Responding to future water demand

In order to manage future water supplies action will required on a number of different scales, from large scale projects funded by governments and agencies such as the World Bank to changing the attitudes of consumers on a local level. There are a number of different responses to future water demand, these are shown below:

1. Dams

Dams can be built in order to create reservoirs from which water can be used for irrigation and drinking. Dams also provide hydroelectric power and can be used to control floods.

CASE STUDY: Three Gorges Dam, China:

The Three Gorges Dam is located on the Yangtze River in China and is the worlds largest dam. The dams have may social, economic and environmental benefits as well as costs.

	Benefits	Costs
Economic	- Provides a safe shipping route meaning that there can be increased trade between cities that once could not be accessed due to the water being too shallow - Increased trade means that economic output will be increased, as there can be increased manufacturing and thus exports - The dam is also an opportunity to gain foreign investment in the region e.g. through the building and technology used in the dam	- The dam will cost $22.5 billion to build which is a huge amount of money. The dam then has to be maintained. - Loss of agricultural land means that there is less exports of crops, and thus economic output
Social	- Increased amount of water available for irrigation as crops - Hydroelectric power is created reducing costs for local homes	- Around 100,000 hectares of farmland has to be flooded to create reservoirs - 1.4 million people have been displaced and have had to relocate due to land being flooded. - The increased saturation of river banks means that peoples homes are being destroyed by landslides
Environmental	- The hydroelectric dam will produce, clean, reliable, renewable power. This is helping to reduce China's reliance on coal and helping to reduce greenhouse gas emissions	- Flooded land means that vegetation flood is degraded by bacteria. These respire anaerobically meaning that methane and CO_2 is produced - Increased sedimentation of the river means that pollutants are more concentrated. It also means that eutrophication occurs killing the ecosystem. - The dam has stopped the migration of some fish types.

2. Diverting Supplies

CASE STUDY: China's South-North Water Transfer

China's South-North water transfer project is one of the largest water transfer projects in the world. The project started planning in 1952, with work starting in 2002, expecting to be completed by 2050. The aim is to divert 45 billion meters cubed of water a year from the water surplus river basins in the south and east to the north where there is frequent deficit in places such as Beijing and Tianjin. The project will cost $62 billion to complete and will involve the resettlement of people which was not popular.

There are 3 main routes in which this project is diverting water. These are:

1. ***Western Routes*** - work started on these in 2010, with the terrain being very difficult and the altitude being between 3000 and 5000m. The route here will pass an area of high industry. As a result it is feared that this will mean that water is polluted on transfer, as well as reduce the volumes in the Yangtze causing problems with sediment and the ecosystem
2. ***Central Routes*** - this is a 1267km diversion with some of the water from the Three Gorges Dam being used in order help.
3. ***Eastern Route*** - this route is 1,155km long diversion from the Yangtze river next to Shanghai to Beijing and Tianjin in the north.

In this project the main key player is the government sponsored 'South to North' Water Transfer Project Company, which works with each provinces water company. Other key players involved in the project as those undertaking the huge civil engineering needed building 3 major canals, pipelines, tunnels and pumping stations.

3. Desalination

Desalination - the removal of excess salt and minerals from sea water

As water costs and demand increases due to the growing population countries are increasing turning towards desalination as a future water strategy.

The USA (Florida and California), Spain, China, Australia and Israel are currently using this technology. These countries are well developed in terms of their economies and technology. However these countries are booming increasingly water stressed. People argue whether desalination is sustainable in the future. The table below shows some argues for and against this:

Desalination is *NOT* sustainable	**Desalination *IS* sustainable**
- The use of energy to produce water is high. It takes around 2 KWh of energy to produce 1m^3 of freshwater. This is unsustainable because fossil fuels are running out and we have not yet become totally dependent on renewable energy. - The minerals in the water are chemically different to that of normal freshwater. This could therefore have adverse affects on ecosystems in the future which we do not know about currently. - The by product of desalination is highly concentrated water known as brine. This is often discharged into the sea. Due to the high salt content this quickly sinks to the bottom of the sea underneath the outlet pipe. The high salt content as a result kills marine plants and life.	- Desalination increases the amount of water in water stressed areas - The freshwater that is produced is suitable for drinking and therefore may help to increase sanitation in poorer areas. This therefore is a contributing factor helping people escape from poverty. - The technology used at present poses not threat to future generations as it is proved to work safely and reliably.

CASE STUDY: Desalination in Israel:

Israel has built one of the worlds largest desalination plants which uses reverse osmosis to treat 624,000m^3 of sea water a day. The Sorek Desalination Plant situated in Tel Aviv cover 10 hectares with investment estimated to be $400 million. The plant aims to produce 650 million meters cubed of freshwater by 2020, providing 10% for drinking water and 20% for domestic use.

4. Restoring Lost Supplies:

Restoration - At a local scale this can involve restoring meanders, replanting vegetation and using sustainable methods to manage watercourses for people and the environment.

In 2007 the Kazakhstan government secured a $126 million loan from the World Bank to help save the northern part of the Aral Sea. The government has already built a dam to split the sea into 2 parts and the new loan is to be used to build a dam to bring the water back into the deserted port of Aralsk.