophication, its management and effects on aquatic life	
P4 describe likely sources of water pollutants in the UK		
P5 outline the process of eutrophication		
P6 collect relevant information from a selected enterprise relating to how it affects water resources [TW, SM, EP]	M3 compare data from different sites and suggest improvements in water pollution management	D2 present detailed and valid environmental assessment of the effects on water resources for a given enterprise.
P7 analyse and interpret information collected [CT, RL]		
P8 explain current relevant legislation in relation to the control of water pollution and water abstraction at a selected site.	M4 explain roles of local and national governments and agencies in the management of water pollution and abstraction regulation.	

PLTS: This summary references where applicable in the pass criteria, in the square brackets, the elements of the personal, learning and thinking skills. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

Delivery of this unit will involve practical assessments, written assessment, visits to suitable aquatic habitats and possibly developing links with industry for site visits and guest speakers to talk about specific locations where water monitoring and treatment are used and links to work experience placements. Unless the centre has a variety of water bodies on site, a lot of this unit will involve site visits, guest speakers and organised visits for practical work. Some of the material can however be delivered using a wide range of techniques including lectures, discussions, seminar presentations, supervised practicals and research using the internet and/or library resources. Delivery should stimulate, motivate, educate and enthuse learners.

Any site visits should be checked for suitability and a risk assessment of activities carried out. Charities that run reserves can often support visits and provide expert guidance on the specific location, as well as sometimes being able to tailor make sessions and practical work. Local water boards also have very good programmes that allow site visits, and provide expert speakers and sometimes work placements. It would be beneficial if learners and site supervisors were made aware of the requirements of this unit before any activities so that naturally occurring evidence can be collected at the time. For example, learners may have the opportunity to use data logging equipment and a variety of different probes or sampling for polluting nutrients and they should ask for observation records and/or witness statements to be provided as evidence of this. Guidance on the use of observation records and witness statements is provided on the Edexcel website.

Guest speakers would also be useful in providing background information on legal requirements and health and safety considerations when recording and checking for pollution in a body of water for example acceptable levels for effluent discharge, safe levels of chemicals, suspended matter sampling, government quality requirements.

Some of the techniques can be carried out by setting up a scenario in a lab or classroom if suitable equipment is available. Samples can be collected from a variety of sources and analysis completed in the classroom. The use of data logging equipment could be linked to a series of science- based lectures where, in a college environment, science specialists may be able to assist.

Whichever delivery methods are used, it is essential that tutors stress the importance of animal welfare, sound environmental management and the need to manage the resource using legal methods.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan gives **an indication of the volume of learning it would take the average learner** to achieve the learning outcomes. It is **indicative and is one way of achieving the credit value**.

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Topic and suggested assignments/activities and/assessment

Introduction and overview to the unit.

Assignment 1: Your New Job (P1, P2, M1, D1)

Introduction to assignment.

Topic and suggested assignments/activities and/assessment
Research, supervised practical work, site visits.
Assignment 2: Help is Needed! (P3, P4, P5, M2)
Introduction to assignment.
Guided site visits, supervised practical work, written work, research.
Assignment 3: Your Role as a Consultant (P6, P7, M3, D2)
Introduction to assignment.
Supervised practical sessions, site visits, Internet research, lectures and guest speakers, industrial placement.
Assignment 4: The Local MP (P8, M4)
Introduction to the legal assignment.
Research, guest speakers, internet research, written work.
Unit review.

Assessment

For P1 learners must explain the main components of the hydrological cycle. Evidence can be in the form of an information booklet, presentation, PowerPoint, series of annotated diagrams or seminar.

P2 requires learners to explain the process of the hydrological cycle in the context of a specified area. Evidence can be notes and observation records from a site visit, research from a site visit, or a presentation on an area learners have researched.

P3 requires learners to describes water pollution in the UK. This can be assessed by collecting evidence from discussions, presentations, a leaflet, a guide for an employer or site owner, or a new employee handbook.

For P4 learners must describe likely sources of water pollution in the UK. This can be assessed through role play of a team investigating what has happened to a site, a web page about areas that are polluted in the UK, or a flow diagram of how to identify common forms of pollution.

In P5 learners must outline the process of eutrophication. Evidence can take the form of a presentation, PowerPoint presentation, annotated poster, and leaflet or information booklet.

For P6 learners must collect relevant information from a selected enterprise relating to how it affects water resources. This would best be evidenced by photographic evidence, results tables and data, witness statements if site visits are carried out and a learner diary.

In P7 learners must analyse and interpret the information collected. This can be linked to P6 and involve explaining and discussing the information gained for P6 and representing the data in an appropriate way.

For P8 learners must explain current relevant legislation in relation to the control of water pollution and water abstraction at a selected site. Evidence can take the form of internet research, a leaflet, annotated poster, presentation, web page, a role play of a court case where a body of water has been polluted.

For M1 learners must examine possible changes to the water quality of a selected river as it travels from source to mouth. Evidence can be a set of field study notes with supporting photographs, a research project based on a site that has been visited, internet research on a site presented in written format, an annotated flow diagram, or cartoon strip about a site.

M2 requires learners to explain the process of eutrophication, its management and effects on aquatic life. Evidence can be a written piece based on a guest speaker or site visit, a page from a revision guide for fellow learners, a web page for land owners or an observed role play based on a problem between a land owner and a company.

For M3 learners must compare data from different sites and suggest improvements in water pollution management. This can be linked to P6 and P7 where the data collected can be compared to another site. Learners may choose a site that is currently managed and, using written tasks, express how this management could be applied to the site that has been studied.

M4 requires learners to explain the role of local and national governments and agencies in the management of water pollution and abstraction regulation. This can be linked to P8 and can be assessed in a similar way or as a mock interview with a government minister.

For D1 learners must discuss the process of acidification, its management and effects on aquatic life. Evidence could take the form of a pictorial presentation with notes (possibly using appropriate software), or an annotated poster or a project.

D2 is linked to P6 and P7. Learners must present detailed and valid environmental assessment effects of a given enterprise on water resources. This can be assessed in a similar way to P6 and P7 but with additional supporting written work such as a report, presentation or similar.

Programme of suggested assignments

The following table shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, M1, D1	Your New job	You have recently been promoted in your job working for the local water board and your new job involves liaising with local government, companies and the press. A big news story has broken about a company wanting to divert a river. You have been called as an expert to talk to the press.	Written tasks, presentations, interviews.
P3,P4,P5,M2	Help is Needed!	A local wildlife reserve has reported a weird scum on the surface of their lake that has a number of streams feeding into it. You must use your knowledge to identify the pollution and to help them overcome this problem.	Field notes, learner diary, poster, written tasks.
P6,P7,M3,D2	Your Role as a Consultant	A new farm/fish farm has recently been set up and as part of your role you will work with them during the set up to ensure that any potential pollution problems are dealt with and base line measurements have been taken for the company.	Data, graphs, tables, presentations, written tasks.
P8, M4	The Local MP	The local government has recently changed and the new MP has been interested in all of the recent goings on in the local area. They have asked you to visit the offices and go through the legislation that the office must be aware of and whether all the problems at local sites have been resolved.	Interview, presentations, written tasks.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC land-based sector suite. This unit has particular links with:

Level 2	Level 3
Introduction to Aquatic Ecology	Understanding Water Quality
	Undertake and Review Work Related Experience in the Land-based Industries

Essential resources

Learners will require supervised access to a selected enterprise that has an effect on water resources. Tutors should ensure they have the full cooperation and permission of the site manager to collect relevant data or samples (water and biological monitoring).

The equipment required will include normal safety gear for use in laboratories, a range of water quality analysis equipment, for example dissolved oxygen meter, thermometer and chemical test kits, water sampling equipment, aquatic flora and fauna sampling equipment, record keeping equipment and a calculator.

Tutors delivering this unit should be competent and experienced in water management.

Textbooks, IT and internet support should be available for learners to provide and underpin knowledge for the topics covered within this unit.

Employer engagement and vocational contexts

Learners would benefit from having access to a working environment. This can be achieved by creating links with local businesses or charitable organisations who may even benefit from taking on learners. Local authorities can be a useful source of information as can business education alliances. Charitable organisations can often provide guest speakers to give lectures as well as demonstrations.

Indicative reading for learners

Textbooks

Abel P – *Water Pollution Biology, 2nd Edition* (Taylor and Francis, 1996) ISBN 0748406611

Croft P – *Key to the Major Groups of British Freshwater Invertebrate Animals* (Field Studies Council, 1986) ISBN 1851531815

Davie T – *Fundamentals of Hydrology* (Taylor and Francis, 2002) ISBN 0415220297

Gilman K – *Hydrology and Wetland Conservation* (John Wiley and Sons, 1994) ISBN 0471951528

Glasson J – *Introduction to Environmental Impact Assessment* (Spon Press, 2005) ISBN 0415338360

Mason C – *Biology of Freshwater Pollution, 4th Edition* (Prentice Hall, 2002) ISBN 0130906395

Perry J and Vanderklein E – *Water Quality: Management of a Natural Resource* (Blackwell Science, 1996) ISBN 0865424691

Pillay T – *Aquaculture and the Environment, 2nd Edition* (Blackwell Publishing, 2004) ISBN 1405101679

Scottish Natural Heritage – *A Handbook on Environmental Impact Assessment* (Scottish Natural Heritage, 2006) ISBN 1853974692

Shepherd C and Bromage N – *Intensive Fish Farming* (Blackwell Science, 1992) ISBN 063203467X

Stirling H – *Chemical and Biological Methods of Water Analysis for Aquaculturists* (Pisces Press, 1999)
ISBN 0952119854

Journals

International Journal of Water (IJW)

Journal of environmental science and health

Water environment research

Websites

www.communities.gov.uk

Department for Communities and Local Government

www.defra.gov.uk

Department for Environment, Food and Rural Affairs

www.environment-agency.gov.uk

Environment Agency

www.hse.gov.uk

Health and Safety Executive

www.netregs.gov.uk

NetRegs

www.ofwat.gov.uk/

Office of Water Services

www.snh.org.uk

Scottish Natural Heritage

www.stwater.co.uk/

Severn Trent Water

www.thameswater.co.uk

Thames Water

www.water.org.uk/home/resources-and-links/links/water-operators List of water boards

Delivery of personal, learning and thinking skills (PLTS)

The following table identifies the PLTS opportunities that have been included within the assessment criteria of this unit:

Skill	When learners are ...
Independent enquirers	carrying out internet and library research and questioning experts.
Creative thinkers	suggesting improvements to techniques used in the field.
Reflective learners	evaluating completed work.
Team workers	carrying out analysis in groups
Self-managers	meeting deadlines
Effective participators	completing group tasks.

Although PLTS opportunities are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	carrying out research
Creative thinkers	applying techniques studied to the working environment
Reflective learners	suggesting improvements to techniques and sites
Team workers	practising techniques
Self-managers	producing written work on time
Effective participators	participating in team activities.

● Functional skills — Level 2

Skill	When learners are ...
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	carrying out internet research writing presentations
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	carrying out internet research on legislation researching water quality at different locations comparing data
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: <ul style="list-style-type: none"> • text and tables • images • numbers • records 	presenting written work and data
Bring together information to suit content and purpose	analysing and displaying data
Present information in ways that are fit for purpose and audience	preparing presentations
Evaluate the selection and use of ICT tools and facilities used to present information	presenting written work and data
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	using calculations in water analysis
Identify the situation or problem and the mathematical methods needed to tackle it	using formulae to calculate population size eg of indicator species, fish, micro organisms
Select and apply a range of skills to find solutions	analysing data
Use appropriate checking procedures and evaluate their effectiveness at each stage	checking data
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	analysing
Draw conclusions and provide mathematical justifications	using formulae

Skill	When learners are ...
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	producing presentations, video, blogs, and group presentations.
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	reading information as part of internet and library research
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	completing reports, diaries and other assessments.