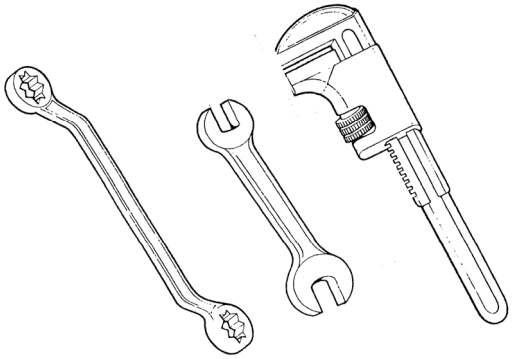
Trade of Plumbing

Module 2: Domestic Hot and Cold Water Service

Unit 7: Sources and Classification of Water Supply

Phase 2



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Document Release History

Date	Version	Comments
June 2006	V.1.0	
17/02/14	2.0	SOLAS transfer

Module 2 – Domestic Hot and Cold Water Services

Unit 7 – Sources and Classification of Water Supply

Duration – 12 Hours

Learning Outcome:

By the end of this unit each apprentice will be able to:

- Describe the sources and classifications of water supply.
- Define the terms hard and soft water.
- Describe the effects and treatment of hard and soft water.

Key Learning Points:

Sc	**Water cycle.**
Sc	**Physical and chemical properties of water, maximum density, relative density etc.**
Rk	**Sources and classification of water supply.**
Rk	**Potable water, water quality, palatable water.**
Rk	**Irish and European water regulations.**
Rk	**Local water authority bye-laws.**
Rk	**Irish building regulations and codes of practice.**
Sc	**Hard and soft water.**
Sc	**PH Scale.**
Rk	**Characteristics and effects of hard and soft water on plumbing systems.**
Rk	**Treatment of hard and soft water.**

Training Resources:

- Classroom facilities
- Information sheets, Building regulations technical guidance document G - Hygiene, local water authority by-laws.

Key Learning Points Code

M = Maths D= Drawing RK = Related Knowledge Sc = Science

P = Personal Skills Sk = Skill H = Hazards

The Chemical Properties of Water

The chemical properties of water are not so constant or easily recognised as the physical ones. This is unfortunate, since often they are not discovered until their ill effects show themselves in the form of badly corroded pipework, "furred-up" pipes and boilers, and so on. These ill effects are due to impurities, which vary according to the areas from which the water comes from, and this is one reason why the chemical properties of water are no so constant.

Water in its natural state is seldom pure. Even rainfall – the main source of natural water – absorbs gases and dust from the atmosphere through which it falls. Thus it reaches the earth not as pure H^2O but as H^2O plus other substances which are either dissolved in it, or are taken up in suspension. More impurities will be taken up from the ground on which it falls and through which it soaks before being collected and used.

Water Supply

Water supply originates in nature in the form of rain, snow and hail falling from clouds. Radiant heat from the sun causes evaporation of water from the earth's surface and the sea, thus forming clouds. The amount of water vapour that can be held by clouds depends on the temperature. When the temperature falls below the saturation point of the vapour, the clouds release the excess moisture, which fall to the earth. This process of evaporation and condensation repeated and is known as the water cycle.

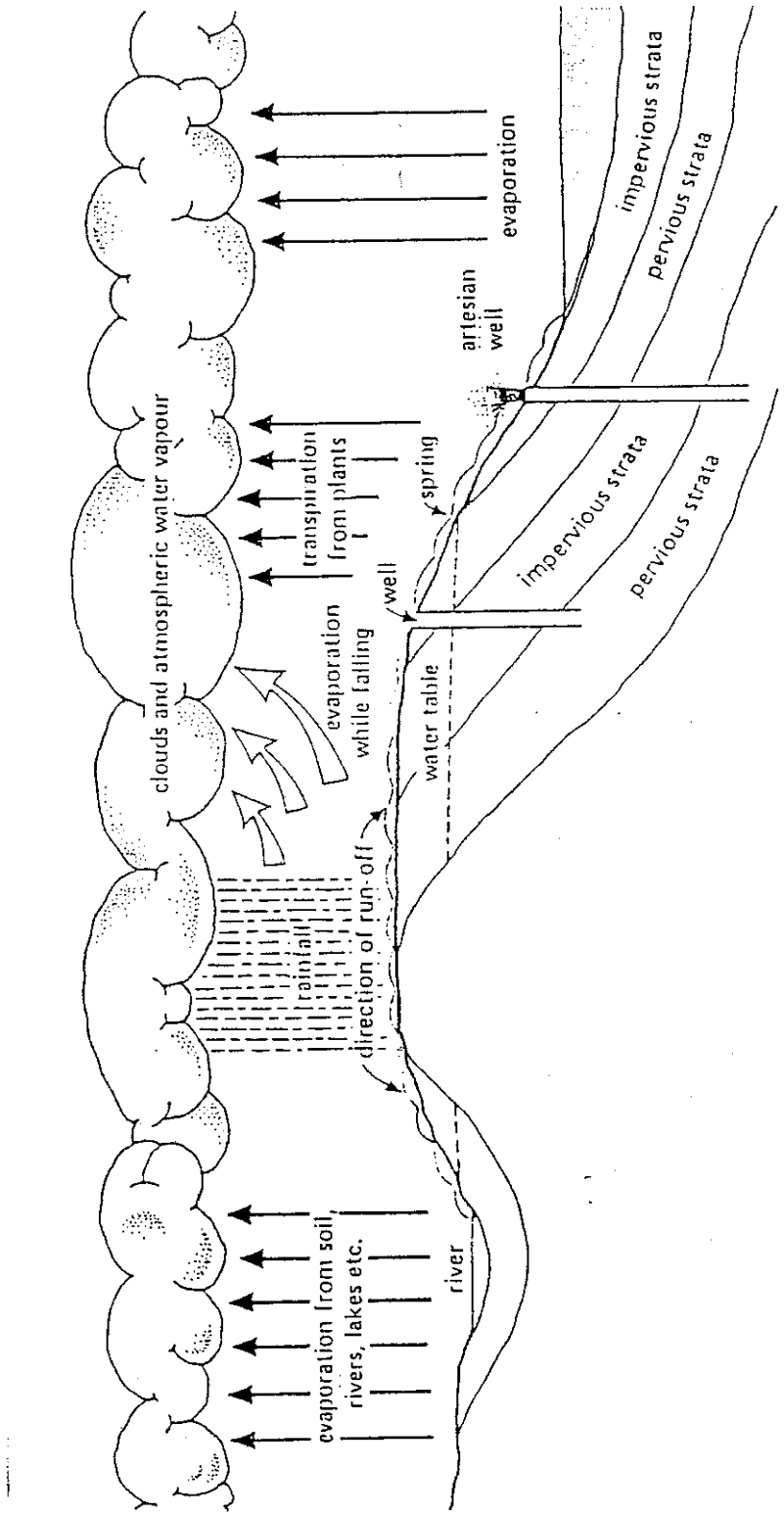

Figure 1. The Water Cycle

A plentiful supply of wholesome water is essential for the occupants of buildings intended for human habitation. Most buildings can obtain their supply from the Local Water Authorities main, but in rural areas it is sometimes necessary to obtain water from other sources such as wells, roofs and paved surfaces.

Wholesome or drinking water must be colourless, free from small suspended matter and harmful bacteria, pleasant to taste and for health reasons moderately "hard".

The following table displays the various classifications of water.

Table 1. Classifications of Water

WHOLESOME	Spring Water Deep Well Water . . . . . . Uplands Surface Water	VERY PALATABLE . . . . . . MODERATELY PALATABLE
SUSPICIOUS	Stored Rainwater Surface Water From . . . . . . Cultivated Lands	. . . . . . PALATABLE
DANGEROUS	River Water To Which Sewage Gains Access Shallow Well Water	

Hard and Soft Water

Generally, surface waters are "SOFT" and subterranean or deep waters are "HARD".

A great deal, however, depends upon the type of earth strata with which the water comes into contact.

The Two Types of Hardness

Temporary Hardness

If the water passes through strata containing a carbonate of calcium or magnesium, a certain amount of these salts will be taken into the solution, depending upon the amount of carbon dioxide present in the water. Upon being dissolved, the **carbonate** becomes **bicarbonate** due to the presence of the carbon dioxide.

This type of hardness can be removed by boiling or heating the water, hence the term "Temporary". When the water is heated the calcium or magnesium salts separate from the liquid and build up over a period of time on the inside pipes and boilers. This effect is referred to as "scaling" or "furring" and greatly reduces the efficiency of plumbing and central heating systems.

Permanent Hardness

If the water passes through strata containing calcium sulphate, calcium chloride or magnesium chloride, these salts are readily dissolved in the water without the presence of carbon dioxide. This type of hardness **cannot** be removed by boiling or heating the water and hence the term "permanent". Permanently hard water will not cause "scaling" or "furring" in domestic plumbing or central heating systems.

Hard water, whatever temporary or permanent, makes the lathering of soap difficult, and usually results in an ugly scum forming on sanitary appliances. Not only is this scum unsightly, but it can also block the pores in skin which may cause irritation. Hard water also dulls washing and can be harmful if it is not thoroughly rinsed out of clothes. The hardness of water is measured in "parts per million" or p.p.m. The general classification of hardness is given in the following table.

Table 2. General Classification of Hardness

Type of Water Hardness	Parts Per Million
Soft	0 – 50
Moderately	50 – 100
Slightly Hard	100 – 150
Moderately Hard	150 – 200
Hard	200 – 300
Very Hard	Over 300

Removal of Temporary Hardness

Temporary hardness can be removed by heating or boiling the water. When this happens in hot water systems, as it is bound to do, tiny particles of solid chalk are deposited on the inside of boilers, cylinders and their connecting pipework. These particles gradually build up layer upon layer, to form a hard, solid coating called "fur".

This is a considerable nuisance for several reasons. Firstly, "fur" deposits reduce the efficiency of hot water systems. This means that more fuel must be used to heat the water, therefore making the system more expensive to run.

Secondly, the "fur" encrustations reduce the bore of the pipes so that the water cannot circulate easily, or run freely from the taps in the right quantities. It can even block pipes, which is both expensive and dangerous. In some cases "fur" can so fill the waterways of boilers, that the water cannot come in contact with the boiler walls in order to absorb the heat from the fuel. As a result the walls get too hot and burn, and the boiler has to be replaced at considerable expense.

Temporary hardness can be removed by fitting a water softener on the incoming water main. These devices remove the harmful slats from the water thereby making it safe to use in hot water heating systems. When the "scaling" or "furring" in pipes, boilers or cylinders.

Removal of Permanent Hardness

The term "permanent" is a misnomer, and is used because this type of hardness cannot be removed by heating or boiling the water.

Although "scaling" or "furring" will not occur in pipes or boilers it is still difficult to obtain lather from soap. The hardness, however, can be removed by fitting a water softener or by the addition of sodium carbonate, sometimes called "washing soda". The sodium carbonate becomes sodium sulphate which remains in solution in the water and is harmless.

Water can be classified as Soft or Hard.

Soft Water

Slightly Acidic – lathers readily – Not very palatable as a drinking water – will corrode metals.

Hard Water

Difficult to obtain a lather – causes scum to form on water surface and plumbing fixtures – will cause furring of boilers, cylinders, pipework etc. when heated.

Soft Water

Water that is free from dissolved salts such as calcium carbonates and sulphates is said to be soft. It tends to be more pleasant to wash in and is much easier to work up a soap lather than when using hard water supplies. Soft water tends to be slightly acidic and sometimes not very palatable to drink.

Soft water may dissolve metals with which it comes into contact with. Lead is particularly vulnerable to attack from soft water, which may lead to lead poisoning. This is one reason why lead is no longer used in plumbing installations. Water that is capable of dissolving lead is said to be **plumbosolvent.**

Hard Water

There are two types of hard water:

1. Temporary
2. Permanent

Temporary Hardness can be removed:

1. By Boiling
2. By Fitting Water Softeners

Permanent Hardness can not be removed by Boiling.

Self Assessment

Exercises

1. Name three sources of potable water supply.
2. Define the terms hard and soft water.
3. Describe the effects water containing calcium carbonate will have on plumbing systems.
4. Describe how water is treated.

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