

# Yarmouth Week 1: Setting the Scene – Floods

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## What is a Flood?

A flood happens when too much water either falls onto the land as rain, overflows from rivers, is pushed onto the shore in a high tide or comes up through the ground. If this happens and the land cannot drain the water away quickly enough flooding happens.

There are several main types of flooding, these are shown below. Flooding can happen due to an individual event such as heavy rain or a combination of factors, for example, Yarmouth could be flooded as a result of a storm that caused the river to burst its bank and strong waves that flood the coast.

## 2012 The Year Britain Flooded

In 2012 Great Britain and Ireland were affected by a series of weather events that led to widespread flooding. A series of low pressure systems steered by the jet stream brought the wettest April in 100 years, with flooding across Britain and Ireland. This continued through May and led to the wettest beginning to June in 150 years, with flooding and extreme events occurring periodically. Figures published by the Environment Agency show that one in every five days saw flooding in 2012. In 2012 Environment Agency flood defences protected 200,000 homes and businesses and over 6,000 flood warnings and alerts were issued.

- Channel 4 Programme 'The Year Britain Flooded' in YouTube video - <http://www.youtube.com/watch?v=SBet9xZaiB8>.

At least 2.5 million properties in England and Wales are at risk from flooding from rivers or the sea, 1.1 million of which are also at risk of surface water flooding. A further 2.9 million properties are susceptible to surface water flooding alone.

### Discussion idea

Watch the CBBC programme – Fierce Earth flooding (27mins) - [http://www.bbc.co.uk/iplayer/episode/b01qgq8z/Fierce\\_Earth\\_Flooding/](http://www.bbc.co.uk/iplayer/episode/b01qgq8z/Fierce_Earth_Flooding/) .

## Different types of flood

### Fluvial (Rivers)

If water levels within a channel rise above that of the bank level, extensive flooding to the surrounding areas (floodplain) can occur. This usually happens after prolonged heavy rain.

- Environment Agency animation of river flooding - <http://www.environment-agency.gov.uk/homeandleisure/floods/143146.aspx>.

There are three key areas on the Isle of Wight where fluvial flood risk is greatest. These are at Ryde (Monktonmead Brook), Newport (Medina) and Freshwater (Western Yar).

## Pluvial Flood (Surface Water)

If rainfall exceeds the capacity of the local drainage system then water can begin to accumulate on the surface leading to short term flooding. Factors such as sewage blockages and poor maintenance can increase the likelihood of this type of flooding. When it cannot cope, the sewage system can overflow into the sea unless it is tidelocked and the drains and sewers can back up to the land causing dirty water to flood into homes and streets.

- Environment Agency animation of sewer flooding - <http://www.environment-agency.gov.uk/homeandleisure/floods/143144.aspx>.
- Southern water picture of how a sewer works - <http://www.southernwater.co.uk/at-home/your-wastewater/pain-in-the-drain/sewer-system.asp>.

### *Topic Idea*

Talk about how we can keep our sewers and drains clear such as not flushing items down toilets, putting cooking fat into drains, sweeping up leaves, etc. See <http://www.southernwater.co.uk/at-home/your-wastewater/pain-in-the-drain/keep-drains-clear.asp>.

## Water Table and Aquifers

The water table is a line beneath the surface of the Earth. Beneath the line, rocks and soil are full of water. The water below the water table is called an aquifer. An area's water table may rise as more water seeps downward from the surface, such as after heavy or prolonged rainfall, if the water table rises high enough it can lead to groundwater flooding. If the water table falls in a drought this can lead to rivers and streams drying out.

Lots of rain over a long period of time (months and months) fills up underground reservoirs known as aquifers. Almost the whole of the southern half of the Isle of Wight is situated over a major aquifer, whilst much of the northern half of the island consists of minor aquifers. Three quarters of the public water supply is from this groundwater. If the aquifers are full and the rain continues sometimes the groundwater levels become so high that the water can come up through the ground and cause flooding.

- Environment Agency animation of groundwater flooding - <http://www.environment-agency.gov.uk/homeandleisure/floods/144597.aspx>.

## Tidal Flood

Tidal flooding happens when flood defences (if any) are breached or overtopped, allowing water to flow to the areas behind. The main cause is a storm surge linked to stormy weather conditions and a high tide. Most coastal flooding takes place when a number of factors come together; strong winds, high tides and storms.

- Environment Agency animation of coastal flooding - <http://www.environment-agency.gov.uk/homeandleisure/floods/143152.aspx>.

On 10<sup>th</sup> March 2008, Yarmouth experienced a storm surge which led to the high spring tide predicted for just after midday being exceeded by 1.1 m (predicted height 3.0 m; observed height 4.1 m). The water rose above the harbour wall, covered the bus station car park, reached the Square, but did not go very far up the High Street. The beer cellars of The King's Head pub were flooded and the ferry terminal's computers were put out of action because their power sockets were too close to the floor (source: Yarmouth Coastal Defence Working Group).

- On 17th October 2012 a high tide brought flooding to East Cowes esplanade. See youtube video - <http://www.youtube.com/watch?v=ytRKqhUJZG8>.

## Tidelocking

Flooding can become much more likely and serious when the rivers are tide locked. This means at high tide the river water cannot flow out into the sea as it would normally do as the sea level is too high. The water has nowhere to go and bursts out of the river banks or drainage system. Yarmouth is susceptible to this type of flooding when high water levels in the River Yar coincide with high tides.

## Manmade Flood

Humans can cause floods such as when artificial structures like dams fail or reservoirs are breached. Sometimes humans deliberately flood the land, for example, in wetland habitat re-creation schemes.

- Environment Agency animation of a reservoir breach - <http://www.environment-agency.gov.uk/homeandleisure/floods/143148.aspx>.

## Extreme Weather – Superstorms and Flash Floods

Newcastle-Upon-Tyne was hit by a superstorm in June 2012 that led to widespread flooding. About 200 homes flooded after more than the average amount of rainfall for June fell in two hours. Youtube video of Newcastle flood - <http://www.youtube.com/watch?v=l4SSHppjp6Q>.

A flash flood is a quick flood caused by a sudden cloudburst or thunder storm. Huge amounts of water fall in a short time and in cities and towns the drains overflow and roads become flooded. Flash flooding can be particularly bad in summer months when there has been little rainfall and the ground is very dry and hard. The water then runs straight off the land with very little absorbed into the ground. There is similarly a problem if the ground is already saturated when heavy rain occurs. The ever-increasing amount of concrete and tarmac used in our urban areas only makes the problem worse as the water runs straight off the surface rather than sinking in. How many of you have paved or concrete front gardens rather than grass?

#### *Topic Idea*

Make a tally chart of the children's front gardens to see how many have surfaces like grass that will absorb water and how many have tarmac or concrete that water will run off.

- Photo gallery of Superstorm Sandy that hit New York in October 2012 - <http://www.telegraph.co.uk/news/picturegalleries/worldnews/9644975/Hurricane-Sandy-pictures-50-dramatic-images-of-destruction.html?frame=2384216>.
- Youtube video of flooding in London - <http://www.youtube.com/watch?v=w50r6WJVOPs>.

#### **Facts and Figures on extreme weather in 2012**

- 7,950 properties flooded
  - 78 days of 2012 saw flooding (1 in 5)
  - 95 days were officially in drought (1 in 4)
  - A hosepipe ban affected over 20 million people
- (source: Environment Agency)

#### *Topic Idea*

Draw a picture/write about the different types of flood, fluvial, pluvial, tidal, or groundwater and think about which is most likely in Yarmouth.

### **What happens in a flood?**

When land is flooded by rivers, groundwater or the sea what is normally dry land becomes underwater. How deep the flood is depends on how much rain falls, and/or how big the storm is and how quickly the land can drain the extra water away.

Floods don't only bring water onto the land, they can bring natural debris like branches and trees and man made debris like litter and sewage. Strong floods can carry objects as big as cars. Coastal floods can sweep boats onto the land and strand them.

Floods can continue to rise even after the rain has stopped. Water that falls onto higher ground can take many hours to flow downstream onto lower lying land and make the flooding worse.

Floods leave a lot of mess behind like mud and it is a big clean up job after they have gone.

- These pictures taken after the Boscastle flood in Cornwall show what devastation a flood can cause - [http://news.bbc.co.uk/1/shared/spl/hi/picture\\_gallery/04/in\\_pictures\\_flooding\\_in\\_cornwall/html/1.stm](http://news.bbc.co.uk/1/shared/spl/hi/picture_gallery/04/in_pictures_flooding_in_cornwall/html/1.stm).
- Slide show of Boscastle flood devastation - <http://www.metoffice.gov.uk/education/education/teens/case-studies/boscastle/slideshow>.

### *Topic Idea*

Draw a picture of your school/street/local park before a flood, during a flood then after a flood.

## How often does it flood?

Flooding is very closely linked to the weather and seasons. Most floods take place in the winter months when lots of rain falls and our country is hit by winter storms. However, many people think that as our climate changes we will have more storms in the summer too. Melting snow can also cause flooding.

Some areas of land are flooded regularly and are called flood plains. The tide goes up and down in patterns daily, monthly and annually and rivers swell and contract many times in one year and flood this land. We think in terms of an annual flood plain which we know will get wet annually. This means there is a 100% chance it will happen every year. The Environment Agency has worked out an extreme flood plain called Flood Zone 2 (a 1-2% chance of flooding in any one year) for all English coastal areas and rivers. This shows where there is an extreme chance that it could flood and as a result the Environment Agency believe that we should be prepared for flooding just in case.

- Environment Agency Flood Risk Map - [http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=\\_e&topic=floodmap](http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=floodmap).

An organisation called the Environment Agency monitors the weather and tides and issues flood warnings and alerts to let people know when a flood is likely so they can prepare. They also produce maps to predict where flooding is likely to happen.

- Environment Agency page showing flood warnings - <http://www.environment-agency.gov.uk/homeandleisure/floods/31618.aspx>

Lots of people think that, as the world's climate changes we are likely to have more rainfall and storms in our country so more floods are possible. As sea levels rise this will make coastal flooding more likely.

## Sea level rise

Sea levels are predicted to rise by up to one metre over the next 100 years as a result of climate change. There are three main reasons contributing to sea level rise.

1. The first is the melting of the glacial ice sheets as a result of the climate warming on a global scale, causing the release of water that would otherwise be stored.
2. Oceans trap heat and in doing so the water warms and expands in a process called thermal expansion. Surface waters are quick to release heat; however heat absorbed into the deeper ocean takes longer to be released and is generally stored. With temperatures rising, more heat is trapped and the oceans continue to expand.
3. The third contributing factor is a process called isostatic rebound. This is the readjustment of the land masses in response to pressure exerted on the land by ice during the last glacial period. In the past much of Britain was covered by glacial ice which caused land masses to sink. As a result of the ice melt the North of the UK is slowly rising, whilst the South-East is sinking to compensate, making it appear that sea level rise is happening faster in the South.

In the future sea level rise could mean land becoming flooded permanently but will also put pressure on local drainage systems, as seawater enters culverts and drainage networks, this could lead to flooding in areas away from the immediate coast.

The best available measurement for the rate at which sea level is rising at Yarmouth, at the present time, is that obtained from tide gauge data recorded at Portsmouth. It is estimated that for Yarmouth, the rise in sea level will be:

From 2010 to 2050 - 0.27 metres

From 2010 to 2100 - 0.90 metres

(Source: Defra)

- See how the Isle of Wight formed when sea levels rose in the past using the Southern Coastal Group animation of the formation of the Solent River - <http://www.southerncoastalgroup.org.uk/solent-evolution.html>.

## Where does it flood?

Some areas are more likely to flood than others as they will be near the river or sea and the land will be low lying. Land that is below sea level is particularly at risk. The Environment Agency produces maps of flood risk areas. You can use this website to see where in Yarmouth is at risk of flooding - [http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=531500.0&y=181500.0&topic=floodmap&ep=map&scale=3&location=London,%20City%20of%20London&lang=\\_e&layerGroups=default&textonly=off](http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=531500.0&y=181500.0&topic=floodmap&ep=map&scale=3&location=London,%20City%20of%20London&lang=_e&layerGroups=default&textonly=off).

Much of the town of Yarmouth and the surrounding area lays only a couple of metres above mean sea level. Every twenty years or so the coincidence of a Storm Surge with a high Spring Tide brings the sea over the harbour wall and causes flooding. To date the effects of such flooding have been minor but, with sea level predicted to rise at increasing rates in the coming century, flooding will become more serious and more frequent (source: Yarmouth Coastal Defence Working Group).

## What are tides?

Tides are the rise and fall of sea levels caused by the gravitational effects exerted by the Moon and the Sun and the rotation of the Earth. In coastal areas like Yarmouth when the tide is high flooding is much more likely.

At Yarmouth there are two high tides and two low tides each day, visit <http://www.tidetimes.org.uk/yarmouth-tide-times> to see when they happen. At high tide the water will come all the way to the top of the shore and at low tide the sea will be at its furthest away from the shore. The piece of land between where the high and low tides fall is called the intertidal zone.

### Topic Idea

Work out when high and low tide will be on a certain day in Yarmouth. To do more you can plot a graph of how the tide changes in Yarmouth over the course of a week.

There are two special types of tides called spring and neap tides. Spring tides happen when the moon is full or new. At these times, the high tides are very high and the low tides are very low. During the moon's quarter phases there is a smaller difference between high and low tides and this is known as a neap tide. Neap tides are especially weak tides.

Flooding is more likely to happen at the time of high spring tides as this is when the water comes its furthest up the shore.

A tide gauge is an instrument used for recording water height, tide height and water levels in both fresh and sea water.

- Animation of spring and neap tides - [http://oceanservice.noaa.gov/education/kits/tides/media/supp\\_tide06a.html](http://oceanservice.noaa.gov/education/kits/tides/media/supp_tide06a.html).

### Topic Idea

Draw a picture of the coast showing where a low tide, high tide and storm surge tide is likely to come up too.

## Storm surges and storm tide

A storm surge is an abnormal rise of water generated by a storm's winds.

A storm tide is the water level rise during a storm due to the combination of storm surge and a high tide.

Floods are very likely when there is a storm tide as the surge of water and high tide pushes the water far up the shore. There was a big storm surge that hit New York in October 2012 and caused widespread flooding. More details at:

- <http://www.nationalgeographic.com/search/?page=1&search=superstorm+sandy&proxyreload=1>.
- <http://www.bbc.co.uk/newsround/20122403> - includes a video explanation of a superstorm

Yarmouth was last flooded in March 2008 when a 1.1m surge was experienced over a 3.1 metre tide. This was not even a Spring tide - it was the surge that made the difference and caused the flooding.

## The Coastal Zone

When looking at coastal flooding it is useful to look at the different zones that are found around the coast and how flooding and storms may affect them. Some parts of the coast may be quite resilient and other parts may flood and be damaged easily. Much also depends on whether there are man made defences in place and we will look at this in week 4.

### Offshore

We can think of the offshore zone as the area that is always covered by the sea. People use this zone for wind and wave power and to extract aggregates for the building industry. If we have more winter storms there will be impacts on these activities and a greater likelihood of damage. Changing currents and tides may also shift sediment patterns and can cause estuaries and harbours to silt up, this will mean that the harbour master may have to dredge (take out) the sediment filling the access channels to the harbour so that boats can still enter without becoming stuck. This is an expensive process. Picture of a dredger at work - <http://static.dredgingtoday.com/wp-content/uploads/2012/09/MMO-Responds-to-Isle-of-Wight-Dredging-Concerns.jpg> .

### Intertidal zone (foreshore)

Intertidal zones lie on the shore between the high and low tide water marks. Rocky shores, mudflats and sandy beaches all lie within this zone. The animals and plants that live here have to be able to adapt to being submerged in salt water and exposed to the sun at low tide. They also have to be able to survive winter storms. The intertidal zone is particularly vulnerable during winter storms and storm surges as the power of the sea can erode rocks, wash sediment away and damage man made features like sea defences and other structures like piers and jetties. As sea level rises the intertidal zone will have to move landwards.

- View picture of coastal zone - [http://www.discoveringfossils.co.uk/coastal\\_geomorphology.jpg](http://www.discoveringfossils.co.uk/coastal_geomorphology.jpg).

### *Topic idea*



Ask the children to go on a walk along the coast at Yarmouth to see what types of habitats and creatures they can find between the low tide and high tide. Also ask them to look for man made structures like promenades, piers and slipways. Ask them to think about what impact a winter storm may have on the things on their list.

### Estuary

An estuary like the Yar estuary is an inlet of the sea, into which the Western Yar flows. Fresh and saltwater mix here so there is a wide diversity of habitats and species that have adapted to this environment. Changes to the salinity (salt water content) of the estuary such as in a flood or with a high tide can impact on the plants and animals and they have to learn to adapt. Many estuaries were formed at the end of the last ice age when sea levels rose and flooded the coast.

- BBC Video clip of birds feeding on estuaries - <http://www.bbc.co.uk/nature/habitats/Estuary#p00c1p2k> .

## **Floods good or bad?**

Flood water can either be clean or dirty, salty or fresh. Salty and dirty water causes more problems and pollution of the land than clean fresh water.

In some areas it doesn't matter if it floods as the land has adapted to this and no real damage is caused. Flood plains are areas of land often next to rivers that flood very often; normally they are used for grazing animals. Increasing water levels can provide a good habitat for plants and animals as the water feeds plants. Birds especially benefit from this as they feed off the little insects on the land. Thorley Brook is a small stream by Yarmouth and when there are high water levels it makes this a good habitat.

Youtube video clip of the River Eastern Yar as it broke its banks and spilled out onto the floodplain at the Alverstone Marshes and Sandown Levels in the week before Christmas 2012 - <http://www.youtube.com/watch?v=4EHkB5rQzyg> .

Saltmarshes are areas of coast that are flooded every day by the sea and the plants and animals that live on them have adapted to this event. There are saltmarshes in the Yar estuary. Without regular flooding this habitat would not exist. In some areas we are deliberately letting the sea flood farmland to create new habitats for wildlife.

- BBC video clip about saltmarshes - <http://www.bbc.co.uk/learningzone/clips/sands-of-forvie-marshes-and-mudflats/4024.html>.
- Download <http://www.solentforum.org/resources/pdf/natcons/saltmarsh.pdf> for more information on saltmarshes in the Solent.
- Look at the Wallasea Island Wild Coast Project for an example of managed habitat recreation - <http://www.rspb.org.uk/ourwork/casework/details.aspx?id=tcm:9-235089>.

In built up areas floods can cause real problems, particularly when properties, buildings and roads become flooded. You can't live in a flooded house, go to a flooded school or go out in a car on a flooded road. What would happen to your pets and garden, how could you play with your friends?

- See <http://www.bbc.co.uk/news/uk-20485228> for a BBC News report of the impacts of flooding on communities in the southwest.

## Flooding and Habitats around Yarmouth

### *Discussion/work idea*

There are lots of different types of habitats and land use in Yarmouth, they are listed in the table below. You can print off this table and decide whether flooding may be good or bad for them. There are two types of flood water to consider in this table, freshwater from run off and river flooding and saltwater from the sea.

Habitat/land use	Freshwater flooding Good or Bad?	Saltwater flooding Good or Bad?
Urban areas		
River flood plain		
Beaches		
Saltmarsh		
Freshwater marsh		
Woodland		
Agricultural land		
Grasslands		

- To find out more about different habitat types, visit the Wildlife Trusts' Habitats Explorer pages - <http://www.wildlifetrusts.org/wildlife/habitat-explorer> .
- Information on the coastal habitats of the Isle of Wight - <http://www.wildonwight.co.uk/habitats/coast.php>.

# Week 2 – How Things Are Changing

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## Introduction

This week we are going to look at how changes to both the natural and man made environment can influence and affect flooding. We will also look at what we can do to predict what might happen by understanding the processes taking place, monitoring these and producing computer models.

The main factors that cause floods such as the weather are changing all the time; in the UK weather is very changeable and can go from snow to heatwaves, floods to droughts. Weather is what we call a dynamic process, that is it is something that changes all the time.

Tides are another example of a dynamic process as they change every single day of the year.

Most of the natural environment changes throughout the year with the seasons and changing weather and land and habitats can normally adapt to these regular changes with no negative effects.

Problems start to arise when land and habitats cannot naturally adapt to changes in weather patterns, this can happen during extreme weather events such as the heavy rainfall of 2012 or as a result of physical constraints that have been built by humans. A seawall helps to protect homes, but it also changes the sediment patterns around the coast and can cause problems such as erosion in other areas not protected by the wall.

- BBC video clip of the extreme weather events of 2012 - <http://www.bbc.co.uk/news/science-environment-20898729>.
- BBC web page – 2012 the second wettest year on record in graphics - <http://www.bbc.co.uk/news/uk-20893308>.

## Topic Idea

Study the various weather and climate data listed below.

- Met office Extreme weather events - <http://www.metoffice.gov.uk/climate/uk/extremes/>. Here you can look at the most extreme weather events for the UK including a good summary of rainfall.
- Met Office mapped climate averages - <http://www.metoffice.gov.uk/climate/uk/averages/ukmapavge.html>. These pages show a whole range of average climate conditions for the UK and clearly show regional weather variations across the UK. You could look and compare what happens on the IOW with Scotland for example.
- Met Office case studies of extreme weather events - <http://www.metoffice.gov.uk/about-us/who/how/case-studies>.
- Data on the climate of Southern England is available at <http://www.metoffice.gov.uk/climate/uk/so/>. These data sets can also be printed.

## Climate Change

The Earth's climate has changed throughout history. In the last 650,000 years there have been seven cycles of glacial advance and retreat, with the abrupt end of the last ice age about 7,000 years ago marking the beginning of the modern climate era - and of human civilization. Most of these climate changes are attributed to very small variations in the Earth's orbit that change the amount of solar energy our planet receives. The current warming trend is of particular significance because most of it is very likely human-induced and proceeding at a rate that is unprecedented in the past 1,300 years.

Earth-orbiting satellites and other technological advances have enabled scientists to see the big picture, collecting many different types of information about our planet and its climate on a global scale. Studying this climate data, collected over many years, reveals the signals of a changing climate.

- National Geographic video clip of climate change - <http://video.nationalgeographic.co.uk/video/environment/global-warming-environment/way-forward-climate/>.
- Graph of changing CO2 levels over the last 400,000 years - <http://climate.nasa.gov/evidence/>.
- BBC video class clip of causes of climate change due to position of Earth and solar energy - <http://www.bbc.co.uk/learningzone/clips/causes-of-climate-change/1491.html>.

The term climate change can be used to express how our weather patterns are changing over time. Some natural changes are normal but there is strong evidence that the impact of man's activities on our planet is causing our climate to change faster than at any other time before. It is this rate of change that is likely to cause us future problems, as our natural environment hasn't got sufficient time to adapt and evolve to these changing weather patterns. In the past when the climate changed, such as the end of the last ice age, the environment had the time and space to adapt; with man's impacts this is no longer possible in many areas. Even if we stop all greenhouse gas emissions tomorrow we will experience climate change for another 30-40 years.

There are two main causes of flooding linked to climate change, increased rainfall and rising sea levels.

Government scientists rate increased flooding as the greatest threat posed by climate change to the UK, and 2012 bore this out: on one in every three days authorities were put on heightened flood alert. Almost 8,000 homes were submerged by floodwater and the Environment Agency issued a record 1,000 flood warnings in November and December.

- BBC video clip on extreme weather events in the UK - <http://www.bbc.co.uk/news/science-environment-21658786> .

The first comprehensive climate change risk assessment for the UK identifies hundreds of ways rising global temperatures will have an impact if no action is taken. They include the financial damage caused by flooding, which would increase to £2bn-£10bn a year by 2080, more deaths in heatwaves, and large-scale water shortages by mid-century.

## Changing Weather Patterns

Climate change models predict that the temperature will rise across the UK and that it will become wetter in the summer, recently collected data appears to support this theory. During the 20th century, the annual mean central England temperature increased by about 0.9 °C. The last decade was exceptionally warm in central England by historical standards, on average about 0.78 °C warmer than the 1961-1990 average. For high temperatures, April (2011), May (2008), July (2006) and September (2006) were all record breakers.

### Topic Idea

Download the following pdf file for a map of changing temperatures in the UK and also a table of changing temperature that could be plotted as a data handling exercise - [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/48649/17-change-in-surface-temperature.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48649/17-change-in-surface-temperature.pdf).

Although the average yearly temperatures are rising a series of unusually wet and cold summers has afflicted the UK for several years. Five out of the last six years (2007-2012), have shown below-average sunshine from June to August, and in some cases well below average. All have had above-average rainfall – in some cases more than 50% above the long-term average. This shows how complex the climate can be and that lots of different factors come into play which makes accurate predictions difficult.

- See <http://www.metoffice.gov.uk/climate/uk/actualmonthly/> for time series data of temperature and rainfall in the UK.

### How is rainfall changing?

The summer rainfall (July - August) has increased dramatically in the past decade. However, there have been more subtle changes in the winter (December - March), which have seen small decreases in rainfall since the late 1970s. In the last 15 years, summer rainfall has increased year-on-year. Since 2006, summer rain has been at least 22 per cent higher than average. In the summer of 2011, rainfall was the highest since 1892. Rainfall for summer 2012 was even higher.

### Topic Idea

Download the following pdf file for a map of changing rainfall in the UK and also a table of changing rainfall that could be plotted as a data handling exercise - [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/48653/17-23-summary-report-precipitation.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48653/17-23-summary-report-precipitation.pdf).

The warmer the air is, the more moisture it can hold. A global temperature increase of more than 0.7 deg C (since pre-industrial times) has led to an increase of about 4-5% in atmospheric moisture. This can lead to more rain.

### A note on the Jet Stream

Jet streams are fast flowing, narrow air currents found in the atmosphere. The UK weather is strongly influenced by a jet stream and changes to its location can dramatically affect our

weather. If the jet stream shifts northwards, dry, high pressure from continental Europe gets drawn in. The absence of insulating cloud cover causes freezing winters and boiling summers. But if the jet stream shifts south, as happened in 2012, wet, stormy weather fronts from the Atlantic are channelled across the UK, and cause heavy rainfall. Many of the floods of 2012 were attributed to this change in the position of the jet stream.

- BBC Video clip and maps of the jet stream and the issues it caused in 2012 - <http://www.bbc.co.uk/news/science-environment-18868494>.

### Elsewhere in the world...

The UK has not been alone in suffering changing weather that can sometimes be extreme. In the US, the eastern seaboard has been hit by heatwaves and storms but even worse has been the "dustbowl effect" in Texas and across much of the nation's agricultural heartland. India's monsoon failed to appear on schedule, leaving millions of farmers in the subcontinent facing destitution. Floods in Beijing, after the heaviest rainfall in 60 years, caused devastation to millions.

- BBC Video clip of Beijing floods - <http://www.bbc.co.uk/news/world-asia-china-18943173>.
- Monsoon flooding in Pakistan - <http://www.bbc.co.uk/learningzone/clips/monsoon-floods-in-pakistan-causes-and-effects/10773.html>.

## Sea Level Rise

Scientists are continually trying to work out how high sea levels will rise over the coming years and they continually have to change their figures as nobody quite knows how our planet will respond to global warming. The current best guess is that relative sea level rise in London will increase by 20 to 70cm by 2095.

- BBC video clip - Evidence for global warming - sea level change - <http://www.bbc.co.uk/learningzone/clips/evidence-for-global-warming-sea-level-change/1497.html>.

Scientists estimate that for every 2.5cm sea levels rise this covers 1.25m -2.5m of beach. If the ice keeps melting, global sea level could rise more than 6 metres. That would flood many island and low lying coastal areas.

- BBC video clip on sea level rise in the Maldives - <http://www.bbc.co.uk/learningzone/clips/the-rising-sea-levels-in-the-maldives-and-attempts-to-protect-them-in-2004/3192.html>.

The rapid melting of the Arctic ice cap, which shrank to a record low in 2012, and the warming of the Atlantic ocean both contribute to sea level rise and changing weather patterns. Scientists believe that both factors contribute to rain-drenched summers in the UK. Ice melting in the Arctic has been linked to duller, wetter English summers in scientific studies.

Experts warned that the Arctic could be free of sea ice in summer within this decade. Satellite pictures of Greenland, where the ice sheet rests on land, showed more widespread melting than ever recorded. If the Arctic sea ice and ice covering Greenland were to melt, sea level would rise 6 meters. Sea ice is known to play a critical role in regulating climate, acting as a giant mirror that reflects much of the sun's energy, helping to cool the Earth.

- View NASA map of Arctic sea ice melting - <http://www.nasa.gov/topics/earth/features/2012-seaice.html>.
- Mean sea level rise in the UK (bottom graph) - <http://www.ntsrf.org/sites/ntsrf/files/pdf/images/bslindex.pdf>.

An example of a positive effect of the melting of the sea ice is that ice-strengthened vessels may be able to sail directly over the pole to take the 'northern sea route'. Supertankers and giant cargo ships could next year travel regularly between the Atlantic and Pacific Oceans via the Arctic to save time, money and emissions, say shipowners.

The warming of the North Atlantic is the second reason for rising sea levels. Water expands as it gets warmer. As the temperature of the ocean goes up, the ocean actually expands, even without adding any water from the melting ice.

#### **Topic Idea**

Use data handling to produce a table or graph to show how much beach would be covered for every 2.5cm of sea level rise, using a figure of a 2m of water covering the beach for every 2.5cm rise. Then look at an OS map of Yarmouth and use the contour lines to see how rises in sea level could flood low lying areas.

## **Climate Change Adaptation**

Climate change adaptation aims to minimise the disruption to our daily lives from our changing climate and extreme weather events by making sure that we prepare, for example, making sure new coastal footpaths can be moved inland away from the rising sea.

Defra is the government department responsible for developing a National Adaptation Programme to address the risks from climate change. The first National Adaptation Programme will be published this year and will focus on making us more resilient or 'Climate Ready' to climate change impacts.

- BBC Class video clip on designing for climate change and rising sea levels - <http://www.bbc.co.uk/learningzone/clips/waterworld/6265.html>.

#### **Discussion Idea**

Think about how average climate, such as seasonal temperature and rainfall, currently affect your life. Also consider the effects of extreme weather such as heavy rainfall, coastal flooding, droughts, very hot days and storms. How would such events affect your school? What could your school do to prepare for such events?

#### **Example of Adaptation Measures**

- Accept the impacts, and plan to move assets at risk like school playing fields inland.
- Build new flood defences, or change the location or nature of the activity. Perhaps you will have to play indoor rather than outdoor football if it rains too much and the pitches are water logged.
- Engage in a new activity, or change practices to take advantage of changing climatic conditions, warmer temperatures would be good for sun bathers and ice cream sellers, indoor attractions like soft play areas do well in wet weather.
- Use large umbrellas or sun shades in the playground in the summer. Keep a pair of wellies at school for when it rains.
- Let adults work from home during extreme weather events.
- Raise buildings off the ground, and adapt them for flooding, would you like a classroom on stilts?
- Make sure new buildings have been adapted to cope with flooding with higher electrical sockets and flood proof floors and doors.
- Use the extra water as a source of power – water mills.

#### Topic Idea

Build two lego houses, one of normal construction, include windows and a doorway. Build the second house on stilts, place in a tray of water and look at the difference. Emphasise the point that the house with stilts has been adapted to take account of climate change.

## Changing Land Use

A long time ago before Yarmouth was inhabited by humans, did it matter if it flooded? Probably not as the local environment could adapt to changes in the climate, for example forests would become grassy plains if the climate became drier.

The first settlers to Yarmouth were probably adaptable too, they would move to find food, shelter and water and their dwellings could be easily rebuilt. Everything they needed could be sourced locally so they didn't need to worry about whether the shops would be empty if the roads flooded.

Over time human settlements have become larger and more permanent and we have built the infrastructure that we need to support them such as roads and electricity networks. Due to the high demand for land we have also built houses and businesses on areas that have always been prone to flooding and we now rely on flood defences to keep them safe and dry.

- View old pictures of Yarmouth - <http://www.yarmouth-harbour.co.uk/gallery/yarmouth-in-days-gone-by/> .

The Environment Agency think that land use planning and development control will have a critical part to play in reducing the impact of flooding and the damages that result. This will particularly apply to new developments in Ryde, at Pan and Gunville in Newport, and to existing and new development in Freshwater. See if you can find these places on a map.



## Historical Maps

We can use historical maps to see how the use of land has changed over time. Find an old map and compare it with a modern day map to see what changes have taken place. Look to see if there is more or less development in Yarmouth nearer the river and coast than was there in the past.

**Resources needed: Historical map of Yarmouth and a current OS Map.**

### Discussion Idea

Ask the children to talk to their parents and grandparents about how the use of land near the river and sea has changed in Yarmouth over the years and record the memories collectively.

In the future we will have to make a choice about whether we should keep homes and businesses in areas prone to flooding or whether they should be moved elsewhere. How would you feel if you were told that your house would no longer be protected from flood waters and you had to move elsewhere?

### Discussion Idea

Ask the children to think about what buildings and infrastructure in Yarmouth may be at threat from flooding and if they could be moved elsewhere. Think about:

- Ferry service to mainland
- Ferry Linkspan & Marshalling Area
- The Harbour and facilities
- Bus & Coach Station
- Car Parks: River Road, Market & Pier Squares, the Common.
- The Fire Station
- Yarmouth Lifeboat Station
- Land use and flooding

How we use the land also makes a difference to whether a flood is likely. Trees and other vegetation are much better at absorbing the water than our roads and streets where the hard surface means that the water just runs straight down it. Many people have had their front gardens paved for parking and in urban areas this causes the rain water to flood straight into drains rather than being absorbed by the grass and plants. If the rain is heavy enough the drains can't cope and the roads flood.

Shrubs and plants create buffers to prevent runoff from seeping into flood plains, urban areas, or other bodies of water. The thick vegetation between a river and a flood plain is called a riparian zone. Deforestation of steep slopes is a particular hazard for flash flooding, the trees would have absorbed and slowed the water flow, without them heavy rainfall can lead to flash floods in the valleys below.

### **Discussion Idea**

Use google maps to look at aerial photos of Yarmouth and pick up the main land uses like agriculture, woodlands, marshes and built up areas. Think about how good each land use type would be at absorbing heavy rain.

### **Discussion Idea**

Ask the children what kind of surface they have in their garden and what they think would happen when it rains. Ask them where the best place to find puddles is and link this to different land surfaces, e.g. you find puddles on impervious surfaces like roads rather than grass.

### **Discussion Idea**

Think what may happen to outside events like the Isle of Wight festival if we have more extreme weather in the summer – see <http://www.bbc.co.uk/news/uk-england-hampshire-18539315> for a video clip of the effects of rain at the 2012 festival.

## **Wildlife and Habitats**

Estuaries and their associated habitats are a very important feature of the Isle of Wight's coastal biodiversity. They are varied in character, but all depend on a balance between sediment supply, the input of fresh and saline water and the tidal regime to maintain the specialist groups of plants and animals associated with them. The Solent Coastal Habitat Action Plan lists the following important habitats for the Island - coastal saltmarsh, mudflats, coastal vegetated shingle, coastal sand dunes, seagrass beds and saline lagoons.

The area around Yarmouth is within the Isle of Wight's Area of Outstanding Natural Beauty and is highly valued with tidal waters, mudflats, saltmarsh, wetlands, farmland and woodland all providing important habitats for wildlife. These assets are also at risk from climate change and could be lost if they are not allowed to naturally evolve and shift landwards.

This landward shift can be prevented by natural and man-made barriers such as the height of the land or flood defences leading to a loss of habitat through a process called 'coastal squeeze'. Around the Western Yar there may be a need to allow the migration of habitats inland through a process called managed realignment such as allowing tidal waters through the embankments and tidal flaps.

- See <http://vimeo.com/16467718> for video clip explaining coastal squeeze.
- Youtube video, Changing Climate, Changing Habitat - [http://www.youtube.com/watch?v=IC1\\_iZrPYWE](http://www.youtube.com/watch?v=IC1_iZrPYWE).

Managed retreat or managed realignment is seen as the only sustainable solution to sea level rise but this may result in the loss of brackish or freshwater habitats if they are not also able or allowed to migrate inland. Options for managed retreat are restricted by the large amount of coastal land that has been developed for industry or housing and is of too high an economic value to be abandoned. Decision-makers and landowners must decide what habitats to maintain and which should be sacrificed when it proves impossible to move all coastal and transitional habitats inland due to lack of space.

## Coastal Processes

The coastline is undergoing constant change due to long-term and large scale impacts of climate change, namely sea level rise, through to the day-to-day effects of waves and tidal currents. It is important to understand coastal processes so that we can manage the coast effectively and plan for flood events. Coasts are shaped by erosion, transportation and deposition (sediment and rocks being laid down). See video clips below for more details on coastal processes.

- See BBC video clip of coastal erosion at work - <http://www.bbc.co.uk/learningzone/clips/coastlines-coastal-erosion/8439.html>.
- House threatened by coastal erosion - <http://www.bbc.co.uk/learningzone/clips/a-house-threatened-by-coastal-erosion/3188.html>.
- Longshore drift - <http://www.bbc.co.uk/learningzone/clips/the-coastline-longshore-drift-and-spits/3086.html>.

### Cliff Fall and Landslips on Isle of Wight

One important consideration on the Isle of Wight arising from climate change is cliff falls and landslides. The Island saw a significant amount of rainfall over the winter 2012/13 period, with the small landslides occurring in a number of coastal areas.

In late December 2012 following a long periods of wet weather, a section of cliff near to the Hideaway Café, Shanklin fell away. As a result, the Isle of Wight Council put in place diversions for safety reasons which has meant walkers need to use the pavement next to the main road into Shanklin rather than the coastal footpath.

- View picture at <http://onthewight.com/2013/01/29/small-cliff-fall-closes-part-of-sandown-to-shanklin-esplanade/>.
- BBC Video clip of coastal erosion - <http://www.bbc.co.uk/learningzone/clips/coastlines-drastic-erosion/8434.html>.

Blackgang Chine is the location of a now-destroyed chine (a coastal ravine) in the soft cliffs about 6 miles from Ventnor at the southern tip of the Isle of Wight just below St Catherine's Down. The location is based on unstable terrain owing to the underlying clay, resulting in a succession of huge landslips giving the area a very rugged appearance. Currently the cliffs are eroding at a rate of about 3.5 metres per year, although this process is not gradual. Large areas of land tend to collapse in stages after periods of heavy rain. The areas most recent and destructive cliff falls occurred in 1928, 1961 and 1994. Continuing landslides and coastal erosion swept away the paths in the early 1900s, and have repeatedly forced the Blackgang Chine amusement park owners to move the cliff top facilities inland.

- <http://www.youtube.com/watch?v=NQ6HaD2ZLtE>.
- <http://www.invectis.co.uk/iow/blackgng.htm>.

This photo of the Totland seawall was recently taken by the Coastguard. It shows how far out the wall has been pushed following the landslip late last year. The damaged section is very dangerous and barriers and diversions remain in place for safety. See <http://www.coastalwight.gov.uk/TotlandMarch2013.htm>.

- Isle of Wight Radio youtube video of Totland landslide - <http://www.youtube.com/watch?v=in8HWaN4iY0> .

Increasing rainfall and more powerful waves are likely to make coastal landslides and cliff falls on the Island more common.

## Historical Flooding

Looking back at past flood events can help us to predict how and where future flooding may take place. The most famous historical floods in this country took place in 1953.

- BBC Video clip of flooding of Canvey Island in Essex I 1953 - <http://www.bbc.co.uk/learningzone/clips/the-impact-of-coastal-floods-on-canvey-island/7413.html>.

### Discussion idea

Use the internet and local library to research past flooding events and coastal landslides in Yarmouth. Look in particular for old newspaper articles. You could present your findings in week 5 when we talk all about Yarmouth.

## Monitoring

To know what may happen in the future as the climate changes and to predict what areas are at risk we need good scientific data over a long period of time so that we can look at trends. Collection of this data is called monitoring.

Scientists measure and monitor all sorts of different data like the temperature of the air and sea, wind strength and patterns and changes in vegetation. Scientists from all over the world collect and share this data and use it to build models of what may happen in the future.

- Use this map to see how the climate may change around the world (click on radio buttons at the top of the map to move between data sets) [http://news.bbc.co.uk/1/hi/in\\_depth/629/629/6528979.stm](http://news.bbc.co.uk/1/hi/in_depth/629/629/6528979.stm).

The Channel Coastal Observatory (CCO) is one of the organisations that gathers and monitors data on what is happening around the coast of the Isle of Wight. The data they collect includes maps of the seabed, sediment patterns around the coast, cliffs and the height of the land and depth of the sea.

- Go to [http://www.channelcoast.org/gallery/grid/surveying/topographic\\_surveys/rtk\\_gps/](http://www.channelcoast.org/gallery/grid/surveying/topographic_surveys/rtk_gps/) to see pictures of monitoring taking place.
- You can visit an interactive map of the Isle of Wight at [http://www.channelcoast.org/data\\_management/online\\_data\\_catalogue/metadata](http://www.channelcoast.org/data_management/online_data_catalogue/metadata)

[/search/index2.php](#) to view some of the data. (Nb this is too complicated for children but you can put up nicely coloured maps to show how monitoring can gather, process and plot data. In particular if you switch on the hydrographic layer it shows in pinks and reds those areas around Yarmouth that are below sea level).

## Computer Modelling

Data collected from monitoring can be used to make models of natural processes to help us predict what might happen to an area as the climate changes. This knowledge can help us plan how to adapt existing buildings and infrastructure and where to locate new development and facilities.

The only way to predict the day-to-day weather and changes to the climate over longer timescales is to use computer models. These models solve complex mathematical equations that are based on well established physical laws that define the behaviour of the weather and climate.

Now that man-made climate change is established beyond reasonable doubt and further climate change is inevitable, it is even more important to improve our climate predictions to provide the best possible information to planners and more widely. In order to do this we will continue to require the best possible science to be developed into climate models which are able to run at the highest possible resolution on some of the most powerful computers on the planet.

- Go to [http://www.bgs.ac.uk/research/climatechange/palaeo/computer\\_modelling.html](http://www.bgs.ac.uk/research/climatechange/palaeo/computer_modelling.html) to see pictures of how computer models have produced maps of past climate change.

Finally, scientists can look back at their past predictions to see if they were accurate and use the information gathered to help improve their models.

## Discussion Idea

Talk about what data it would be good to gather for Yarmouth and feed into a computer model to predict climate change.

-end-

# Week 3 - What Happens in a Flood

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## A Flood is Coming

This week we will be looking at what may actually happen in a flood, how you can prepare beforehand, what to do in a flood and the clean up needed afterwards. If you are lucky you will get some notice that a flood is on its way so that you can make preparations, if for example a winter storm is going to coincide with a high tide then you can be prepared. However sometimes floods can strike out of the blue such as in a storm surge or flash flood and you may get very little notice.

It always pays to be prepared and plan ahead so that you are ready. There are lots of things you can do to help keep damage to a minimum and keep you and your family safe.

- The Environment Agency have a series of video clips on people talking about their experiences of being flooded - <http://www.environment-agency.gov.uk/homeandleisure/floods/143403.aspx>.

## Characteristics Of Flood Water

Flood water is not clean water, it can be fresh water, sea water or sewage water and it can contain lots of different pollutants and debris depending on where it comes from. Flood water is known as 'black' water due to all these things that are in it.

- Debris – twigs, branches, litter and even shopping trolleys, road signs and bicycles
- Sediment and vegetation – mud, sand and plant matter
- Sewage
- Chemicals such as engine oil and petrol from flooded cars

Water is classified into three categories depending on how dirty it is:

- Clean: from a pipe leak
- Grey: an internal leak with some waste water such as that from a washing machine
- Black: water from an external source that will be contaminated to some degree depending on its origin. Most floodwater will be 'black' water.

## Discussion Idea

Ask the children to think about what the floodwater could contain if there was a storm surge in Yarmouth and seawater entered the town. Think about natural debris like sand, mud and vegetation and manmade debris like litter, road signs, street furniture. Also think about drains, how would they flush the toilet or have a bath if there was nowhere for the water to go as the drains were full of floodwater.

- See <http://www.guardian.co.uk/environment/gallery/2009/nov/22/cockermouth-flooding-clear-up#/?picture=355926577&index=0> for pictures of flooding debris.

### **Topic Idea**

Build a lego house and put in a tray of water. Then go outside and scavenge debris like twigs, leaves and soil that you think may be in floodwater. Add to the clean water and swirl about to see what floodwater may actually look like. Drain the water away and see what mess is left.

### **Car Pollution Example**

If floodwater enters cars there are all sorts of chemicals and pollutants that could be washed out. Cars contain, oil, petrol and antifreeze and these chemicals will enter the floodwater and be washed away with it, this could cause problems for plants and animals if they become contaminated with these chemicals.

Think about what would happen if your car flooded, how would it get dried out and repaired? Do you think it would work again and if not what might happen to it?

## **Flood Preparations**

Being prepared is the best way to cope when a flood comes and minimise the damage and disruption to your life. A good start is to make a flood plan.

### **Make a Flood Plan**

Make a flood plan. If you live or work in a flood risk area, act now and plan what you would do in a flood. Don't wait until it happens as you may not have time. Completing a flood plan will help you decide what practical actions you can take before and during a flood, which will help reduce the damage flooding can cause.

If you think that flooding is going to happen, do the following:

- Monitor the Environment Agency flood warning pages - <http://www.environment-agency.gov.uk/homeandleisure/floods/31618.aspx> .
- Turn off gas, electricity and water - make sure you know how to turn off these supplies at the mains.
- Have contact telephone numbers to hand: relatives, insurance company, local authority, expert professional advisers, builders, recovery experts.
- Move irreplaceable valuables to safety.
- Make a flood kit (keep it handy).
- Have a plan for where family members and/or pets can stay if evacuation is required - does your insurance policy cover the cost of relocation?
- Photographic record of property and special belongings.
- Move vehicles to higher ground.

- Put temporary flood-protection equipment in place when there is a flood warning e.g. barriers like sandbags, airbrick covers, door gates

BBC Video clip of causes and effects of flooding -

<http://www.bbc.co.uk/learningzone/clips/river-flooding-in-britain-causes-and-effects/5865.html>

#### *Topic Suggestion:*

Download the personal flood plan template below and ask the children to fill it in, this could be done at home with their parents or alternatively as a class exercise. See

[http://a0768b4a8a31e106d8b0-](http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/geho0709bqpu-e-e.pdf)

[50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/geho0709bqpu-e-e.pdf](http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/geho0709bqpu-e-e.pdf).

## **Keeping safe in a flood**

### **What to do if your House is Being Flooded**

There are some important points to remember if water is entering your house.

- Make safe/turn off gas/electric/water supplies when floodwater is about to enter your home if it is safe to do so
- Do not touch sources of electricity when standing in floodwater
- Floodwater can rise quickly – stay calm and reassure those around you. Call 999 if you are in danger
- Floodwater is dirty and dangerous – keep children, pets and vulnerable people away from it
- Wash your hands thoroughly if you come into contact with floodwater. Use anti-bacterial hand gel as the water supply may be contaminated
- If floodwater rises higher than one metre you should allow water to enter the property to reduce the risk of structural damage
- Evacuate when told to – listen to the advice of the emergency services.

#### *Topic Suggestion*

Make a poster to give people advice on what to do if their house is being flooded (see list above). The poster could feature the flood character. Could these be put in the local library or other civic building?

- BBC video clip of recent flooding of properties in Devon and Cornwall - <http://www.bbc.co.uk/news/uk-england-21906397> .

### **Emergency Flood Kit**



Having an emergency flood kit to hand is invaluable if your house is being flooded. Leave it somewhere safe and then you will have it to hand if you need it. Things to include are:

- Torch and spare batteries
- Portable, battery-operated radio and spare batteries
- First-aid kit
- Essential medicines
- Essential toiletries and anti-bacterial no-water gel
- Camera to photograph damage
- Cash and credit cards
- Warm and waterproof clothing and footwear
- Mobile phone and charger
- Insurance documents
- Camping gas stove
- Food and hot drink supplies
- Water purification tablets
- Warm clothing and blankets
- Proof of identity – passport/driving licence.

### *Topic Suggestion*

Make a class flood kit. If you haven't got some of the actual items, can you make them out of paper or cardboard or draw a picture of them?

### **Going Outside in a Flood**

You have to be very careful when going out into a flooded street or park as you don't know how deep the water is, what other objects are floating around in the water or whether there are holes in the ground where man hole covers have lifted. It is easy to get stuck or stranded. The water will also be dirty so you don't want to get any in your mouth, nose or eyes and you must wash your hands if you have been in flood water.

On the coast big waves can unexpectedly hit the shore in a storm and sweep things into the sea, there may also be debris in the water or air. You need to be very careful going near the shore in a storm. Image of a storm wave -

[http://i.telegraph.co.uk/multimedia/archive/01587/storm23\\_1587918i.jpg](http://i.telegraph.co.uk/multimedia/archive/01587/storm23_1587918i.jpg) .

Environment Agency advice on keeping safe:

1. Six inches of fast flowing water can knock you over.
2. Two feet of water will float your car.
3. Flooding can cause manhole covers to come off, leaving hidden dangers.
4. Don't walk or drive through flood water.
5. Don't let children play in flood water.
6. Don't walk on sea defences or riverbanks.
7. When water levels are high be aware that bridges may be dangerous to walk or drive over.

8. Culverts are dangerous when flooded. A culvert is a drain or pipe that allows water to flow under a road, railroad, trail, or similar obstruction.
9. Look out for other hazards such as fallen power lines and trees.
10. Wash your hands thoroughly if you touch floodwater as it may be contaminated.

### **Topic Suggestion**

Draw a picture of the flood character dressed for going out in a flood and write some rules about what it should and shouldn't do when going outside.

### **Where would I get Clean Water from?**

The quality of tap water is the responsibility of your local water company. Usually, in a flood the water supply and distribution network are unaffected and so it is safe to drink the water. If for any reason it is not safe to drink, the water company will inform you.

If there is evidence or concern that the tap water may be contaminated, boil and cool it before using it to wash food that won't be cooked, such as fruit or salad. It is safe to use unboiled tap water in the preparation of food which is to be cooked. It is also safe to use unboiled tap water for cooking if it will be boiled during the cooking process.

Water companies have a duty to take all necessary steps to protect public health. If a water treatment works becomes flooded, for example, alternative supplies will be made available, such as by bottled water or water bowser, but in the meantime you may be advised to boil water before drinking or temporarily stop using water for household purposes. For Yarmouth the company is Southern Water.

### **After the Flood**

If your house has been flooded, your drains blocked and your water supply contaminated, where would you get the clean water that you need for washing, cooking and cleaning? How would you go to the toilet if yours won't work?

If the water is still in your house then you would have to move out until it goes and you can start to clean. The local council will set up emergency shelters and may well provide access to toilets and showers, either temporary ones or in public buildings. You may go and stay with friends and relatives nearby.

### **Buildings**

Before entering a flooded building you need to think about and do the following.

- Is it safe? – there may be hidden dangers and slippery surfaces in the floodwater
- Check that the electricity has been turned off at the mains before standing in any floodwater

- Wear a face mask, waterproof outerwear and gloves as floodwater may be contaminated. Stay out of affected areas as much as possible
- Unplug and remove any electrical appliances
- Take photographs or video recordings of the damage caused
- Make lists and notes of damaged items/areas to hand to the loss adjuster or claims adviser - take copies for your own records
- Open windows to reduce the humidity

Black-water contamination will almost certainly result in absorbent materials such as carpets and upholstery being removed, as de-contamination would not be cost effective unless the item was of particularly high value or of historic significance.

- Image of the inside of a flooded house and the mess caused - [http://i.telegraph.co.uk/multimedia/archive/01659/floods-toilet\\_1659840i.jpg](http://i.telegraph.co.uk/multimedia/archive/01659/floods-toilet_1659840i.jpg) .
- Flooded living room - [http://i.telegraph.co.uk/multimedia/archive/02350/gilling-west-house\\_2350066k.jpg](http://i.telegraph.co.uk/multimedia/archive/02350/gilling-west-house_2350066k.jpg) .
- Flooded kitchen - [http://www.thetimes.co.uk/tto/multimedia/archive/00081/78393191\\_flood10\\_81110b.jpg](http://www.thetimes.co.uk/tto/multimedia/archive/00081/78393191_flood10_81110b.jpg)

Once floodwater has entered a building it is almost certain to cause some damage that will require cleaning, drying and repair. However, the extent and degree of damage will depend on:

- The depth that the water reaches and its speed of flow
- The course it takes
- The length of time it remains in the building
- The type of materials used in the building
- The amount of contaminants carried by the floodwater
- The length of time it takes to start the drying process.

Damage costs increase significantly once floodwater rises above floor level and comes into contact with internal finishes, electrical sockets, kitchen fittings, carpets, furniture and personal possessions. Flood depths greater than 1 metre above floor level can cause structural damage to buildings.

Gas supplies, pipe-work and meters are normally resistant to water. During floods, however, mud and moisture can enter the burners, jets and electrical components of fires and boilers and damage them. These elements all need to be inspected, cleaned, dried and tested before re-use to make sure they are safe.

As the building and surrounding land dry out, you need to monitor the stability of the walls and floors and the integrity of the mortar joints. Any cracks that appear in foundation walls or around openings need to be investigated.

- Explore the Environment Agency's interactive flood house - [http://www.environment-agency.gov.uk/shell/Flood\\_house\\_tips.swf](http://www.environment-agency.gov.uk/shell/Flood_house_tips.swf) .
- Watch the BBC School report – 'After the Floods' - <http://www.bbc.co.uk/news/uk-england-devon-21888662> .

### *Discussion idea*

Ask the children to think about what furniture and furnishings are in their house and how floodwater could damage them. They could make a table saying whether these items could be cleaned, repaired or would need to be thrown away.

## **Insurance**

Paying for the clean up, repair and purchase of new items after a flood is very expensive. Most people have buildings and contents insurance that will cover these costs. However, it is becoming increasingly expensive and difficult to get insurance for properties in flood risk areas. If you can't get insurance it can also be difficult to sell the house if you want to move.

### *Discussion idea*

Think about how you would pay for the cost of clean up. Can you make a list of all the things that might need replacing, for example, in your living room. See if you can guess the cost of these items and add the total to see what it may cost

## **Future Property Protection**

After your house has been repaired after a flood there are things that you can consider doing to minimise the damage from a future flood. These measures can also help you get insurance.

There are two main ways to do this which should be considered together:

- Flood resistance – prevents or reduces the amount of water that gets inside the property.
- Flood resilience - reduces damage caused when flood water gets inside the property. Youtube clip of flood resilient home - <http://www.youtube.com/watch?v=BzcphvtHns4&feature=related>.

See the Environment Agency webpage on how to keep floodwater out of a property for more details - <http://www.environment-agency.gov.uk/homeandleisure/floods/106769.aspx> .

Explore the Environment Agency's interactive flood house - <http://www.environment-agency.gov.uk/homeandleisure/floods/31644.aspx#> .

### *Topic Idea*

Obtain some sandbags from the local council or Environment Agency and use them to block a doorway in the school. You could run a hose nearby to see what happens. Download the information sheet on sandbags from <http://www.environment-agency.gov.uk/homeandleisure/floods/106769.aspx> to see how to use them properly.

### *Topic Idea*

Design a new flood measure to stop water coming into a house, be inventive. Look at the National Flood Forum case studies for ideas - [http://nationalfloodforum.org.uk/?page\\_id=275](http://nationalfloodforum.org.uk/?page_id=275).

## **Wider Impacts of Flooding**

Flooding doesn't just affect buildings, it also affects the local infrastructure, farmers and the shops.

### **Infrastructure**

The November 2012 flooding brought numerous road closures due to flooding and the Exeter to London railway line was also flooded. When road and rail networks are affected people are unable to get to work and school and delivery lorries cannot bring in goods like food and petrol.

High winds in winter storms can bring power lines down and knock out people's electricity supply.

- BBC video clips of impacts on road and rail and flooded sewer (bottom two clips) - <http://www.bbc.co.uk/news/business-20900662> .

### *Discussion idea*

Ask the children how they would be affected if the infrastructure in Yarmouth became flooded, such as the ferry terminal, road and bus terminal. How would their parents get to work, what would happen if delivery lorries couldn't come across from the mainland due to damage to the ferry terminal or bad weather?

### **Agriculture**

Flooding can have big impacts on agriculture. In 2012 it's estimated that £600 million worth of crops such as potatoes and wheat was lost. The apple crop was affected and honey production dropped by around 75%. Record rainfall in 2012 has cost British farmers £1.3bn, prompting calls for government to provide insurance against extreme weather if it wants to preserve national food security.

The National Farmers Union (NFU) estimates the extreme levels of rainfall in 2012 has cost the industry £600m in lost output, especially from poor wheat and potato harvests, and

another £700m in extra costs such as feed for cattle, which could not graze in water-logged fields.

- BBC video clip of a pig farmer dealing with flooding - <http://www.bbc.co.uk/news/uk-20833524> .
- BBC video clip of potato farmers - <http://www.bbc.co.uk/news/business-20900662> .

## Retail

The timing of the November 2012 week of severe weather was significant. The last week of November is normally a very busy one for retailers. In 2012 some retailers had to close their shops due to flooding. Numbers of Christmas shoppers were down on normal figures due to shoppers having their travel plans disrupted. If you'd woken up to a flooded house for the second time in a week you probably wouldn't be in the mood for Christmas shopping.

Flooding also disrupts deliveries as lorries cannot access places, how would you feel if you couldn't get your birthday present or birthday cake as flooded roads mean they can't be delivered to the shops?

- BBC video clip – 'the wrong stock' - <http://www.bbc.co.uk/news/business-20900662>.

## Recreation

Flooding also has the potential to disrupt recreational activities, due to the flooding of facilities like village halls and sports pitches. It can also prevent people getting access to places when the roads and streets are flooded.

### Topic Idea

Make a list of lots of the different activities that you do and describe how flooding may impact on those activities (see sample table below).

Activity	Flooding impact
Travel to school	My street is flooded so I have to walk rather than go by car and I have to go the long way round so I am late for school.
Weekend football matches	
Visiting relatives	
Going shopping	
Taking my dog for a walk	

# Week 4: Planning for Floods

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## Who is responsible for managing floods?

There are lots of different organisations who are responsible for predicting, preventing and managing floods in our country. They need to work together to help manage flooding effectively and spend the money allocated on flood prevention and prediction efficiently. The money to pay for flood prevention and clean up comes from the tax payers, so your parents and guardians are funding this work through the taxes they pay.

In total the Government is to spend £294 million on flood risk management in 2013. It is estimated that for every £1 invested in flood defences this saves £8 later in clean up and repair of the damage that floods cause.

### Topic Suggestion

As a data handling exercise the children could build a table using the £1 to £8 conversion rate for a series of costs, e.g. £100, £1,000.... To gain an understanding of how much money can be saved in the long run with upfront investment.

### Department for Environment Food and Rural Affairs (Defra)

Defra is the government department with overall policy responsibility for flood and coastal-erosion risk in England. Defra funds most of the Environment Agency flood-management activities in England and provides grant aid to local authorities like the Isle of Wight Council and drainage boards to support investment in projects to manage flood and coastal-erosion risk. Defra is also the body that is responsible for the National Emergency Flood Framework for England.

For smaller schemes the Environment Agency Regional Flood and Coastal Committee (RFCC) can collect money from the council tax that your parents will pay to fund smaller schemes. Ask you parents if they knew this?

- See youtube video clip of West Wittering flood alleviation scheme that talks about cost and funding - [http://www.youtube.com/watch?v=61Bdi\\_NkG5w&list=UU8XLubOua8P9B1hT0Qb5Tbg&index=24](http://www.youtube.com/watch?v=61Bdi_NkG5w&list=UU8XLubOua8P9B1hT0Qb5Tbg&index=24) .
- BBC Video clip about flood defence funding in the UK - <http://www.bbc.co.uk/news/uk-21364056> .

### Environment Agency

It is the job of the Environment Agency to make people aware of flooding from rivers and the sea, provide flood-warning services and build and maintain flood defences.

- Environment Agency video clip of what the Agency does to help people prepare for floods - <http://www.youtube.com/watch?v=mteDer6-L8M&list=UU8XLubOua8P9B1hT0Qb5Tbg&index=19> .

### Water companies

These companies are responsible for the supply of clean water and the treatment and disposal of sewage. They are also responsible for public sewers and the maintenance and

function of this infrastructure. Water and sewerage companies are responsible for managing the risk from sewer flooding.

### ***Local authorities***

Local councils are the first port of call for advice and guidance on flooding issues local to you. For Yarmouth it is the Isle of Wight Council. In an Emergency, the Isle of Wight Council will assist by issuing sandbags. These are provided primarily, to stop the flooding of properties by water running off the highway.

The Isle of Wight Council is also responsible for developing, maintaining and applying a strategy for local flood risk management and for maintaining a register of flood risk assets. They also have lead responsibility for managing the risk of flooding from surface water, groundwater and ordinary watercourses.

### ***National Flood and Coastal Erosion Risk Management Strategy – England***

The National Flood and Coastal Erosion Risk Management Strategy for England was issued on the 18 July 2011 and it provides a national framework for local communities to develop local partnerships and solutions to the flood and coastal erosion risks they face.

### ***Property Owners***

Home owners and businesses are responsible for their own premises and making sure that they have the necessary equipment and advice to deal with a potential flood.

## **Flood Prediction**

We need to be able to predict where and when floods are likely to occur so that we can make sure that we don't build on vulnerable land and that land at risk is adequately protected. To do this we need to have good information on lots of different topics like rainfall, tides, land use and flood defences.

Listed below are some of the main sources of information that we can use to help predict flood risk.

- River and sea flood maps. The Environment Agency (EA) produces flood maps to set out the risk of flooding from rivers and the sea.
- Coastal erosion risk maps. The first coastal erosion risk maps, showing predictions of the extent to which the shoreline on England and Wales may change up to around 2025.
- Flood risk information letter. The EA can provide a free letter setting out the flood risk from rivers and the sea for the area of your address.
- Reservoir flood maps. These show the areas at risk from flooding if large reservoirs (those that hold over 25,000m<sup>3</sup> of water) were to fail.
- Information about local flood risk. The Isle of Wight Council's functions include the development of local flood risk management strategies showing the extent of flood risk in the area and how it will be managed in partnership with others.
- Information about sewer flooding. Water and sewerage companies are responsible for managing the risk from sewer flooding.
- Bespoke flood and coastal erosion risk assessments. Some commercial companies can conduct flood and coastal erosion risk assessments and sell you more localised information about the risk to your property.
- Information from insurance companies may be able to provide you with their view of your flood risk.



### Topic Idea

Write to the Environment Agency for a free letter setting out the flood risk for a specific site(s) in Yarmouth - the school, ferry terminal, etc.

## Flood Risk

Flood Risk takes into account the harm that a flood actually causes. It is a combination of the probability (likelihood or chance) of an event happening and the consequences (impact) if it occurred.

The organisations responsible for coastal risk management on the Isle of Wight are the Isle of Wight Council and the Environment Agency.

If a flood occurred in an area where there was no impact to people or property then that area would not be considered a flood risk even if flooding occurred. Areas that are most at risk are low lying densely populated urban areas next to a river or the sea.

$\text{Probability} \times \text{Consequence} = \text{Risk}$

### Discussion Idea

Look at an OS map of the Island and identify those areas that are both built up and are low lying, so may be at risk of flooding.

### Topic Idea

Ask the children to think about what buildings and infrastructure in Yarmouth may be at risk from flooding and see if they can rank the risk according to if they think it is significant, moderate or low. They could produce a table to show their findings to show in week 5.

Sample Table – Flood Risk in Yarmouth			
	Significant risk	Moderate risk	Low risk
Ferry terminal	✓		
Local library			✓

## Flood Risk on the Isle of Wight

On the Isle of Wight the Environment Agency have produced the following figures for flood risk:

- 8.0 per cent of Isle of Wight is within a flood plain
- 2,428 properties are at risk of flooding
- 43 per cent of properties in a flood zone are signed up to Flood Warning Direct (FWD). This gives people advance notice that a flood is likely so they can prepare.

The Isle of Wight is predominantly subject to fluvial and tidal flooding. Although groundwater flooding occurs, it is minimal in comparison. Flood events are typically localised - an event will often affect 10 houses or less. Records of historical flood events are limited.

Building on the flood plain, conversion from pasture to arable land and river engineering are all thought to have contributed to increased flooding over the years.

The main river catchments and their associated causes of flooding on the Isle of Wight are stated in the table below.

Catchment	Typical Cause of Flooding
River Medina	High groundwater flows at the Lukely Brook Tributary; tidal flooding; problems resulting from earlier channel modifications
Eastern Yar	Rainfall runoff; blockages at structures; high groundwater levels imposing high baseflows
Western Yar	Tidal locking; river unable to drain naturally due to flood control structures.
Monktonmead Brook	Tidal flap; sewer flooding
<i>Source: Environment Agency</i>	

The Environment Agency does a great deal of work to manage flood risk on the Isle of Wight. Most work focuses on tidal reaches of watercourses and involves regular grass and weed cutting along the river banks. Various flood alleviation schemes have also been put in place. These include a 4km stretch of the River Medina at Newport and the Lukely Brook between Towngate Bridge and Westminster Mill.

In 1968, a pumping station was built on the Monktonmead Brook at Ryde, and works have been ongoing ever since, with the intention of expanding the station as and when necessary.

- Video clip of Monktonmead Brook outfall - [http://www.youtube.com/watch?v=t\\_uNkPflizQ](http://www.youtube.com/watch?v=t_uNkPflizQ) . What do you think will happen to the water flow from this outfall in times of flood?

## Flood Mapping

Flood mapping is a key part of flood-risk management as it shows where flooding is likely to happen. In particular these maps show Flood Zones which indicate what type of development if at all might be appropriate. For instance it would not be wise to build a new doctor's surgery in an area that may be flooded regularly.

The Environment Agency puts Yarmouth as 'moderate risk of flooding'. This means that the chance of flooding each year is greater than 0.5% (1 in 200). This takes into account the effect of any flood defences that may be in this area.

## Flood Zones

People use flood zones to indicate what type of development or infrastructure can be built at a location so that houses and businesses are not built in areas at high risk.

### Flood Zone 1 – Low Probability

This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). All uses of land are appropriate in this zone.

### Flood Zone 2 – Medium Probability

This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year. Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, are appropriate in this zone. This is marked as light blue on Environment Agency maps.

### Flood Zone 3a – High Probability

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. The water-compatible and less vulnerable uses of land are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood. This is marked as dark blue on Environment Agency maps.

### Flood Zone 3b – The Functional Floodplain

This zone comprises land where water has to flow or be stored in times of flood. Only the water-compatible uses and the essential infrastructure should be permitted in this zone. It should be designed and constructed to:


- Remain operational and safe for users in times of flood;
- Result in no net loss of floodplain storage;
- Not impede water flows; and
- Not increase flood risk elsewhere.


### Topic Idea

View the flood maps for Yarmouth provided by Karen McHugh and see if you can find the different types of flood plain. To see flood defences you will need to go the Environment Agency's interactive map on coastal erosion and search for Yarmouth in the box on the rhs of the page - <http://www.environment-agency.gov.uk/homeandleisure/134831.aspx> .

The Environment Agency produces flood maps on its website and you can visit <http://www.environment-agency.gov.uk/homeandleisure/37837.aspx> to look at where you live. On this map it is possible to see these flood zones on an Environment Agency map. The map shows Flood Zone 3a in Dark Blue and Flood Zone 2 in light blue.

The map also shows the main river and the benefit of flood defences if they are in place.

The **purple line**  shows all flood defences built in the last five years to protect against river floods with a 1 per cent (1 in 100) chance of happening each year, or floods from the sea with a 0.5 per cent (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

**Hatched areas**  benefit from the flood defences shown, in the event of a river flood with a 1 per cent (1 in 100) chance of happening each year, or a flood from the sea with a 0.5 per

cent (1 in 200) chance of happening each year. If the defences were not there, these areas would be flooded.

### Topic Idea

Ask the children to set up a table that lists different types of buildings and infrastructure and whether they think these developments should be allowed to be built in the different types of flood zones (see sample below).

Development (e.g.)	Flood zone 1	Flood zone 2	Flood zone 3a	Flood zone 3b
Hospital	✓	✗	✗	✗
Bus station				
Farm				
Electricity sub station				
Sewage treatment works				

## Management Plans

There are two types of management plan that set out how we manage flooding. Catchment Flood Management Plans (CFMPs) set fluvial (river) flood policy and Shoreline Management Plans (SMPs) set coastal flood policy. Of most importance to Yarmouth is the Shoreline Management Plan as the greatest risk of flooding comes from the coast.

### Isle of Wight Shoreline Management Plan (SMP)

The location of flood defences and how they will be developed or not in the future is written in a plan called a Shoreline Management Plan. There is one of these plans for the whole of the Isle of Wight and it is written by the Isle of Wight Council. This is called The Isle of Wight Shoreline Management Plan and was agreed in 2011.

SMPs set the policy for the coastal units in the region and it is possible to set one of the following policies:

- Advance the line
- Hold the Line
- Managed retreat
- Do nothing
- Property Level Protection

For most of the area around Yarmouth it is intended to keep the existing defences in place an option known as 'hold the line'. From Sandhard to Yarmouth Pier some managed realignment may take place, this is when the sea is allowed to breach defences and make a new natural shoreline.

- Youtube animation of coastal realignment - <http://www.youtube.com/watch?v=U0WOWKciG7o>.

- Chapter of SMP relevant to Yarmouth - [http://www.coastalwight.gov.uk/smp/FINAL\\_SMP\\_for\\_web/pdf\\_MainDoc/Chapter4/Chapter4\\_PDZ6\\_Dec10\\_Final.pdf](http://www.coastalwight.gov.uk/smp/FINAL_SMP_for_web/pdf_MainDoc/Chapter4/Chapter4_PDZ6_Dec10_Final.pdf). This contains lots of text but is worth looking at or printing for the maps that it contains.
- Isle of Wight SMP summary leaflet - [http://www.coastalwight.gov.uk/smp/DRAFT%20SMP%20FOR%20WEB/SMP\\_Leaflet.pdf](http://www.coastalwight.gov.uk/smp/DRAFT%20SMP%20FOR%20WEB/SMP_Leaflet.pdf). Contains a useful map of the Island showing the sea defences.

The SMP has the following table that summarises the management options for Yarmouth in the short, medium and long term.

Preferred Management Option for Yarmouth in the SMP	
From present day	To maintain and improve defences around Yarmouth against tidal flooding and erosion. Allow natural adaptation within the Western Yar Estuary. Develop plans to restore the natural behaviour of Thorley Brook and Barnfields Stream. Continue flood defence at the Causeway.
Medium term	To maintain and improve defences around Yarmouth. Allow natural adaptation within the Western Yar Estuary, including Thorley Brook and Barnfields Stream, allowing adaptation of habitats. Maintain and improve flood defence at the Causeway.
Long term	To maintain and improve defences around Yarmouth. Allow natural adaptation within the Western Yar Estuary. Maintain flood defence at the Causeway.

#### *Topic idea*

Have a look at the maps in the IOW shoreline management plans to see what they tell us about the defences around the Island and what it is intended to do in the future. **Hard copy of SMP needs to be supplied to the school.**

### West Wight Coastal Defence Strategy

Coastal Defence Strategies (now called Flood Risk Management and Erosion Strategies) are produced to take forward the detail of SMPs for a smaller area. The Isle of Wight Council began the West Wight Strategy, which covers Yarmouth, in 2006 and public consultation was held in 2007. This strategy began to develop the ideas of how to management the coastline at Yarmouth. The strategy is now on hold and it will need to be restarted in order to develop any schemes to protect Yarmouth.

### Western Yar Estuary Management Plan

View/download at:

[http://www.iwight.com/living\\_here/environment/estuaries/images/RevisedWYEMP2004.pdf](http://www.iwight.com/living_here/environment/estuaries/images/RevisedWYEMP2004.pdf).

The Western Yar Estuary Management Plan was written in 1998 and revised in 2004. It sets out key issues, policies and actions that aim to manage the Western Yar's sensitive environment through partnership. The Plan was revised and updated through consultation with local people, organisations and authorities that sit on the Western Yar Estuary Management Committee. The key policy relevant for defending the coast is:

- Key Policy Area 2: Physical Processes. Aim: To allow the physical and other natural processes within the Western Yar to function with the minimum of human modification.

### **Discussion Idea**

Do the children agree with the statement above, or do they think that the coast should be able to change naturally and it is humans that will need to adapt and move inland. Should we defend our homes and businesses or move them?

## **Flood Defences**

### **Hard Engineering (Manmade defences)**

There are a variety of ways in which humans are trying to prevent the flooding of coastal environments. Typically this is through so called hard engineering structures such as seawalls. This armouring of the coast is used to protect towns and cities which have developed right up to the beachfront.

Hard engineering options tend to be very expensive. They are often very obvious and have a high impact on the environment. Ironically, the fact that they are very obvious makes them seem reassuring to people living near them. They look strong and thus give people confidence in them.

Hard engineering aims to completely block waves and their effects, but this can have the unfortunate side effect of causing erosion of the beach in front of them. They are typically found in seaside resorts and where roads / buildings are sited right on the shoreline. Examples of hard engineering include:

- Youtube video of Thames Barrier – a hard engineering flood defence option - <http://www.youtube.com/watch?v=w50r6WJVOPs>.

### **Seawalls**

Sea walls are man made wall structures built on or near the shoreline with the purpose of absorbing storm wave energy to protect the land or an area of water behind the wall from erosion. The purpose of a seawall is to protect areas of human habitation, conservation and leisure activities from the action of tides and waves.

- View picture of seawall at Ventnor - <http://en.wikipedia.org/wiki/File:Seawallventnor.jpg> .

### **Wooden Groynes:**

- Look like wooden “fences” that are built down the beach, at built at right angles to the coastline.
- They are designed to stop sand and shingle being moved along the beach by long shore drift.
- They work by building up the amount of sand on the beach. The side of the groyne facing the waves suffers erosion, but the side protected from the waves allows deposition to occur and sand builds up there.
- Groynes have a life span of approximately 20 to 30 years.

### **Gabion Groynes:**

- Large steel or stainless steel mesh cages that are filled with rocks.
- They run down the beach, at right angles to the coastline.
- They function in a similar way to wooden groynes.

- Expected life span of 20 – 25 years if made from steel because they will rust. Stainless steel ones last much longer.

#### **Rock Armour / Rip Rap:**

- Large boulders, of 10 tonnes or more, are piled up along the shoreline to form a type of sea wall.

- The rocks are dumped on top of each other leaving gaps between them that allow water through. This disperses the energy of the waves and reduces their erosional power. They can be very effective.

- The boulders must be large, strong and resistant to erosion. Granite and basalt are often used. Small or weak rocks would not be able to withstand the impact from the waves and would quickly be eroded.

- See BBC video clip on the construction of coastal defences - <http://www.bbc.co.uk/learningzone/clips/coastal-management-strategies-sea-defences-and-managed-retreat/3243.html> .
- See [http://www.geography.learnontheinternet.co.uk/topics/coastal\\_management.html#hard](http://www.geography.learnontheinternet.co.uk/topics/coastal_management.html#hard) for photos and videos of different types of coastal defences.

#### **Soft Engineering**

Soft engineering options are often less expensive than hard engineering options. They are usually also more long-term and sustainable, with less impact on the environment. There are two main types of soft engineering.

##### **Beach Nourishment**

This replaces beach or cliff material that has been removed by erosion or longshore drift. Sand is either brought in from elsewhere, or transported back along a beach, usually once a year. In tourist areas this is often done during the spring after the winter storms and before the tourists arrive to enjoy the beach. Beach nourishment is a relatively inexpensive option but requires constant maintenance. The annual costs are lower than installing hard engineering options, but to keep replacing the beach material as it is washed away requires annual expenditure.

- Youtube video clip of beach nourishment at Skegness - [http://www.youtube.com/watch?v=IKDAaVi-FEY&list=PLT2hg1kfUYgFdRvqsrjcW3\\_GQalWrMkw&index=5](http://www.youtube.com/watch?v=IKDAaVi-FEY&list=PLT2hg1kfUYgFdRvqsrjcW3_GQalWrMkw&index=5) .

##### **Managed Retreat**

Engineers do nothing and the coast is allowed to suffer erosion, deposition and flooding naturally. This is an option considered when the land is of low value and there are no significant risks to the people. It is very inexpensive in the short term although if land erodes there may be a need to compensate people for the loss of businesses, land and homes.

- View Environment Agency youtube video clip of Medmerry realignment scheme in Sussex - <http://www.youtube.com/watch?v=EIGZXfdvC4> .

##### **Do Nothing**

This is often in an area that is natural and it is either not appropriate or unaffordable to put in defences. It is therefore left as it is without any interference.

### **Flood defence failure**

The failure of flood defences can have serious consequences. Flood defences fail – BBC Video clip - <http://www.bbc.co.uk/news/uk-20490086>

### **Discussion Idea**

Ask the children what type of defences Yarmouth should have along its coast, should we go for hard engineering like seawalls or use nature as a natural buffer? Which would be cheaper, which would be better for nature and which would be better for people and their homes and businesses?

### **Case study - New Defences on the Island**

A major scheme to repair an important sea wall has been completed at St Helens Duver. The £1.1 million pound project included works to modify the sea wall and replace the promenade deck. The wall had deteriorated over time and required significant improvements. In January 2012, a contract was awarded to local firm Imphouse to carry out repairs which began in April.

The works involved encasing the seawall in reinforced concrete and replacing the promenade deck, over most of the 650 metre frontage. The works were carried out during the spring to avoid the main peak summer season, and winter environmental constraints relating to the feeding activities of over-wintering birds.

- Letter to residents about repairs – download and read at <http://www.coastalwight.gov.uk/sthelens/pdfs/StHelensDuverLetter26thMarch2012.pdf/>
- Isle of Wight Council Youtube video of opening of the seawall - <http://www.youtube.com/watch?v=ciZ6B53XKcA> .

### **Case Study - Monktonmead Brook**

More than £1million will be spent on flood defences at Monktonmead Brook in Ryde. Since the beginning of the winter, the brook has flooded a number of times and has been subject to flood alerts. Appraisal work is already underway in the area and design work is expected to begin later this year. The majority of the work will be carried out in 2014/15, protecting around 200 homes. The Environment Agency says shifting sands on Ryde beach have made it difficult to maintain the pipe where Monktonmead Brook flows into the Solent, across Ryde Sands. Work is expected to be carried out on the pumping station on Ryde Esplanade.

## **Flood Insurance**

In the past the Government have made an agreement with insurers to ensure that all houses at risk from flooding can be insured against damage. This agreement runs out in July and despite lots of talks between the Association of British Insurers (ABI) and the Government it has not been renewed. Many people whose houses have been flooded or whose properties are in a flood risk area are worried that they won't be able to get insurance for their homes or that insurance will be too expensive. The cost of cleaning a home up after a flood and replacing all the damaged items is very expensive and insurers can be reluctant to offer home insurance to vulnerable properties. How can people pay for the repairs to their houses that will run into thousands of pounds if they can't get insurance?



The Environment Agency can give you an Insurance Related Request (IRR) letter which some insurance companies ask for to help them consider whether they will renew your housing insurance or give you a new quote.

The standard IRR provides information about:

- Whether your property falls within or outside the area at risk of flooding
- Whether there are any defences in the area and the standard of protection that they provide
- How likely flooding is, taking into account any risk management measure such as flood defence barriers in the area
- Whether there are any plans for flood risk management measures in the area
- View BBC Video clip on flood risk and insurance - <http://www.bbc.co.uk/news/uk-politics-18739128> .

### *Discussion Idea*

Think about how you would pay for repairs and replacement items for your house if you couldn't get flood insurance. Perhaps you would have to buy second hand or go to a charity for help. The 48,000 homes affected by the 2007 floods cost, on average, between £20,000 and £30,000 to repair, while the cost to the economy was £3.2bn, according to an Environment Agency report.

## **Adaptation**

The impacts of climate change are likely to worsen many problems that coastal areas like Yarmouth already face. Shoreline erosion, coastal flooding, and water pollution affect man-made infrastructure and coastal ecosystems. Confronting these existing challenges is already a concern. Addressing the additional stress of climate change with potentially increased rainfall and storms may require new approaches and more money.

This process of planning ahead so that we are ready for climate change and its consequences like increased flooding is known as adaptation.

Many coastal communities around the world are taking actions to prepare for and adapt to the impacts of climate change. Coastal adaptation measures include a wide variety of activities that include:

- Restoring natural storm surge buffers and incorporating climate change into coastal habitat restoration plans, for example, allowing saltmarsh to move landwards
- Building, strengthening and repairing dikes, seawalls, and other structures that protect built up areas from erosion and storms
- Making sure new buildings and structures can withstand higher water levels
- Expanding setbacks (the distance between seawalls and the shoreline) and enabling wetlands and beaches to migrate inland
- Upgrading and redesigning infrastructure such as bridges, roads, culverts and stormwater systems to be higher, bigger and stronger
- Mapping coastal hazards and developing emergency response plans to deal with storms and floods

- Property Level Protection: Making buildings more resilient and resistant to flooding

### Property Level Protection: Resilience and Resistance

Resistance and Resilience are a very important part of adaptation and Shoreline Management Plans; Coastal Defence Strategies are increasingly including this as a short term policy to minimize flood risk.

**Flood resistance:** measures which prevent flood water entering the property such as door barriers and automatic air brick replacements.

**Flood resilience:** measures which aim to reduce the damage caused by flood water which has entered a property such as tiled floors and raised electricity sockets.

Look at the Insurer Aviva's website which asks its customers to think about resilience and resistance. <http://www.floodresilienthome.com/after-the-flood.html> .

### Discussion Idea

Think about buildings and infrastructure in Yarmouth like the ferry terminal, bus station, bridge, etc. and discuss how they could be adapted in the future to cope with more storms and floods.

- See how farmers in Bangladesh are already having to adapt to climate change - [http://www.youtube.com/watch?v=bWGRX\\_cH3oM](http://www.youtube.com/watch?v=bWGRX_cH3oM) .

# Week 5: All about Yarmouth

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## Introduction

This week we are going to look at Yarmouth in more detail and what the flood risks are to the town and what we may be able to do about them.

Yarmouth is an ancient harbour that has changed a lot over the years. Yarmouth has been a settlement since 991 and the harbour was once important for the export of grain, livestock and coloured sand from Alum Bay and the import of coal for the local gasworks. Yarmouth Harbour now supports a variety of commercial, fishing and leisure craft and is a gateway to the Isle of Wight being the only ferry port in the West Wight. Yarmouth Harbour Commissioners manage the harbour and its jurisdiction extends over the Western Yar estuary and out into the Solent.

The development of the harbour and changes to the estuary are connected. As Yarmouth Mill and the breakwater were built, and the harbour developed, it caused changes around the mouth of estuary that caused the water flow to slow down and the mud to build up. This provided a place for the saltmarsh plants to grow.

- More information on Yarmouth Mill - <http://www.britishlistedbuildings.co.uk/en-393272-yarmouth-mill-yarmouth-> .
- Visit the Yarmouth Harbour gallery to see lots of different pictures of Yarmouth - <http://www.yarmouth-harbour.co.uk/gallery/>.
- Historic pictures of Yarmouth - <http://www.yarmouth.shalfleet.net/> .

Yarmouth is at risk from flooding both from the River Yar (fluvial flooding) and the sea (coastal flooding). The biggest threat to the town is when a combination of factors come into play. If the River Yar is full of water after heavy rains but the water cannot flow out into the sea due to a high tide then flooding becomes a real risk. When this happens the river becomes 'tide locked' as the water cannot escape and it could burst its banks. A second major threat is if a high tide and storm surge combine to push seawater further inland than it would normally go.

Without flood protection works the Yar estuary would be open to the sea at both at its source and outflow, and there is the potential for large scale flooding of properties.

### *Discussion Idea*

Research flooding articles in the Isle of Wight County press - <http://www.iwcp.co.uk/search.aspx?s=flooding> . You could print any off that you find and make a class montage to display to the rest of the school.

## Western Yar Estuary

The Western Yar Estuary is open to the sea at Yarmouth and is protected by a narrow stabilised sand and gravel spit at Norton with a harbour wall in poor condition. The estuary is also sheltered by the town of Yarmouth, the Harbour and the ferry terminal. The estuary

runs inland 3km almost due south towards Freshwater, with approximately 9km of frontage within the estuary. There are extensive mudflats, marshes and reed beds. The estuary almost dries out at low water and effectively ends at The Causeway road bridge where there are tidal flaps. These flaps allow freshwater from the river to run out to the sea but prevent seawater entering the river.

Within the town of Yarmouth there are a large number of residential and non-residential properties that are low-lying and vulnerable to tidal flooding. A swing bridge carries the main road from Newport to West Wight communities across the estuary mouth. The seaward face of the communities of Yarmouth and Port la Salle is currently defended but is vulnerable to future coastal erosion and retreat.

#### **Topic Idea**

Use an OS map to trace or make a picture of the Yar estuary, draw in the town, the saltmarshes, major roads and bridges, etc. Colour on your map where you think flooding could occur from both the river and the sea.

#### **Topic Idea**

Find a good location (Yar Bridge?) and take some photos of the estuary at both high and low tide and look at the difference in water levels. You could also take some pictures of Thorley Brook at high and low tide. Make a list of what you can see at low tide that is covered by water at high tide.

## **Coastal Flooding**

There is significant flood risk to the town of Yarmouth due to low lying land and its coastal location. Tidal flooding has already affected the harbourside and western edge of the town and flood risk will continually increase in the future as sea levels rise. The land height of Yarmouth is relatively flat and western parts of the town are below 3m AOD (AOD for "above ordnance datum" or mean sea level).

The coastal areas of the Western Yar estuary are subject to rapid tidal currents and open sea waves which enter Hurst Narrows. The narrows are at the western entrance to the Solent between Hurst and Fort Victoria and are a narrow mile-wide section of sea. Open sea waves can be destructive in stormy conditions. Youtube video of storm waves - <http://www.youtube.com/watch?v=teo8ooXMDic>.

The Yarmouth shoreline is likely to erode at slow to moderate rates as the foreshore is narrow and provides limited protection. Immediately east of Yarmouth there is the possibility that shore erosion could cut through into the lowland valley of Thorley Brook to produce a small new tidal inlet. This could potentially link to the Western Yar estuary leaving the town of Yarmouth as an island at high tide.

#### **Topic Idea**

Look at the OS map of Yarmouth to identify low lying land close to the river and sea. Also see if you can find where the Hurst Narrows are on an OS map. If Yarmouth did become an island at high tide how do the children think this may impact on their lives?

## Yarmouth Storm Surge

On 10th March 2008, Yarmouth experienced a storm surge which led to the high spring tide predicted for just after midday being exceeded by 1.1 m (predicted height 3.0 m; observed height 4.1 m). The water rose above the harbour wall, covered the bus station car park, reached the Square, but did not go very far up the High Street. The beer cellars of The King's Head pub were flooded and the ferry terminal's computers were put out of action because their power sockets were too close to the floor. There was no damage to any of the moorings. Long term residents of Yarmouth could remember previous high tides topping the harbour wall but were somewhat vague about when they occurred. It seems that such an event occurs about every twenty years.

External visitor – older resident of Yarmouth to talk about their past experiences of flooding in the Town. Could the children visit the King's Head Pub to show where the water came up to and the impacts on the Pub?

- Look at the photographs and maps in this document - <http://www.yarmouthtowncouncil.co.uk/yarmouth-tc/UserFiles/Files/YCDWGfinalreport2010incmaps.pdf> .

Due to rising sea levels the impact of storm surges in causing floods at Yarmouth will become ever more severe as the century progresses. In the presence of a major storm surge, flooding will occur around high water. Early on in the century it will only be associated with Spring Tides, but as the century progresses it will happen at Neap Tides as well. By 2100, the combination of a high Spring Tide and sea level rise alone, i.e. without a storm surge, will result in the sea just topping the harbour wall.

- View the digital flythrough video showing coastal flooding at Yarmouth now and in the future produced by the Channel Coastal Observatory (CCO). Link will be sent to school by Sam Cope from CCO.
- View the coastal erosion map of Yarmouth that will be sent to the school from CCO.

### Topic idea

Visit the town and harbour (as a class or as homework with parents?) and see if you can make a list of all the things that may be affected or damaged if water came over the harbour wall. Think about what buildings may be flooded, street furniture washed away, overflowing drains. What about grass areas and planted beds? What might happen to the boats and pontoons and car parks?

## Flood Defences

### Existing Defences (source, Isle of Wight Shoreline Management Plan)

To the west of Yarmouth harbour, Norton Spit is a natural feature which has been stabilised by timber breastwork and extended by a rock armour breakwater. Without maintenance, the stabilisation of the spit and breakwater are expected to fail within 20 years. To the east

of the harbour, around the western edges of the town of Yarmouth (from the Castle to Thorley Brook) a series of seawalls and revetments have residual lives of 15-25 years, with the exception of two sections of steel sheet piling within the ferry terminal which are expected to last much longer.

Within the Western Yar Estuary there are scattered short lengths of wall and embankments. At the Freshwater causeway there are tidal flaps that mark the southern tidal limit.

There is an embankment which cuts off Thorley Marshes that also acts as footpath and cycle track along the east side of the Western Yar Estuary.

From Yarmouth Castle the defences are continuous until Port la Salle. There are localised land stability problems in this area and landslides could be caused by deterioration of the sea-wall.

#### **Topic Idea**

Have a walk around Yarmouth and look at the different types of coastal defences that are in place. Take some pictures of the ones that you find and make a class poster for display. Also have a look at their condition and rank them as poor, fair or good. You could make a chart of the defences and their condition on your return.

Need an external visitor to support this walk to talk about the defences.

### **Defence Options (source, Isle of Wight Shoreline Management Plan)**

There are two key documents that set out Yarmouth might be defended in the future; the Isle of Wight Shoreline Management Plan 2010 is the most recent document describing what can be afforded, and the West Wight Coastal Defence Strategy (still unfinished) which provides greater detail.

The Isle of Wight Shoreline Management Plan sets out three different options about how coastal defences in Yarmouth should be developed in the future.

Useful to have an external visitor with knowledge of the SMP to help support this section. Also let the children have a flick through a hard copy of the SMP to look at the maps.

#### **1. Do nothing (No Active Intervention)**

If the defences surrounding Yarmouth Harbour are left as they currently are, there will be an increased frequency of tidal flooding and erosion as defences fail near the harbour mouth. Within 20 years the defences and sheltering structures protecting the mouth of the estuary are expected to fail, opening up the estuary behind to wave attack. Salt water intrusion from sea level rise and increasingly frequent tidal flooding will result in changes to coastal grazing marsh and saline lagoons.

If nothing is done to protect Yarmouth and the surrounding area the communities and local businesses would suffer. Communities in West Wight may have some of their access roads cut off and the local habitats would change as the water would become more salty. Access to the footpath and cycle route bordering the estuary would be affected. There would be damage to the historic character and landscape of Yarmouth, including loss of Yarmouth Castle.

Just east of Yarmouth there is increasing potential towards the middle of this century for a breach (break) through the foreshore and embankment enabling the creation of a small tidal inlet into Thorley Brook. This may offer nature conservation benefits. This is not the preferred option.

### With Present Management

Under current management arrangements the flood defences around the Western Yar Estuary, including the breakwater, and surrounding coastline would be maintained and replaced. These structures will come under increased pressure with increased wave action and water depth but would maintain the present form and operation of the Estuary. Maintenance of the current defence levels would not reduce the present and increasing risk of flooding to Yarmouth town centre, where defence levels are already overtopped.

Within twenty years there will be a need to investigate options to provide a higher standard of protection. Towards the middle of the century rising sea levels and tidal inundation may impact upon saltmarshes within the Estuary, with coastal squeeze resulting in loss of habitat of nature conservation importance. The seawall barrier at Freshwater Bay will continue to prevent tidal inundation of the Estuary from the south and maintain the operation of the Estuary in its current sheltered form.

From Yarmouth to Port la Salle maintenance of the seawalls will prevent erosion and a marine breach through to Thorley Brook, maintaining properties and infrastructure, but the defences themselves would become increasingly exposed to wave action.

This is not the preferred option.

### Future Management

Tidal flood risk presents the main challenge to the future of this significant and historic community. To not undertake management in this area is unacceptable due to the large number of properties at risk in Yarmouth, the scale of damage to the character of the town and historic features, and the impact on key transport links. The defence structures will need to be redesigned to protect against the current and future tidal flood risk. This includes the need to consider upgrading the breakwater. The grassed amenity areas and car parks at the south-west of the town provide potential space to create raised defences. It is recommended in the SMP that of the current defences and embankments around the town of Yarmouth and the Western Yar Estuary, only those are maintained where there is a clearly justified reason and high flood and erosion risk.

### Preferred Management option set out in the Isle of Wight Shoreline Management Plan (SMP)

Preferred Action in the IOW SMP	
From present day	To maintain and improve defences around Yarmouth against tidal flooding and erosion. Allow natural adaptation within the Western Yar Estuary. Develop plans to restore the natural behaviour of Thorley Brook and Barnfields Stream. Continue flood defence at the Causeway.
Medium term	To maintain and improve defences around Yarmouth. Allow

	natural adaptation within the Western Yar Estuary, including Thorley Brook and Barnfields Stream, allowing adaptation of habitats. Maintain and improve flood defence at the Causeway.
Long term	To maintain and improve defences around Yarmouth including the breakwater. Allow natural adaptation within the Western Yar Estuary. Maintain flood defence at the Causeway.

### Discussion idea

Ask the children if they think their town should be defended into the future and if so what are the important areas and buildings to protect. Which areas could we let the sea in to? Mention costs and that someone has to pay for these new defences – the taxpayers – their parents.

## Yarmouth Breakwater

The first breakwater was built in 1847 and created a sheltered harbour which helps to protect the estuary and parts of the town from coastal flooding and erosion. The current breakwater is made from old railway line and sleepers which need to be replaced every few years. In the future the breakwater will need to be improved or replaced to cope with increased storminess and higher sea level. Yarmouth Pier and the groynes along the coast also help to break up the waves from the Solent.

Yarmouth Harbour Commissioners are thinking about the future now so that they are ready to protect the harbour and town in the future.

External visitor Chris Lisher to come and talk about the breakwater and how to protect the harbour. Also to talk about how the Harbour Commissioners are planning for coastal change.

Picture of the breakwater -

<http://www.geolocation.ws/v/W/File:Breakwater%20at%20Yarmouth%20Harbour%20-%20geograph.org.uk%20-%201706183.jpg/-/en> .

Also could use google maps for an aerial of the breakwater.

### Topic idea

How do the children think that the breakwater can protect the town from storm surges and flooding? What might the breakwater do to the incoming waves? What would happen if the breakwater failed and was breached (a hole made in it). You could ask the children to build lego houses and place in a tray of water, then simulate waves, you could then add a lego breakwater and compare the difference.

## Tidal locking

According to the Environment Agency one of the greatest threats from flooding in Yarmouth is tidal locking where the river is unable to drain naturally due to high tides and tidal sluices. The nature of the defences around the coast of the Isle of Wight means that where the rivers and sea meet the rivers are mostly protected from salty water flowing upstream by tide locked sluices. Picture of Bembridge tidal sluice -

<http://www.geograph.org.uk/photo/120708>. This gate stops sea water flowing upstream



into the river, but it also slows down the river flow and in times of heavy rain this could cause the river to flood.

#### *Topic idea*

See if you can find where the tidal flaps are for Yarmouth and perhaps go and visit them to see how they work. You could take some pictures. Hint: If you walk along the eastern side of the Western Yar for about a mile you will come to a bridge. Look for the tidal flaps.

## Fluvial Flooding

Fluvial flooding is when the flooding is from rainfall (freshwater) rather than from the sea.

Use Isle of Wight Catchment Management Plan (summary report) to support this section – for maps and pictures. Download from - <http://www.environment-agency.gov.uk/cy/ymchwil/cynllunio/127387.aspx>.

A river catchment, or drainage basin, is all the land from the mountain to the seashore, drained by a single river and its tributaries. Yarmouth lies in the Western Yar catchment (see map in above document).

#### *Discussion idea*

Watch BBC video clip about rivers from source to sea - <http://www.bbc.co.uk/learningzone/clips/the-course-of-the-river-severn-from-source-to-sea/340.html>. Using an OS map ask the children if they can find the source of the Yar and look on the map how it changes along its course. Use google maps to visit different sites along the Yar to see how it changes along its course.

There have been a number of fluvial flood events on the Island over the last century, particularly on the Western Yar, River Medina, Eastern Yar and Monktonmead Brook catchments. Of those events that were recorded, instances affecting more than 10 properties were low. The Environment Agency estimate that there are 25 to 50 properties in the Western Yar catchment at risk in a 1% annual probability river flood.

- Lake and Alverstone floods Isle of Wight, December 2012 after River Yar bursts its banks - <http://www.youtube.com/watch?v=flSsiOssKTM>.
- Flooding in the Eastern Yar river Valley, Isle of Wight - <http://www.youtube.com/watch?v=jN2VT4pRkD8>.

The key flood risk in the Western Yar catchment is river flooding in Freshwater. The river channel of the Western Yar drains a small catchment which is restricted in places and this can give rise to localised flash flooding. Nearer the coast, river flooding may be affected by high tide levels, which will get worse with a predicted future sea level rise. Only modest development is planned for now, however any new development could increase flood risk.

#### *Discussion idea*

What do you think may happen if there were no sluice gates to stop the tide rushing into the rivers? Answer – possible flooding and also changes to the surrounding river habitats as the water and soil become more saline (salty).

- Video clips of tidal sluice failure in Guyana - <http://guyaneseonline.wordpress.com/2013/03/13/sluice-gate-collapses-and-inundates-kingston-georgetown-video-updates/> .

Catchment Characteristics of the Western Yar	
River source:	Yarmouth and Freshwater
Tidal limit	Freshwater tidal flaps
Main river length (km)	11.9
Average annual rainfall (mm)	776
Total area (km <sup>2</sup> )	776
Geology	Chalk, sand/clay gravel
Approx. population	Freshwater: 5,300 and Yarmouth: 900.
Source: Environment Agency Isle of Wight CFMP	

### Topic Idea

Using the flood risk maps ask the children to think about what buildings in Yarmouth may be at risk from fluvial flooding and see if they can rank the risk according to if they think it is significant, moderate or low. They could produce a table to show their findings.

## Flooding and Water Quality

After heavy rainfall, beaches can become polluted and water quality decline for the following reasons:

1. **Pollution from sewerage** – bacteria from sewage can enter our waters as a result of system failures or overflows or directly from sewage works
2. **Water draining from farms and farmland** – manure from livestock or poorly stored slurry can wash into rivers and streams resulting in faecal material entering the sea
3. **Animals and birds on or near beaches** - dog, bird and other animal faeces can affect bathing water as they often contain high levels of bacteria (much higher than treated human waste)
4. **Water draining from populated areas** - water draining from urban areas following heavy rain can contain pollution from a variety of sources, including animal and bird faeces
5. **Domestic sewage** – misconnected drains and poorly located and maintained septic tanks can pollute surface water systems

Last year's washout summer has been blamed for a decline in the number of Isle of Wight beaches recognised for excellent bathing water quality.

Nine achieved the Marine Conservation Society's (MCS) recommended quality standard in its latest Good Beach Guide — one fewer than last year and two less than the year before. The MCS said it mirrored a national trend, caused by one of the UK's wettest summers on record. Nationally, the number of beaches receiving the top rating fell by 113, with 403 of the 754 designated UK bathing beaches having excellent water quality.

Totland Bay, Colwell Bay, Cowes, Seagrove Bay at Seaview, Whitecliff Bay at Bembridge, Yaverland, Sandown, Ventnor and Compton Bay all achieved the highest standard. Gurnard, St Helens and Bembridge achieved guideline standards, but Ryde and Shanklin only managed the lowest pass recognised by the MCS.

The MCS said the likely cause was the increased amount of bacteria and viruses, washed into our seas during heavy rain, posing an unseen danger of ear, nose and throat infections and gastroenteritis.

- Watch Environment Agency video on 'How Clean is your Bathing Water' - <http://www.environment-agency.gov.uk/homeandleisure/recreation/143125.aspx> .
- More information on water quality after heavy rain - <http://www.nhs.uk/Livewell/Healthyholidays/Pages/Cleanseas.aspx> .

#### **Discussion Idea**

Visit the Good Beach Guide website and look up the nearest ones to Yarmouth: Totland Bay and Colwell Bay - <http://www.goodbeachguide.co.uk/beach/colwell-bay> and <http://www.goodbeachguide.co.uk/beach/totland-bay> . See what information you can find out about these beaches from these pages.

## **How Might Flooding Impact on Life in Yarmouth?**

#### **Transport**

The Western Yar valley (which runs south to north through West Wight) is crossed by roads and tracks in several locations; there is potential to cut off these links during future flood events. At Freshwater Bay the A3055 coastal road links through the main town of Freshwater to the northwest. The principal road from Newport to the West Wight crosses the Western Yar estuary at Yarmouth Harbour via a swing bridge.

A coastal footpath runs around the length of this frontage. The majority of beaches are accessible via small local roads and footpaths and at Alum Bay via steep steps or a chairlift.

#### **Topic Idea**

Use the OS map to find the main roads serving Yarmouth and see how you could reach places if one of them was flooded. Could you reach them at all, could you take a detour? I.e if the A3054 was flooded at Norton, how could they get to their friend's birthday party in Freshwater?

A vehicle and passenger ferry from Yarmouth to Lymington provides a key transport link for the community, industry and tourism. Several small piers and boat moorings are located around the coastline and RNLI lifeboats operate from Freshwater Bay and Yarmouth Harbour.

- High tide hits ferry service newspaper article (and one video of floating bridge) - <http://www.iwcp.co.uk/news/news/high-tide-hits-ferry-services-46611.aspx> .

**Discussion Idea**

What could happen in Yarmouth if the ferry terminal was flooded for several days. How might this impact on the local community and visitors to the Island?

**Heritage**

The constant human occupation and historic development of the West Wight has led to a wealth of historically important buildings in the towns and villages close to the coast including one Grade I listed church, seven Grade II\* listings and 58 Grade II listings. Freshwater Bay and Yarmouth are also Conservation Areas.

Access to the Western Solent for shipping has resulted in much of this stretch of coastline being used for military defence, leaving many historic military features. The marine area surrounding this area has a notorious history of shipwrecks with 122 recorded shipwrecks and two Protected Wreck Sites.

The settlement of Yarmouth is predominantly residential, with a wooden Grade II listed pier and several cafes, and a pub within the town centre square and small shopping area. Yarmouth Castle, built by Henry VIII to defend the shore, is a popular tourist destination run by English Heritage. Yarmouth Common is a seafront green to the east of the town centre.

- To find out more on this topic download - <http://www.english-heritage.org.uk/publications/flooding-and-historic-buildings/flooding-and-historic-buildings-2nd-ed.pdf>. To look at the pictures.

**Discussion Idea**

Think about how flooding might affect the heritage of Yarmouth. Older buildings are more difficult to put in flood resilience and adaptation measures and there are also restrictions on what can be done to them so that their character is preserved. Can you make a list of old buildings in Yarmouth and see which are low lying and vulnerable to flooding.

**Recreation**

The river is popular for recreational boating and fishing as well as a hotspot for wildlife enthusiasts.

The Western Yar valley links from Yarmouth in the north to Freshwater Bay in the south where it becomes marshland. From Yarmouth to The Causeway the river is an estuarine system accessible to small crafts via the swing bridge crossing Yarmouth harbour. At the river mouth, the harbour is vital to the economy of the area both as a vehicle ferry port and as a centre for yachting.

There is a cycle route from Yarmouth and Freshwater along the old railway line on the eastern bank of the estuary. This is extremely well used by both locals and tourists and forms part of the National Cycle Network (<http://www.sustrans.org.uk/> for a map).

**Discussion idea**

How might flooding affect recreational activities in Yarmouth? Make a list of all those activities you can think of and create a table to show how flooding could affect these (see below).

How flooding could impact on recreation in Yarmouth	
Activity	Impact

Dog walking	Flooding of paths and parks mean that cannot take my dog for a walk in the park
Football	Flooded pitches mean my matches are cancelled.
Sailing	Storm damage to pontoons mean we cannot reach our boat.

### Wildlife

The Western Yar estuary is relatively natural with little development and therefore supports a wide range of coastal and estuarine habitats, particularly extensive saltmarsh and intertidal mudflats that support nationally important overwintering populations of wildfowl and waders and important breeding populations of terns, gulls and waders. To the east of the estuary the landward extent of the saltmarsh is constrained by the old railway embankment. Surrounding the saltmarshes are areas of low lying grazing marsh communities that provide high tide roosts for nationally important breeding birds.

- Visit <http://www.conservancy.co.uk/learn/wildlife/habitats.htm> for information on different coastal habitats, these pages also contain information on what might happen to habitats with coastal change. This site is for Chichester Harbour but most of the habitats also apply to Yarmouth.

### Discussion idea

The children could work in groups to select a habitat from the list in the website above (<http://www.conservancy.co.uk/learn/wildlife/habitats.htm>) and write facts about it and what could happen with coastal change. They could present their findings to each other.

## Yarmouth Coastal Defence Working Group

In 2008, Yarmouth Town Council and Yarmouth Harbour Commissioners jointly set up the Yarmouth Coastal Defence Working Group because of the community's concerns about coastal flooding and sea level rise. The group has been looking at past flooding incidents and future predictions to understand what may be happening and to look at how funding can be raised to protect the town. They produced a report and a leaflet to show the science and what could be done.

- Hand out leaflets entitled "Rising Sea Level in the Yarmouth Area" to the children (Karen McHugh to send around 20 copies).

Need visitor: (Sylvia Mence) from the Yarmouth Coastal Defence Working Group to talk about the work of the group and the development of a local community flood plan.

# Week 6: Scenario and Flood Game

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## The Flood Game

The Environment Agency has designed a flood game for primary school children. Please play this game; there are a number of things that will be needed to prepare for the game:

1. Print out the game and instructions at [http://www.solentforum.org/current/CCATCH/Yarmouth/Yar\\_school\\_pack/Environment\\_Agency\\_Flood\\_game\\_instructions\\_A4\[1\].pdf](http://www.solentforum.org/current/CCATCH/Yarmouth/Yar_school_pack/Environment_Agency_Flood_game_instructions_A4[1].pdf); print out three A3 colour copies of the board.
2. Divide into 3 groups – Red, green and blue teams.
3. Each team to bring in a dice and a counter (ideally the colour of their team)
4. Each team to bring in: A can of drink, some tinned food, warm hat, scarf and socks, a favourite item (toys).
5. A very important document.
6. First aid kit.

Play the game slowly over 40 minutes.

Afterwards spend 30 minutes discussing the game using the questions provided on the instructions.

Also spend 20 minutes on talking about what they think may need to be done in the future to stop flooding happening again.

## Yarmouth Flood Scenario

### Scenario Agenda

1. Outline aims and agenda.
2. Explain why scenario planning is a good idea.
3. Presentation on Coastal Change Yarmouth (Karen McHugh).
4. Revisit the coastal change visualisations shown in week 5 that illustrate how the coast at Yarmouth may change in the future. Download at [http://www.solentforum.org/current/CCATCH/members\\_area/Yarmouth/](http://www.solentforum.org/current/CCATCH/members_area/Yarmouth/).
5. Summary of the scenario (Karen McHugh) based on the newspaper article.
6. Workshop session 1 – issues and challenges.
7. Workshop session 2 – solutions and considerations.
8. Feedback, summary and close (Sue Hawley, Karen McHugh and Nic Barnes).

Please undertake the topic idea below on the day that the scenario flood takes place.

### Topic Idea

For homework, download this document -

[http://www.solentforum.org/current/CCATCH/Yarmouth/Yar\\_school\\_pack/Yar%20Newspaper%20Scenario.pdf](http://www.solentforum.org/current/CCATCH/Yarmouth/Yar_school_pack/Yar%20Newspaper%20Scenario.pdf). Ask the children to take it home for their parents to read and then ask them the following questions. Use data handling to process the answers and prepare a report to display at the community open day on 19<sup>th</sup> June.

Homework Questions for Parents. Suggest that the children take the table home for parents to fill in and talk their answers through with their children. These questions are available as a printable table to complete at

[http://www.solentforum.org/current/CCATCH/Yarmouth/Yar\\_school\\_pack/](http://www.solentforum.org/current/CCATCH/Yarmouth/Yar_school_pack/).

1. How long have you lived in Yarmouth?
2. Has your house or business ever been flooded?
3. Have you ever not been able to do something, e.g. work/travel/recreation due to flooding?
4. Are you worried about flooding in the future?
5. Do you know what the main flood defences are around the town?
6. Do you think that future flooding will affect your life or work? If so how?
7. Do you think that a new flood wall and breakwater should be built to protect the Town?
8. Do you think that new flood defences will make the town look ugly?
9. Do you think the people of the town would be prepared to pay for new flood defences?
10. Have you ever made any changes to your house or lifestyle to take account of possible flooding?

### Scenario Aims

We are going to make up an imaginary story about Yarmouth, which could happen in the future. If this does happen how do you think this will affect the town and the people that live and work in it?

Come up with a list of things that the community will need to think about:

- **The Issues** - a list of problems that need to be solved in the town
- **The challenges** – what problems do the issues cause for the town
- **The Solutions** - What can the community do to try and solve some of the problems.

### Resources needed

Download the following newspaper article (children's version) -

[http://www.solentforum.org/current/CCATCH/Yarmouth/Yar\\_school\\_pack/Yar%20Newspaper%20Scenario%20Child.pdf](http://www.solentforum.org/current/CCATCH/Yarmouth/Yar_school_pack/Yar%20Newspaper%20Scenario%20Child.pdf). Please note there are two versions of this article; one for homework exercise with parents and a children's version for this scenario game.

### Scenario Groups

Please divide into three teams and name yourselves the Red, Green and Blue teams. Please assign an adult and two children in each group; one child to be a scribe and the other the team spokesperson. Note – need to ensure have an adult per group for this exercise.

Read carefully through the newspaper article with your group.

### Task 1

Using the table set out below as a template, list all the issues that are raised in the article. Next write down what you think are the challenges raised by that issue. You can also write down any questions that you think need to be thought about too.

Sample Table 1. Scenario Issues and Challenges	
Issues	Challenges and Questions
Building a new higher breakwater	Can only do this if also build a wall around the town. This is really important for the harbour otherwise the boats will stop coming. Can we see if anywhere else has built a bigger breakwater and if it actually worked.

### Task 2

For table 2, take the issues that you set out in table 1 and think about possible solutions. Think about who might help with the solutions within Yarmouth and how much a solution may cost (high, medium, low). Also say if you think you need more information on anything and whether there are any questions you need answered.

Sample Table 2. Solutions	
Issues	Solutions and considerations
Building a new higher breakwater	Good idea if we can find the money (high cost) How might we pay for it? What might happen to the town when it is being built, will the harbour have to close? Do we have enough information on how big and strong to build it to last a long time?

### Reporting

When you have finished both tables ask your team spokesman to report on what you have found. As a group think about what the most important issue is in Yarmouth and make a poster to tell people in Yarmouth about this issue and how it might be addressed. Take the posters to the Yarmouth open day. You can also take your group tables along to explain to people at the drop in day all about the issues affecting Yarmouth.



## Evaluation

This section will be prepared and presented by Anita Van Mil from Resources for Change. See [http://www.r4c.org.uk/Coastal\\_Community\\_Engagement\\_in\\_Hampshire.html](http://www.r4c.org.uk/Coastal_Community_Engagement_in_Hampshire.html).

### Heart-Head-Bag-Bin Evaluation

The children could complete our Head-Heart-Bag-Bin evaluation (download at [http://www.solentforum.org/current/CCATCH/Yarmouth/Yar\\_school\\_pack/](http://www.solentforum.org/current/CCATCH/Yarmouth/Yar_school_pack/)), using a large drawing of a stick man and inviting the children by the end of week 6 to write post it notes on:

- what they have learned (stick post it on the head)
- how they feel about the project (stick post it on the heart)
- what they will take away from it and use in the future ((stick post it on carrier bag)
- what they didn't like about it and want to forget about (stick post it on the bin)

### Yarmouth Drop in Day - 19<sup>th</sup> June

The CCATCH project is holding an open day on 19<sup>th</sup> June in Yarmouth Town Hall to present the work that has been done to the community. As part of this day we would like the children to attend and take some of their work along that they have done over the project.

## Week 6 Homework Questions

The children have been asked to show their parents the following fictitious news article from 'The Yarmouth Times, 2038'. This article sets out some of the debates that the people of Yarmouth will need to think about regarding future flooding. Download at [http://www.solentforum.org/current/CCATCH/Yarmouth/Yar\\_school\\_pack/](http://www.solentforum.org/current/CCATCH/Yarmouth/Yar_school_pack/). (DOWNLOAD ADULT VERSION).

Based on the article and your knowledge, parents are asked to complete the following questions with their children. The answers will be combined by the children and presented at the Coastal Change Yarmouth open day on 19<sup>th</sup> June at Yarmouth Town Hall.

	Question	Answer	
1.	How long have you lived in Yarmouth?		
2.	Has your house or business ever been flooded?	Please circle Y/N	If yes, please say when and whether this was coastal or river flooding
3.	Have you ever not been able to do something, e.g. work/travel/recreation due to flooding?	Please circle Y/N	If yes, what was it that you couldn't do?
4.	Are you worried about flooding in the future?	Please circle Y/N	
5.	Do you know what the main flood defences are around the town?	Please circle Y/N	If yes, please can you list the ones you know.
6.	Do you think that future flooding will affect your life or work?	Please circle Y/N	If yes how?
7.	Do you think that a new flood wall and breakwater should be built to protect the Town?	Please circle Y/N	

8.	Do you think that new flood defences will make the town look ugly?	Please circle  Y/N	
9.	Do you think the people of the town would be prepared to pay for new flood defences?	Please circle  Y/N	
10.	Have you ever made any changes to your house or lifestyle to take account of possible flooding?	Please circle  Y/N	If yes, what changes have you made?

Visit [http://www.solentforum.org/current/CCATCH/Yarmouth/Yar\\_school\\_pack/](http://www.solentforum.org/current/CCATCH/Yarmouth/Yar_school_pack/) for more information.

Do you have any other comments that you would like to make about flooding in Yarmouth?

The popular coastal town of Yarmouth has recently found itself at the centre of a heated debate surrounding the management of the coast. The Isle of Wight Council has been defending their plan for the development of new coastal defences which, according to opponents, are not necessary and would ruin the charm of the town.

The Council's proposals come after a decade of uncertainty over how to respond to the problem of flood risk in Yarmouth. Fuelled by global climate change, almost half a metre of sea-level rise has combined with stormy winters creating a headache for both coastal engineers and property owners. The town floods more often than it did at the turn of century and the damage to shops and houses is expensive.

Last year a severe storm badly damaged the harbour breakwater and it is now clear that it needs to be replaced and made higher. It is estimated that this will cost £20million. A spokesperson at Yarmouth Harbour states:

*"The replacement of the breakwater can only go-ahead if other defences are built in the town. This is because if flood water is stopped in one area of the town, it must also be stopped in other areas, otherwise the water will just get through anyway. The harbour itself is now dangerous as boats are not protected from the Solent. It is essential that the breakwater is replaced to protect the harbour".*

So what other defences are proposed by the Isle of Wight Council. A spokesperson from the council states:

*"A wall needs to be built around the whole of the town between the Castle and Thorley Road and then around the back of the town to the Mill. From there the wall will need to wrap around the back of the park and join up with the back of coastguard cottages and then link along the side of Bridge Road and back to the ferry terminal. In addition the roads in and out of the town wall will need to be raised and large gates will need to be placed on the two harbour slipways." It is estimated that these defences will cost £30 million.*

The Isle of Wight Council have just completed a feasibility study exploring all the different future management options for the Yarmouth area. The controversial conclusion of the study is that the flood wall and upgraded breakwater option is the best option to protect the town.

Many at risk property owners are happy about the plans. Businesses and homeowners alike have become more concerned about flooding in the last 20 years, and although they have implemented a range of temporary resistance and resilience measures in the last 20 years, they believe that the flooding is set to get a lot worse over the next 50 years. One emotional homeowner commented:

*"Every time there is a high spring tide and a storm warning I get really worried. Last year the water came in over my front door flood gate and ruined all of my downstairs rooms".*

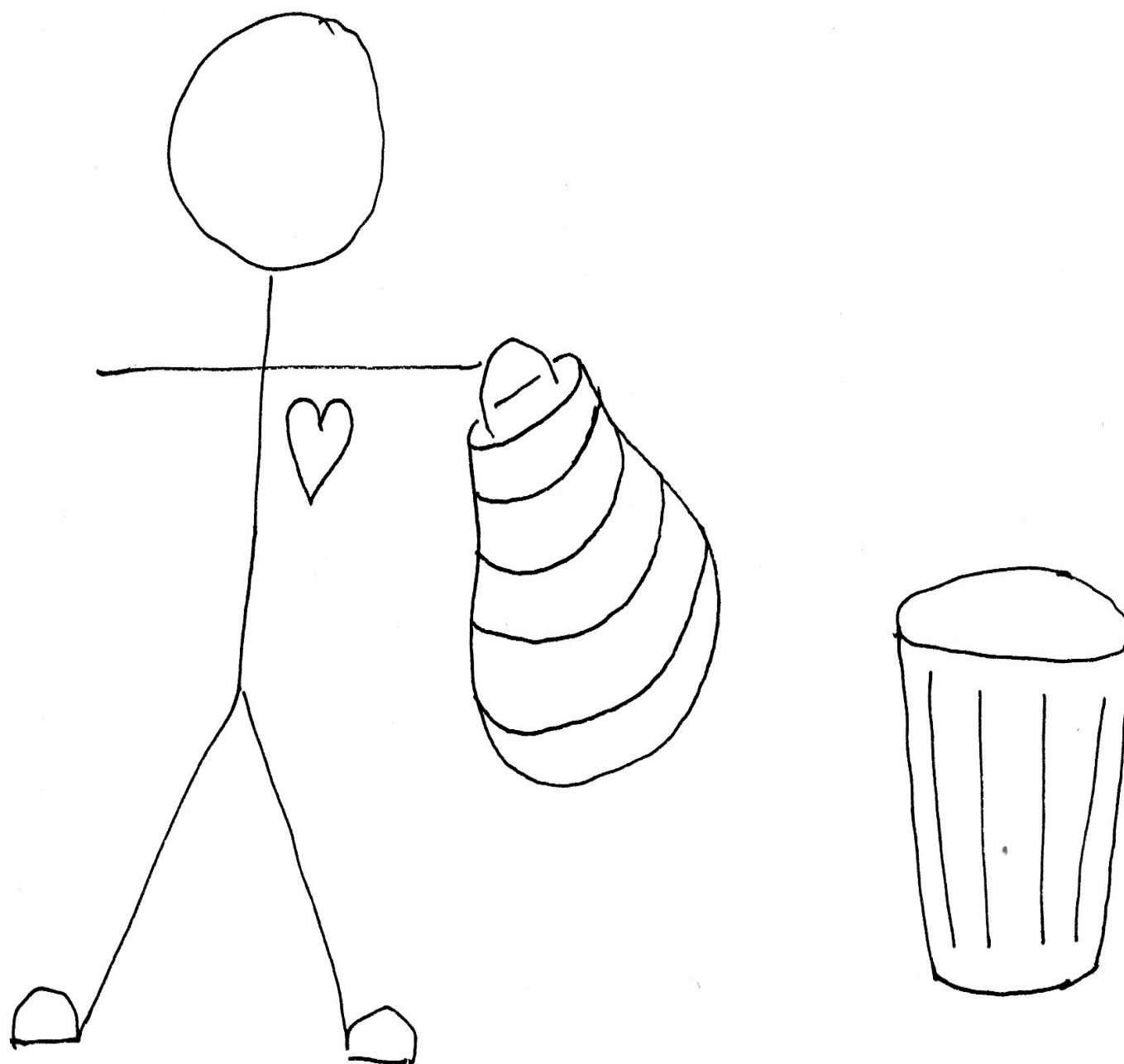
Many people in the town are very unhappy about the plans and believe that people are making too much of a fuss. One commented to say:

*"Bits of Yarmouth has always flooded on an extreme high tide. The water soon goes away and people should just put sandbags up higher. A wall will ruin the look of the town and the views and will cost far too much money".*

Opponents state that the water often enters the town from the River Yar anyway as when the tide is high the river cannot drain; this means that water comes up through the drains and from the side and the back of the town.

A town councillor has also criticised the impact of such a project on the visual environment at Swanage, pointing to the fact that a majority of the community may agree that the look of Yarmouth plays a major role in making it the important tourist destination that it is. However, this is of little consolation to home and business owners facing damage to their properties.

Wightlink the ferry operator declined to comment. Last year they were unable to dock at Yarmouth over two days due to extreme high tides and stormy conditions. The feasibility study states that if the flood gates over the slipways are operated, Wightlink would not be able to access Yarmouth unless they paid for major improvement works to the slipway and link span to prevent flooding.



# the flood game

A resource to teach 7-11 year olds about flooding



# INTRODUCTION

If you are one of the five million people in England and Wales who live in a floodplain, your home is more likely to flood than it is to catch fire. You may have a smoke alarm, and the chances are you know what to do in a fire. But are you and your family prepared for a flood? Most people think that flooding can never happen to them.

Flooding is a natural process that can happen suddenly. While the Environment Agency aims to provide advance warning and local authorities may provide assistance, the person who can do most to help is you.

If you live in a flood risk area, either near the coast or close to a river, be prepared for flooding and take precautions beforehand. Don't wait until it happens, you may not have time.

The risk of flooding is increasing too, with climate change expected to cause wetter winters, sea level rise and more frequent and larger storm events. These will increase the likelihood of flash floods and coastal flooding.

Remember - even if your home is not in a flood risk area, you might be visiting relatives or on holiday in a town that is at risk. Everyone needs to know what to do and what not to do in a flood.

## THE FLOOD GAME

The aim of the game is to start children thinking about what they would need to do if their house was about to be flooded.

It is expected that this game will be played as a group against other teams. However it could also be played by a small group of individuals.

Objects to represent spare clothing, first aid kit, emergency food and drink, important documents and personal possessions should be placed on a table in the centre of the room before play commences.

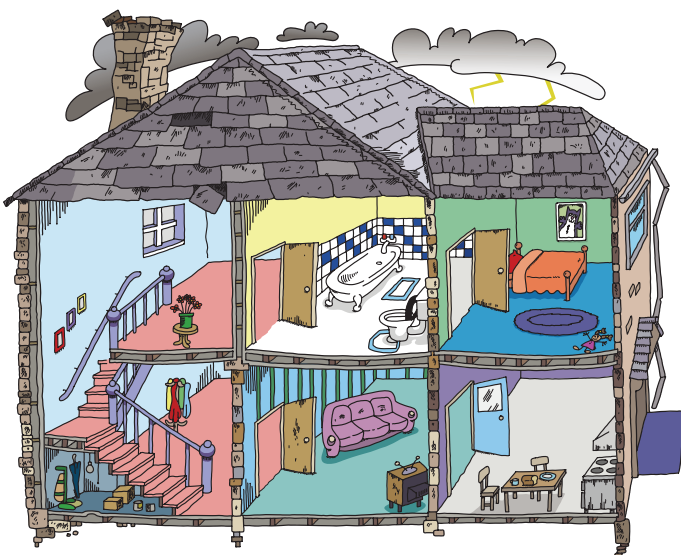
If there are no props available, make a note of which items have been collected on a piece of paper.

## HOW TO PLAY

- 1** The aim is to go round the house and collect all the items needed for your flood kit and then to get out of the house to safety.
- 2** Place your counter on the start square in the bedroom. All teams/players throw the dice, highest scorer goes first.
- 3** Each time you land on an orange square, collect an object to represent that item, such as a bottle of water to represent 'food and drink'. If you land on this square a second time you do not need to collect the item again.
- 4** Keep going round the house until you have collected all five different items, then follow the path out the door and down to the rescue boat.
- 5** The first team to reach the end square and shout 'safe and dry', with all five items, is the winner.

When playing in a team/or with individual players, the aim of the game is to move round the board as quickly as possible to collect all five items in the house and reach the finish before the other teams/players. Use just one counter per team/individual, and collect one complete flood kit per team/individual.

**NB:** During a severe flood event you may be asked to evacuate your property by the emergency services or appropriate authority. At all other times, evacuate the property if you need to, but only when you feel safe to do so.





## ADDITIONAL EQUIPMENT

In order to make the game more fun and to help children keep a record of which items have been collected for the flood kit, leaders are recommended to provide objects as listed below. Most items should be those that are readily available at home. Alternatively, pictures from magazines could be used. One flood kit, comprising one of each of the five items, is required for each team or individual.

- Dice - one per team
- Counters - one per team or individual player
- Pens and paper if props are not being used

The following items, which make up the flood kit, should be laid out on a central table:

- Food and drink - cans/bottles of water, tinned food
- Warm clothing - socks, hats, scarf
- Sentimental items - photo albums, books, toys, letters
- Important documents - insurance papers, birth certificates
- First aid kit - plasters, cotton wool, crepe bandages

## DISCUSSION

Once the children have played the game leaders can reinforce the ideas with a few questions. Some ideas are listed below.

### **Q Summarise what items were collected for the flood kit and why.**

**A** Food and drink, spare clothing, personal possessions, important documents, first aid kit. NB Spare drinks/water should be taken because drinking water supplies may become contaminated by storm water/sewage.

### **Q What else might be needed? Why?**

**A** Wind-up or battery powered torch, a wind-up or battery powered radio to listen for weather updates, spare batteries, fully charged mobile phone, warm waterproof clothing and blankets, Wellingtons, baby food and baby care items, any medication required on a daily basis, such as inhalers. In a flood event you may find there is no electricity, and therefore no heating or light.

### **Q What other items are important to you that you would want to save?**

**A** Help children to distinguish between CDs/DVDs/Play station which can be replaced and personal items which can not - photos/favourite cuddly toy/valuables etc.

### **Q What else might you need to do if a flood was coming?**

**A** Help elderly and vulnerable neighbours out of danger, switch off gas, electricity and water supplies when floodwater is about to enter the home if safe to do so. DO NOT touch sources of electricity when standing in floodwater. Put sandbags or flood protection equipment in place, move items either upstairs or to a high place, move pets to safety, place sofas/tables on bricks. (Hint for children, points were gained/lost during the board game for forgetting/remembering to do these things.)

Where it is not possible to move items upstairs, like in a bungalow or caravan, valuables should be placed on wardrobes or high shelves.

### **Q Important! Floodwater is dangerous. There are a number of things you should be aware of during a flood. What hazards should you look out for?**

**A** Suggest the following hazards associated with flooding:

- manhole covers may have come off and there may be other hazards you can't see;
- standing water and mud can obscure holes and sharp objects;
- fast flowing water may sweep you off your feet - never try to swim through floodwater;
- large waves crashing on shore may contain rocks and debris which can cause injury;
- large waves crashing against piers and seawalls during flood events may sweep you off your feet - stay well clear;
- floodwater may be contaminated by sewage, chemicals and rotting food - wash your hands thoroughly if you touch it.

If children or leaders are worried about their home being at risk from flooding they should contact Floodline on **0845 988 1188** or visit **[www.environment-agency.gov.uk/floodline](http://www.environment-agency.gov.uk/floodline)** for advice and information.



This is the Environment Agency.  
We have given a severe flood warning  
for the area that you live in.



NB: During a severe flood event you may be asked to evacuate your property by the emergency services or appropriate authority. At all other times, evacuate the property if you need to, but only when you feel safe to do so.

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