



Briefing report for Henderson Global Investors, Insight Investment, Railpen Investments and Universities Superannuation Scheme

## UK water sector

### **Understanding the investment implications of adapting to climate change**

October 2009



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**Report for**

Henderson Global Investors,  
Insight Investment,  
Railpen Investments  
Universities Superannuation Scheme

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This report shall be referenced as:

Acclimatise (2009). *'Understanding the investment implications of adapting to climate change – UK water sector'*. Oxford

Other reports in this series are:

- Acclimatise (2009). *'Understanding the investment implications of adapting to climate change – UK energy generation'*. Oxford.
- Acclimatise (2009). *'Understanding the investment implications of adapting to climate change – UK commercial property'*. Oxford.
- Acclimatise (2009). *'Understanding the investment implications of adapting to climate change - oil and gas'*. Oxford.

Companion reports have been prepared:

- Henderson Global Investors, Insight Investment, Railpen Investments and the Universities Superannuation Scheme (2008) *'Managing the unavoidable: understanding the investment implications of adapting to climate change'*.
- Henderson Global Investors, Insight Investment, Railpen Investments and the Universities Superannuation Scheme (2009) *'Managing the unavoidable: investment implications of a changing climate'*

All of these reports are available for download from

[www.acclimatise.uk.com/resources/investors](http://www.acclimatise.uk.com/resources/investors)

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This briefing report was prepared by Acclimatise, the trading name of Climate Risk Management Limited, for Henderson Global Investors, Insight Investment, Railpen Investments and the Universities Superannuation Scheme.

It is intended to support the development of an informed dialogue between institutional investors, companies and policy-makers about the direct and indirect impacts of a changing climate on key business sectors. Comments are invited from all those interested in the investment implications arising from a changing climate.

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# Understanding the investment implications of adapting to climate change

## The UK water sector

### Introduction

In January 2008 Henderson Global Investors, Insight Investment, Railpen Investments, and the Universities Superannuation Scheme issued a report *'Managing the unavoidable: understanding the investment implications of adapting to climate change'*. The report highlighted a number of issues on behalf of the investment industry regarding the implications of inevitable climate change for business. These issues included:

- The lack of attention on the now unavoidable impacts of physical climate change that may have significant long-term implications for companies and their investors.
- Tools need to be developed to aid companies and investors in understanding the risks and opportunities associated with climate change.
- Investors need to engage with companies to ensure they have appropriate climate change adaptation systems in place.
- Investors also need to engage with policy makers to ensure the views of long-term investors are taken into account in policy formation in this area.

Henderson Global Investors, Insight Investment, Railpen Investments, and the Universities Superannuation Scheme commissioned Acclimatise to prepare four sector reports (oil & gas, energy generation, water and commercial property) each with a UK company focus to:

- Provide a high-level review for investors of the risks and opportunities for businesses created by inevitable climate change.
- Identify the specific investment drivers at risk.
- Provide guidance on the questions investors and their analysts should ask of companies to encourage further disclosure.

This report explores these issues for the UK water sector and those listed companies providing drinking water and waste water (sewerage, sewage treatment and industrial trade effluent treatment) services. The water and waste water service providers in Wales, Scotland and Northern Ireland are not operating as public listed companies. The contents of this report will however be relevant to investors interested in the large number of companies working in this sector (construction companies, engineering consultants, equipment suppliers etc.).

An overview of the four reports and the research findings following subsequent discussions with companies is provided in a further report by Henderson Global Investors, Insight Investment, Railpen Investments, and the Universities Superannuation Scheme published in November 2009: *'Managing the unavoidable: investment implications of a changing climate'*<sup>1</sup>

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<sup>1</sup> Available from [www.acclimatise.uk.com/resources/investors](http://www.acclimatise.uk.com/resources/investors)

## The UK water sector: the adaptation challenge

The water industry has a long tradition and experience in managing natural climate variability in the design and operation of clean water and waste water assets. There is a strong technical and management expertise based within the regulated companies, government, regulators, research organisations, professional bodies, academia, engineering and environmental consultancies, construction companies and plant and equipment suppliers.

UK water companies are faced with significant challenges driven by the direct and indirect impacts of inevitable climate change on their business systems. They operate in a heavily regulated regime controlling their interaction with the environment, customer levels of service, public health, charging, operational management and expenditure, capital investment planning and long term strategic planning. The sector is characterised by its large fixed assets and long asset life times, requiring significant capital investment with high operational costs, and an ever changing and more prescriptive regulatory landscape, particularly on water resources, drinking water quality and discharges to the environment.

The environmental and financial regulators together with local and national government, NGOs, service and water resource competitors all have their own adaptation policies and actions each of which have an impact on company performance and strategies.

Five key areas should be taken into consideration when looking at the impacts of a changing climate on a company operating in this sector:

- Business strategies of the company.
- Direct impacts of incremental climatic change and extreme events.
- Indirect and compound impacts of climate change on business models.
- Existing and future asset base and asset maturity.
- Wider external stakeholder positions and changes in the regulatory landscape.

### Business strategies

A water company's business strategies, its future objectives and plans are the starting point for any risk assessment of the impact of climate change. Although there is uncertainty in the knowledge we have about future climate change, there is sufficient information to enable robust decision making to take into account the possible impacts. Investors should challenge companies that are unable to demonstrate how they have integrated climate change into their strategic planning.

One of the key measures of companies in the water sector is the size, value and profile of their regulatory asset base. Within the life of many existing assets (and particularly those in the early stages of development) these impacts will become more severe, leading to increasing operational costs and unplanned capital investment. The asset base of the water companies is vulnerable to climate change because of its direct relationship to the water environment.

The industry's environmental, quality and financial regulators<sup>2</sup> have developed a series of annual and long term reporting requirements for water companies in the UK. The various plans are all public documents (although there are elements that are defined as commercially sensitive). They impose a statutory obligation on each of the companies to prepare and disclose their business strategies and their plans to adapt to climate change. In some cases, the process for taking climate change into account is prescribed (for example the Water Resource Management Plans submitted to the Environment Agency). The level of prescription and regulatory interest in water sector adaptation is unique amongst other UK business sectors.

## Water resources



Maintaining resilient water supplies to customers within the context of competing environmental pressures, growth and the compound effects of climate change is a major priority for the industry. Drought is a growing problem for the UK, particularly in south-east England (London receives less per capita rain than Dallas, Rome or Istanbul).

The draft business plans submitted by the companies in 2008 contained a provision for £1.16 billion for water resource investment driven by climate change assumptions (4.2% of

the total proposed investment of £27.4 billion).

However Ofwat has stated that it has not made any allowance in the draft baseline for 2010-15 investments driven by assumptions about the impact of climate change on the supply/demand balance. For companies where this could drive significant investment, it has stated that expenditure would have to be justified by further modelling work, based on new analysis using the UK climate scenarios (UKCP09)<sup>3</sup>.

The results from this analysis will not be available in time for the final determination. Ofwat has acknowledged this and accepted that once the evidence base is available and the analysis completed additional investment would be considered for inclusion in an interim determination under the regulatory notification procedures.

<sup>2</sup> England and Wales (Environment Agency, Drinking Water Inspectorate, Ofwat), Scotland (Scottish Environment Protection Agency, Drinking Water Quality Regulator for Scotland, Water Industry Commission for Scotland) Northern Ireland (Northern Ireland Environment Agency [for both environment and drinking water regulation] Northern Ireland Authority for Utility Regulation)

<sup>3</sup> The UK Climate Projections (UKCP09) provides the latest information on how continued emissions of greenhouse gases may change the UK's climate over the 21st century. UKCP09 comprises a package of information including, publications, key findings, user support and customisable output. This is primarily available on-line. For access to the main technical information about UKCP09, and the full range of information and support, go to <http://ukclimateprojections.defra.gov.uk>.

All companies in England and Wales in 2007 produced a Strategic Direction Statement at the request of Ofwat setting out their long-term plan for the next 25 years. Ofwat intended that this approach will set decision making at the 2009 price review in a longer-term context. Companies took advantage of this to highlight their concerns regarding climate change and the impacts for levels of service, asset resilience and security of supplies together with the implications for capital investment and operational expenditure. Examples of the comments made by companies are included in this report under the section on 'Risk disclosure by major companies'.

Ofwat has issued a policy statement on climate change<sup>4</sup> to guide companies in the preparation of their business plans for submission as part of the 5 year periodic review of prices in 2009 (PR09). Ofwat states:

*“Our aim, as the economic regulator of the water industry, is to protect consumers, promote value and safeguard the future. To achieve this, we need water and sewerage sectors that are sustainable in all respects: financially, socially and environmentally. This is essential to achieve a long-term, high-quality service to consumers. Environmental sustainability in particular demands an effective response to climate change. This is why ‘taking a long-term view of sustainability’ is one of the key strategic priorities in ‘Ofwat’s strategy – taking a forward look’, which we published in April 2008.”*

### Direct impacts: extreme (acute) and incremental (chronic) change

In recent years we have seen a number of high profile disruptions and service level restrictions both locally and nationally driven by extreme events:

- Disruptions to water supplies resulting in usage restrictions and hosepipe bans – periodically in parts of south east England.
- Drought – 2003 and 2006.
- Foul sewage and surface water flooding of properties – frequently following intense local storm events.
- Major river pollutions caused by storm water sewer discharges – London 2007
- Flooding of critical assets – 2007.

These disruptions illustrate the potential vulnerability of assets to events greater than the industry’s current asset design, engineering and operational standards. The industry has a long tradition of engineering and operational excellence in coping with extreme events and seasonal changeability in weather and has implemented practical strategies to manage uncertainty and minimise disruption. However these more recent events combined with the availability of increasingly sophisticated climate change models, have generated greater interest in planning for more severe and frequent climatic events.

The flooding of Mythe water treatment works in 2007 provides a practical example.

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<sup>4</sup> 'Preparing for the future – Ofwat’s climate change policy statement' 2008

## Asset resilience: Mythe water treatment works 2007



The flooding events in summer 2007 were exceptional, with some areas seeing two months' worth of rainfall in just 12 hours. The design standard levels of protection for both sewers and, in some areas main river flood defences, proved to be inadequate.

Gloucestershire was particularly badly affected during the floods. The Mythe water treatment works near Tewkesbury was flooded leaving 350,000 people without mains water supplies. Severn Trent Water implemented its emergency plan to maintain drinking water supplies by deploying 1,400 bowsers and distributing bottled water supplies. Water supplies were restored 17 days later.

The total costs to Severn Trent Water arising from the Mythe flooding event were £29.6M. The costs to other businesses affected by the disruption in supplies are not known.

Extreme flooding events are becoming more regular in the UK. The increasing risk has been well documented by the Government, the Environment Agency, insurers and recent inquiries following flood events. There is widespread acknowledgement that inevitable climate change will cause millions of pounds of damage, requiring extensive adaptation measures, and increasing both CAPEX and OPEX.

Following the flooding events of 2007 Ofwat has now requested that companies prepare a flood risk assessment to identify critical assets and develop an action plan for submission in 2009.

Diagram 1 illustrates the importance of identifying climatic sensitivities and critical thresholds. These provide the boundaries between tolerable and intolerable levels of risk. Information and data on current and future climate conditions can then be assessed against the thresholds, to evaluate the likelihood of their being exceeded.

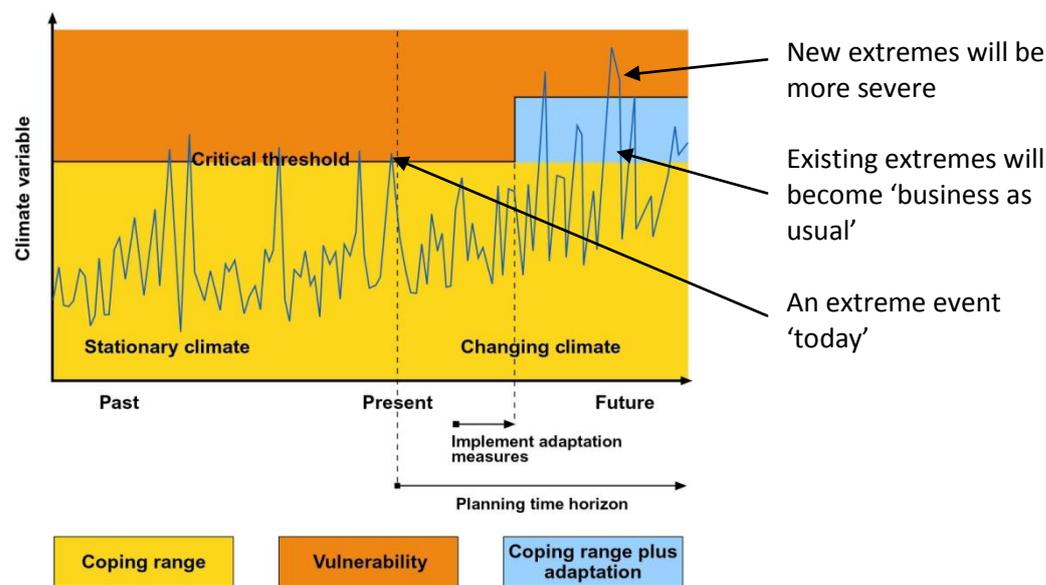
Setting the critical thresholds for asset design and operation is essential, but there is always an event greater than that for which protection has been provided. The effect of climate change (as shown by Diagram 1) will increase the risk of extreme events exceeding critical thresholds. In many cases companies will be using similar approaches, as for example in maintaining 'water resource headroom', to ensure that the 'coping range' in a drought situation is increased though adaptation by developing additional water resources, providing additional raw water storage, improving demand management and reducing leakage etc.

Companies will have to assess their risks and develop strategic plans to expand the 'coping range' of their assets through adaptation measures in order to meet regulatory environmental and public health standards and levels of service obligations. These are non-negotiable and leave little room for manoeuvre by the companies to decide to accept the

risk as in many cases this could lead to regulatory action through prosecution and/or being penalised in price reviews.

It is important that investors take into account the extent to which individual companies are building climate resilience into their business models rather than dealing with extreme events through business continuity and crisis management planning. As can be seen from the Mythe event, because the underlying change in the flooding risk profile for the asset was not detected, the company had to rely on its crisis management plans with costs of £29.6M and a potential loss of customer confidence.

**Diagram 1: Impact of extreme (acute) events and incremental (chronic) change on critical thresholds<sup>5</sup>**



The risk of increasing severity and frequency of extreme events due to climate change has grabbed the media headlines and is the focus of most interaction between water companies and analysts. In contrast the 'creeping' average changes are much harder to recognise and are more likely to be overlooked.

Incremental (chronic) changes to our climate are more subtle and their impacts on business models may pass undetected until critical thresholds are breached. The responses may result in 'step-changes' for a company, increasing operational costs beyond forecasts, falling revenues, unplanned capital investment and additional balance sheet financing to manage the consequences. This point has now been recognised by Ofwat:

*"Future climate change is often thought of in terms of low-frequency, high-impact events, such as extensive floods or prolonged droughts. However, the effects of a gradual shift in everyday conditions could be equally important. This is particularly relevant in the water and sewerage sectors where the extensive asset base (for example, pipes, sewers and treatment works) is influenced by the weather conditions. Serviceability is the capability of a system of assets to deliver the right level of service to customers and the environment both now and in the future. It is*

<sup>5</sup> Willows, R.I. and Connell, R.K. (Eds). (2003). *Climate adaptation: Risk, uncertainty and decision-making*. UKCIP Technical Report. UKCIP. Oxford.

*essential that the right sets of measures and monitoring processes are in place to track serviceability in a changing climate.”*

‘Preparing for the future – Ofwat’s climate change policy statement’ 2008

Business continuity and crisis-management responses are appropriate to manage the impacts of extreme events but have little relevance to incremental change. The latter requires companies to carry out fundamental reviews of their business models and check that processes are ‘fit for purpose’ and climate resilient under new operating conditions to meet changing customer expectations and regulatory requirements.

### Sewer flooding



In 2007-08 the total number of properties internally flooded by sewage was 7,650, an increase from 5,750 in 2006-07. The increase was caused by the widespread heavy rainfall in the summer of 2007-08, where surface water flows exceeded the hydraulic capacity of combined sewers.

Foul and surface water flooding of properties from the public sewerage system owned and operated by the privatised companies has been an ongoing problem, now exacerbated by climate change. Recent flooding events, the Pitt Review and continuing pressure from consumer groups has raised the profile of this issue.

Ofwat has issued guidance to the companies on the submission of investment plans for sewer flooding driven by climate change. It states that:

*“Each company should also set out the assumptions it has made on climate change, how this affects solution selection and the associated expenditure implications. Each company must be clear how it has assessed the impact of climate change and what changes will result, i.e. what assets it plans to adapt and to what extent. We will need to be confident that each company’s plan will deliver best value for consumers over the long term.”*

In their draft business plans submitted in 2008 companies proposed a range of measures to increase resilience. These take the form of both network resilience projects and asset specific flood resilience proposals. In total, companies proposed more than £500 million of investment.

Assets and operational processes designed without any allowance for incremental change are more likely to fail to meet future design criteria, operational performance targets, KPIs and regulatory standards. Understanding incremental changes to the climate and a company’s current thresholds, sensitivities and vulnerabilities are significant issues to be considered in any analysis of a company’s future financial performance. The coverage of these issues in the business plan submissions and the extent to which Ofwat takes them into account in the setting of prices during the PR09 (and subsequent) price determination

processes should be carefully monitored by investors. If the appropriate level of funding is not included within determinations:

- Companies faced with regulatory compliance issues may need to find alternative means of funding with a direct impact on investors.
- Investment may be postponed to the next price review in 2014 creating increasing exposures for some companies.
- Asset maintenance standards and profiles may deteriorate leading to reduced levels of service.

### Indirect and compound impacts on business models

In addition to the direct physical effects of climatic change, it is important to recognise the indirect and compound impacts operating through a company's business systems. These will be felt by every water company and will affect the following business systems:

- Natural resources and raw materials.
- Supply chains and logistics.
- Asset design and construction.
- Asset operation, performance and maintenance.
- Regulatory asset values.
- Markets and customers.
- Workforce.
- Local communities and the environment.

For example, the increasing stress on the availability and security of water resources due to the direct changes in precipitation and temperature is further compounded by the indirect impacts arising from changes in the:

- ecology of the water resource (this may lead to restrictions on water abstractions to protect species and habitats under stress),
- raw water quality (with implications for the operation and performance of water treatment assets, leading to potential statutory compliance issues and/or taste complaints from consumers),
- water demands from other users as they respond to climate change and compete for a larger share of a diminishing resource, and
- waste water treatment discharge standards to surface waters used for abstraction to provide increased protection and maintain water quality.

Responding to these impacts by new investment or changes in operational management of water resources and treatment may result in conflicts with local communities and other interests.

Analysis for investment purposes needs to consider not only the direct physical impacts and costs of climate change (such as a major flood) but also these indirect costs. The relative thresholds and sensitivities for the various business systems within each company together with a company's risk attitude (and the risk attitudes of financial, environmental and quality regulators) need to be assessed and understood.

## Existing and future asset base

Every company has a unique asset profile based on asset technology, remaining asset life, water resources, clean water and waste water treatment process and capacity, clean water and sewerage networks, cost profiles, margins, location, plant and equipment age and efficiency. Domestic and commercial customers and their growth profiles (for example average per capita consumption in the London region is 165 litres/day compared with the UK average of 150 litres/day) vary across the country, along with environmental quality objectives. Ofwat and the other regulatory agencies recognise that the companies have different risk profiles and take this into account when setting targets.

The consequence of changes in climate, the impacts on business systems, stakeholder positions and regulatory change will be different for each company because of its unique asset profile. A company's risk management options (and operating and investment costs) will be partly determined by the characteristics of its existing asset base, and by the economic, environmental, geographic and social profile of the area it serves. Investors will need to be aware of the unique differences in the risk profiles for each company in order to assess their responses.

## Stakeholder positions

When assessing a company for investment purposes, it is important to understand the positions taken by external stakeholders in addition to considering the risks and opportunities arising from climate change. Stakeholders to consider are:

- EU and UK Government
- Regulatory agencies (Ofwat, Environment Agency, Drinking Water Inspectorate)
- NGOs
- Consumer groups
- Domestic and commercial customers
- Suppliers
- Other major water users (resource competitors)
- Insurers
- Business organisations

The policies and adaptation actions adopted by these stakeholders based on their own climate change risk assessments and perceptions can have significant implications for individual companies. Periodic price reviews for the water industry in the past have seen conflicting positions being adopted by the Environment Agency and Ofwat. Other stakeholders can play an important role, for example the insurance industry's position on providing flood insurance and the pressure it has placed on the water companies to respond to sewer flooding.

Consumer interest in this area is growing and with it the potential reputational risks, in a sector that has experienced previous controversies – drought, leakage, flooding, water bills, pollution. In October 2009 Consumer Focus (the UK Government's consumer protection organisation) published a report<sup>6</sup> setting out the issues it considered water companies, regulators and the government should address to ensure that consumers are protected.

Conflicting and converging objectives set by stakeholders may add to confusion and uncertainty. Policy initiatives (in particular changes to regulatory provisions and codes of

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<sup>6</sup> Consumer Focus (2009) *Adaptation to a changing climate: today's investments in tomorrow's climate*.

practice) are likely to have implications for a company's plans for adaptation to climate change.

The Environment Agency and the UK Government (Defra) both have active policy initiatives to promote water efficiency. The EA in particular has been concerned that companies should not develop new water resource assets, without actively improving their performance on water leakage and water efficiency. Any new water resource projects requiring planning permission will find that demand management, water efficiency and water leakage will feature as main 'target' areas by objectors. Local authorities are actively promoting water efficiency through their spatial planning powers; in some cases they are seeking to make water efficiency standards and targets a mandatory and integral part of new domestic and commercial build.

Current EC water and waste water legislative provisions<sup>7</sup> were adopted for the most part without any clear understanding of the impacts of climate change. The development of the EC policy on adaptation should lead to a review and modernisation of existing legislation to ensure that the objectives and priorities are still relevant, achievable and appropriate within the context of environmental responses to climate change. Any revisions to the Directives leading to the identification of new obligations are likely to have financial and compliance implications for UK water companies.

One example of government policy initiatives having future direct implications on the water sector is the introduction of the Climate Change Act 2008. A statutory power is now available to the Government to direct public sector organisations and statutory undertakers, such as utility companies, to produce a report on how their organisation is assessing and acting on the risks and opportunities of a changing climate. The Government can also ask for a group of organisations to report together on climate change adaptation considerations related to a specific location or a particular sector. Given the heavily regulated nature of the water companies it is unlikely that this will impose a significant burden on the sector. Their current regulatory submissions and legal reporting requirements may well cover anything that the Government may seek information on under the Act.

The heavily regulated nature of the UK water industry leaves little room for manoeuvre by individual companies. A prescriptive approach has been adopted on many issues by Ofwat and the EA. In recent years as the awareness of climate change has increased Ofwat has sought to respond to criticism and recognise that in order to deliver and maintain secure water and waste water services to customers at an acceptable cost, the companies will have to respond to the challenges of climate change.

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<sup>7</sup> Water Framework Directive, Drinking Water Directive, Environmental Liability Directive, Waste Framework Directive, Ground Water Directive, Marine Strategy Directive, Soil Framework Directive, Bathing Water Directive, Pesticides Directive, Directive on European Quality Standards in the Field of Water Policy and Amending Directive 2000/60/EC, Sewage Sludge Directive and IPPC Directive (Integrated Pollution Prevention and Control)



## Impacts and consequences

Investors are concerned with securing a sustainable return on investment over a given timescale. They wish to understand the consequences of climate change impacts on the value of individual businesses. Decisions to invest or withdraw investment in a company will be based on each investor's value drivers.

In discussions with Henderson Global Investors, Insight Investment, Railpen Investments and the Universities Superannuation Scheme the following value drivers of greatest significance to investors relative to the water sector were identified:

- Operational risks.
- Regulatory impacts.

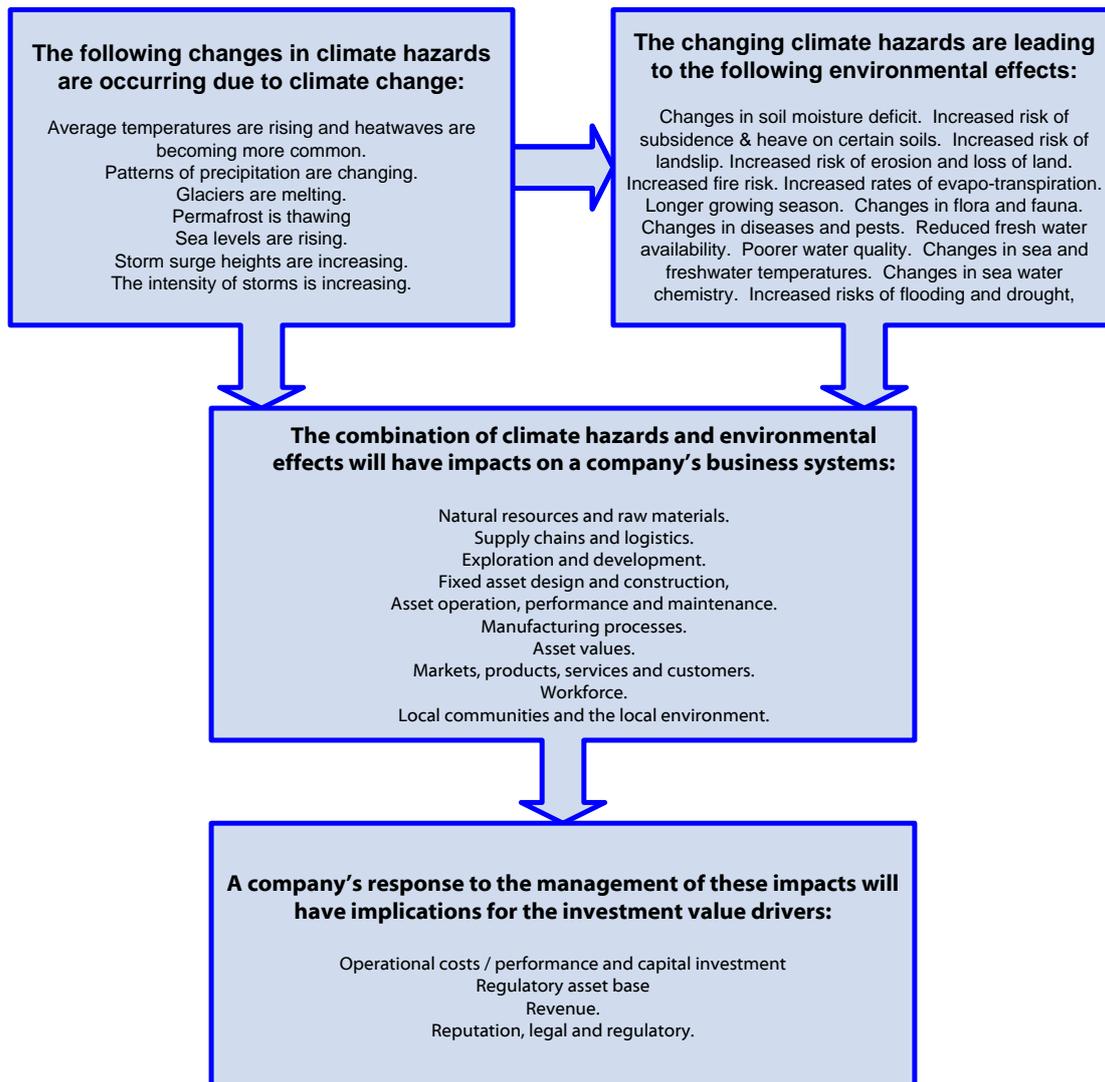
Most investment analyst reports on climate change impacts focus on direct climate hazards and environmental effects due to extreme events. They concentrate on analysing a one-to-one mapping of hazard to impact, for example, flood risk for property. This oversimplifies the complex cause and effects that exist:

- as the climate change and environmental hazards manifest themselves within a company's business systems, and
- the compound impact as the individual business system elements react and interact with each other.

It also ignores the effect of incremental climate change and under-estimates the potential costs of the impacts and the adaptation responses by the company and by its stakeholders.

Diagram 2 sets out the relationships between climate hazards, environmental effects, business systems and investment value drivers.

**Diagram 2: Relationships between climate hazards, environmental effects, business systems and investment value drivers**



Key climate change challenges facing companies in this sector are:

### Generic challenges

- Meeting changing customer expectations on acceptable levels of service and influencing customer behaviour.
- Maintaining current levels of serviceability, responding to future changes in levels set by Ofwat to ensure that assets and services are fit for purpose.
- Influencing and responding to the changes in demand profiles from both domestic and commercial customers
- Statutory duties on companies, Ofwat and the Environment Agency to embed sustainability into policies and decision making.
- Securing consistent policy and regulatory positions from stakeholders.
- Ensuring critical asset resilience to extreme events with an increasing risk of flooding to assets in floodplains and on the coast, and an increase in the intensity, severity and frequency of other extreme events such as droughts, heatwaves and storms.

- Structural impacts on assets resulting from changes in soil moisture deficit and an increasing risk of subsidence and heave.
- Implications for revenue, operational expenditure and capital investment.
- The sector is at risk from the potential exposure of other third party assets to climate change, and in particular security of electricity supplies. An assessment of the implications for a company operating in this sector should also consider the risks to key suppliers.
- Delivering adaptation responses that do not involve further increases in energy consumption from non-renewable sources.

### Drinking water service challenges

- Customer charges, metering and the introduction of innovative tariffs to promote water efficiency.
- Promoting and delivering increasing water efficiency.
- Delivering economic level of leakage targets that are likely to change over time to reflect the impact of climate change.
- Reductions in the availability of water in rivers and aquifers with additional competition from other water users.
- Increase in the demand for water, particularly at times of reduced availability, exacerbating supply issues.
- Deterioration in raw water quality due to changes in run-off characteristics, nutrient levels, reduced dilution of pollutants, discolouration and the breakdown of soils in upland areas.
- Implications for water resources, balancing supply and demand, ensuring security of supply with increasing drought risks.
- Delivering and managing treatment processes to meet drinking water quality standards with changes in raw water quality.
- Increased energy demands to maintain drinking water standards.

### Waste water service challenges

- Deterioration in river water quality and flows with reduced dilution of pollutants and ecological changes.
- Delivering and managing waste water treatment processes to meet existing effluent discharge standards and future standards required to protect the water environment in response to climate impacts.
- Increased energy demands at waste water treatment works to deliver improved effluent discharge standards.
- Increase in odour and fly complaints.
- Increased risk of overloading of sewers and flooding to properties which were not designed to take climate change into account.

In Appendix 1, Tables 1 and 2 provide a high-level qualitative review of significant impacts and consequences of climate change, the key business systems affected and appropriate risk management responses for each of the investment value drivers. The review has been split

between those issues generic to the water sector and those that are specific to drinking water and waste water services<sup>9</sup>.

## Risk disclosure by major companies

A review of the four largest water and waste water companies quoted on the UK FTSE (Northumbrian Water Group plc, Pennon Group plc, Severn Trent plc, United Utilities plc) was undertaken to identify:

- Current good practice on the assessment, management and disclosure of risks and opportunities driven by climate change.
- Evidence of climatic change affecting the financial value drivers.
- Evidence of action by individual companies to assess emerging climatic risks.
- Evidence of action on specific adaptation measures.
- Evidence of disclosure and reporting to the investment community.

Examples of climate change signals and company responses are provided below:

- Northumbrian Water Group plc
  - The company recognises in its Strategic Direction Statement that significant investment is likely to be required to deal with climate change, particularly to manage the risk of flooding caused by surface water from more intense rainfall.
  - The company refers to the uncertainties and comments that overall investment will remain broadly stable for at least a decade, though areas needing investment are likely to change. Beyond that the investment trend will be dependent on what action is needed to cope with climate change.
  - Northumbrian Water has identified “future proofing our operations against climate change” as one of the four key challenges facing the company.
  - The Company states that its goal is to ‘future proof’ Northumbrian Water as best as it can against the impacts of climate change and to respond as early as possible as information becomes available.

*“There will be difficult decisions about when and how much to invest in measures to adapt to climate change but they must be based on a sound, scientific assessment of the probabilities. And they must be made in good time.”*

Looking to the future, Northumbrian Water, November 2007

- Pennon Group plc
  - The company states that it is working closely with many organisations to assess the implications of climate change for water supply and waste water services. Adaptation plans are being developed which will involve innovative approaches and new methods of influencing catchment behaviour, upstream of its water supply systems, in sewered areas and downstream of its waste water systems to protect the wider environment.

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<sup>9</sup> A review of potential asset impacts has been undertaken by Water UK: Water UK (2007) *A Climate Change Adaptation Approach for Asset Management Planning*. The report and impact tables can be accessed at <http://www.water.org.uk/home/policy/reports/climate-change/asset-management-planning>

- Customer survey work carried out by the company indicates that “in no uncertain terms that the very least they expect from us, whatever the implications of climate change, is a supply of water that they can use without worrying about its quality or reliability.”
- The Company recognises that climate change is an increasing priority for investment plans during the period 2010–2035.

*“We need to adapt to the flooding risk from the extreme weather events that are expected as a result of climate change. Extreme weather events already account for 60% of the flooding incidents caused by overloaded sewers, more for South West Water than most other companies.”*

Strategic Direction Statement, South West Water, December 2007

- Severn Trent plc
  - Severn Trent refers to climate change adaptation as a one of a number of named non-negotiable corporate responsibility issues which have particular importance for the water industry when compared with other FTSE100 companies.
  - In its Corporate Responsibility Report for 2007 Severn Trent states “Whatever actions are taken over the coming years to reduce emissions, it is clear that climate change already has serious implications for our operations and strategic development. We therefore need to understand the impacts of climate change on areas such as water supply, water usage, and sewerage, and to develop adaptation strategies.” In comparison the climate change corporate responsibility targets and objectives the Company has set itself in the same report do not include any that are directly specific to adaptation.
  - The company’s Strategic Direction Statement issued in December 2007 recognises the impact of climate change across its services. Adaptation to develop climate resilient assets and services is widely discussed.
  - In October 2007 Severn Trent plc identified climate change as one of the five major issues that would shape the company’s business plan and the industry.

*“Whatever you think or believe about the science behind climate change, it is increasingly difficult to deny that real shifts have happened. Just think about the recent challenges of flooding in Carlisle, Hull, Sheffield and Gloucester. We will experience greater extremes of weather and that inevitably impacts our decisions and choices around network design, both water and waste. It will also impact the way we choose to adapt and maintain our assets”*

Tony Wray, Chief Executive, Severn Trent, October 2007

- United Utilities plc
  - In its Strategic Direction Statement the Company identifies six elements for its business strategy over the next 25 years. Three of these (sustainable water resources, integrated approach to drainage and price to customers) directly refer to the challenge of climate change.
  - The Company recognises that higher temperatures in rivers and lakes can make them less healthy and therefore less able to support plant and animal life, and less tolerant of waste water treatment works’ discharges. The

Company is concerned that this may jeopardise the improvements in environmental quality that have been achieved in the past 15 years, let alone the achievement of new, higher standards.

- Drinking water treatment processes may also operate less effectively at higher temperatures, requiring us to review the design of treatment works.
- The Company in its Strategic Direction Statement states that “the most significant development discussed in this document is the challenge of climate change – adapting to its effect on our assets and reducing our impact.”

*“Part of our adaptation activity will involve influencing customer behaviour towards a more water efficient lifestyle. More customers will be metered between 2010 and 2015 (we expect around 250,000 customers to choose meters) and we will trial new pricing approaches to encourage and reward conservation. We also expect to ramp up our water efficiency activity.”*

Where we are heading, United Utilities, November 2007

The level of research undertaken by the companies is significant and probably greater than any other business sector (although in recent years the overall level of investment in R&D has decreased). The companies have undertaken their own research and engaged on collaborative projects (the companies are well aware that in their relationships with Ofwat a collaborative research approach to produce a water industry view is desirable). All of the companies have been using the outputs and scenarios from climate models and combining these with their own water supply/demand models.

## Conclusions

The level of disclosure on the impacts of climate change by the water companies demonstrates an awareness and understanding of the scale of the impacts greater than any other business sector in the UK. The companies are analysing the risks and developing a high level of expertise and sophistication in the practical application of the climate model outputs.

Water companies are sometimes caught between a rock and a hard place on issues such as climate change, where there remains a discretionary choice to be made about the OPEX and CAPEX investment requirements and the pricing limits.

Inconsistency and the lack of agreement between the industry’s environmental and public health regulators (the Environment Agency and the Drinking Water Inspectorate), Defra, the Treasury, Ofwat, consumer groups, NGOs, and various trade associations on the scale of the problem, the adaptation options, the level of investment and the price implications have been a feature of all the periodic price reviews. Differences of opinion between the various stakeholders has enabled Ofwat to use this as a reason to avoid funding climate change adaptation measures in the past, and in particular those related to the development of new water resources and sewer flooding.

The uncertainty regarding future investment has already led to a delay in the delivery of climate resilient assets by the industry. The detailed submissions to be made by the companies to Ofwat this year as part of the periodic price review will include financial

provisions for both operational and capital investment to meet the impacts of climate change. It remains to be seen, however if the costs directly attributable to building business resilience to climate change will be clear. Many schemes will have multiple drivers to meet multiple objectives – stripping out the costs directly attributable from climate change may not be possible from the public versions of the submissions.

## Questions for investors

A series of questions has been developed to assist investors to elicit relevant information from companies for investment analysis and as a basis for further engagement. These are based on:

- Key risks and adaptation issues identified in Appendix 1, Tables 1 and 2.
- Analysis of company public reports.
- Insight of the report authors based on their understanding of the potential risks and impacts inevitable climate change are likely to create.

Two groups of questions are provided covering each of the investment value drivers together with a set of questions aimed at understanding issues under the broad heading of 'Governance'. A series of primary questions has been developed with suggested follow-up questions to assist discussions in each case.

These questions should be considered as providing a framework for discussion and engagement. It is not intended that each and every question should be asked, or that there is an implied 'correct' answer. The questions can be modified to suit an investor's particular interest and concerns, and be made specific to a particular company. It should also be noted that the unique asset and financial risk profiles for each company operating in this sector will create different responses. Comparisons between companies may be difficult.

## Governance

### **What steps are you taking to assess the vulnerability of existing and future assets to changing climatic risks?**

- Are there any specific knowledge gaps where further information is required?
- Have you commissioned any external research?

### **What additional actions are required to further develop climate adaptation strategies within your company? How can these be integrated within existing risk management strategies?**

- How have you embedded climate change across your business?
- Is there a process for ensuring climate risks are built into your investment decision making process?

### **What further action can you take to develop internal capacity, awareness and understanding regarding the business impacts arising from inevitable climatic change?**

- Have you appointed a Director to take specific responsibility for assessing the impacts of inevitable climate change on the company?
- What are the results of engagement with external stakeholders?

### **How successful have you been in engaging with your regulators, suppliers and customers on the impacts of inevitable climate change?**

- Are you sharing information and understanding on the business impacts of climate change with your regulators, suppliers and customers?
- What steps have you taken with your suppliers to ensure they are climate resilient?

### **What steps are you taking to ensure your company complies with the Companies Act 2006 with regard to disclosure of risks due to inevitable climate change?**

- Is your reporting under the Act consistent with your regulatory reporting?

## Investment value driver: operational risks

### **What impacts are changing climatic conditions predicted to have on your water resource and water treatment capacity?**

- What steps are you taking to monitor current performance relative to changes in climate?
- Have you identified the impacts on energy usage?

### **Ofwat has stated that it will not accept water resource schemes in PR09 until an analysis has been completed using the UK Climate Projections UKCP09. What actions do you intend to take over the next 12 months to review both your strategies and your major projects?**

- What are the financial, regulatory and service level implications if Ofwat does not accept water resource schemes through the notification process?

### **How are changes in raw water quality and water resources due to climate change predicted to affect your drinking water operational processes?**

- What are the consequences for operational expenditure?
- What are the consequences for capital investment?
- If additional treatment is required, what are the energy cost and greenhouse gas implications?

### **The Government has acknowledged that on their own, measures to control demand are unlikely to be sufficient to meet future requirements. On the supply side, new water resources are likely to be required if the levels of service that consumers expect are to be met.**

- What are the financial performance implications of the demand and supply measures?
- Are significant new water resources required?

### **How will predicted changes in water quality, low flows, ecological resource, temperature and precipitation affect your waste water treatment processes?**

- What are the consequences for operational expenditure?
- What are the consequences for capital investment?
- If additional treatment is required, what are the energy cost and greenhouse gas implications?

### **What are the OPEX and CAPEX implications arising from the impact of changes in precipitation and an increasing risk of intense short duration storm events on sewer flooding?**

- Will you use the UKCP09 projections and probabilistic outputs to assess future liabilities?
- If these are greater than your current PR09 submissions, will you be seeking additional investment through the notification process?

**Are changes in extreme weather conditions, increasing variability and incremental climatic changes considered in project analysis?**

- How are you factoring climate change into your asset design and operational performance forecasts?

**If you are not undertaking specific adaptation measures during current project design stages, what steps are you taking to adapt your assets at a later date?**

**Are you taking any actions to assess the implications of future changes in regulations, legislation and codes of practices on your operations in response to inevitable climate change?**

- What steps are you taking to monitor such changes and to engage with regulatory agencies in policy development?
- How will these changes affect operational costs and revenue?
- Will a review and modernisation of the various EC directives to take account of climate change create additional investment implications?

**What are the OPEX and CAPEX implications in delivering critical asset resilience to extreme events (flooding, droughts, heatwaves and storms)?**

**What actions can the industry take to manage customer and media concerns (and political pressure) if water and sewerage services are more frequently affected by extreme events?**

- Have you taken any specific actions as a consequence of the 2007 floods?

**Have you assessed the operational costs and investment requirements arising from inevitable climate change?**

- What are the implications for the company and its customers if the 2009 price determination does not allow for funding of all climate change related OPEX and CAPEX proposals?
- Do you intend to extract the costs attributable to climate change and report on these as a separate item?

## Investment value driver: regulatory impacts

**Are any additional actions required to ensure that industry regulators understand that climate change will be a driver for increasing capital and operational costs?**

- Are there any further changes required to the regulatory funding determination processes to reflect these upwards cost pressures?
- Are there any inconsistent policy positions from the regulators?

**What impact would water rights trading and competition have on the asset base and revenues of individual companies?**

**Are there any implications for industry economic models arising from changes in seasonal demand?**

- Are the long term economic analyses for the industry affected by climate change?

**Are there any implications for asset life and depreciation after factoring in climate change?**

**What is the company's position on alternative charging and tariff strategies?**

- Has an assessment of the potential revenue implications been undertaken for any of the alternative tariffs being trialled?

**Would a competitive market in water rights trading reveal the economic value of water?**

- Would it encourage innovation in water efficiency actions and the development of new water resources?

**What are the revenue implications of further demand management and water efficiency measures?**

- How effective do you consider that the revenue correction mechanism will be in 'compensating' for the revenue implications arising from increased metering?

**Is the customer prepared to pay for delivering climate resilient assets and services?**

- What are the results from your market surveys?

**How will climate change affect current levels of serviceability?**

- What are the OPEX and CAPEX implications?

**Are you engaged in any discussions with regulatory agencies on the impacts of climate change for regulatory compliance?**

- Do you foresee any issues with regard to compliance with water abstraction licences and discharge consents?
- Will changes in water and ecological quality due to climate change jeopardise the improvements in environmental quality that have been achieved in the past 15 years, and the achievement of new, higher standards?

**Are there any emerging regulatory compliance or litigation exposures?**

- What actions are you taking to manage your exposure?

## Appendix 1: High-level qualitative review of impacts

**Table 1: Investment value driver: operational risks**

Business model system	Impacts and consequences	Risk management responses
<p>Supply chains and logistics</p>	<p>Generic</p> <ul style="list-style-type: none"> <li>The supply chains for major companies may involve a number of suppliers across the world. Just-in-time manufacture, supply and distribution are already vulnerable to climate-related disruptions.</li> <li>Manufacture, storage and distribution of equipment and supplies are likely to become more vulnerable.</li> <li>Assets and transportation routes (together with associated essential utilities provided by third parties) located in coastal areas and on river floodplains are predicted to be at a greater risk.</li> </ul>	<p>Generic</p> <ul style="list-style-type: none"> <li>Diversify supplier base.</li> <li>Provide additional storage capacity for products and raw materials in case of disruption to supply.</li> <li>Careful siting of new facilities taking account of climate change.</li> <li>Relocation of existing facilities may be necessary.</li> <li>Flood and coastal erosion management strategies for existing facilities.</li> <li>Flood defence measures including: upgrading hard flood defences, creating 'set-back' flood defences, purchasing removable temporary flood barriers and managed retreat (allowing areas to flood) in coastal areas.</li> <li>Improving drainage systems to increase capacity to cope with greater rainfall intensity and installing Sustainable Drainage Systems (SuDS) which allow water to soak into ground, reducing rapid runoff.</li> <li>Raising floor levels and using flood-resilient materials.</li> <li>Business continuity programmes.</li> <li>Supplier contracts at pre-determined prices.</li> <li>Third party utility operators and transportation authorities to demonstrate the resilience of their facilities to increased flood risk.</li> <li>Providing own utilities to remove dependence on third parties.</li> <li>Insurance policies covering flood damage, business continuity and disruption.</li> </ul>
<p>Asset design</p>	<p>Generic</p> <ul style="list-style-type: none"> <li>Water industry assets traditionally have comparatively long asset lives. Designing and building assets that are capable of delivering and maintaining services with changing customer demands and regulatory consents driven by climate change will be a major challenge if premature asset write-off is to be avoided.</li> <li>The effect of climate change will be to increase the flood risk to assets. Flood management and drainage systems are likely to be compromised by sea level rise, storm surges, coastal erosion, changes in precipitation, and greater intensity and frequency of fluvial and pluvial events. This will lead to asset damage, disruption to services, consent and regulatory failures, disruptions to off-site utilities.</li> </ul>	<p>Generic</p> <ul style="list-style-type: none"> <li>Design standards for both clean and waste water assets may need to be reviewed, together with operational management practices, to ensure that new assets can deliver throughout their asset life.</li> <li>Further research and development into treatment design and operational management.</li> <li>Careful siting of new facilities taking account of climate change.</li> <li>Third party utility operators and transportation authorities to demonstrate the resilience of their facilities to increased flood risk.</li> <li>Providing own utilities to remove dependence on third parties.</li> </ul>

Business model system	Impacts and consequences	Risk management responses
	<ul style="list-style-type: none"> <li>The impact of rising ambient air temperatures and changes in annual and seasonal precipitation will have impacts for raw water quality and resource availability and reliability.</li> <li>Changes in water quality of receiving watercourses will result in a tightening of discharge consents.</li> </ul>	
<b>Asset operation and performance</b>	<p><b>Generic</b></p> <ul style="list-style-type: none"> <li>The location of both sewage and water treatment works adjacent to rivers and watercourses, often in floodplains, creates a significant risk of flooding for industry assets. The events of summer 2007 in the UK demonstrated clearly the risks.</li> <li>Existing flood management and drainage systems are likely to be compromised by sea level rise, storm surges, coastal erosion, changes in precipitation, and greater intensity and frequency of flooding events. This will lead to asset damage, disruptions to off-site utilities, increased risk of pollution and disruption to water and waste networks and water treatment assets.</li> <li>Increased capex and opex will be necessary to replace damaged assets.</li> <li>Rising temperatures will affect the efficiency and performance of plant and equipment such as compressors, pumps, generators.</li> <li>Fuel consumption is likely to increase to maintain output and performance leading to higher operational costs and increased emissions.</li> <li>Changes in the management and usage of assets may result in, reduction in asset performance and life, higher depreciation costs, earlier (premature) asset write off.</li> <li>Impact of climate change on the electricity grid and supply system increases the risk of disruptions to power supplies. Increasing risk of failures in the supply of water and treatment of waste water and in pumping in network systems.</li> </ul> <p><b>Clean water</b></p> <ul style="list-style-type: none"> <li>Increasing competition for water resources from other users, adapting to the impacts of climate change.</li> <li>Increase in the frequency and severity of drought events leading to restrictions on water supplies. Unplanned CAPEX and OPEX increased significantly for all companies during previous drought events.</li> <li>Increasing sedimentation in reservoirs due to increase in intense rainfall event. Changes in water quality and reduction in water storage. Increase in</li> </ul>	<p><b>Generic</b></p> <ul style="list-style-type: none"> <li>Review asset maintenance programmes.</li> <li>Flood management strategies for existing facilities.</li> <li>Flood defence measures including: upgrading hard flood defences, creating 'set-back' flood defences, purchasing removable temporary flood barriers and managed retreat (allowing areas to flood) in coastal areas.</li> <li>Improving drainage systems to increase capacity to cope with greater rainfall intensity and installing Sustainable Drainage Systems (SuDS) which allow water to soak into ground, reducing rapid runoff.</li> <li>Raising floor levels and using flood-resilient materials.</li> <li>Business continuity programmes.</li> <li>Supplier contracts at pre-determined prices.</li> <li>Third party utility operators and transportation authorities to demonstrate the resilience of their facilities to increased flood risk.</li> <li>Providing own utilities to remove dependence on third parties.</li> <li>Review maintenance regimes.</li> <li>Understanding implications for levels of serviceability.</li> <li>Technical modification to facilities to allow operation during warmer average temperatures, dry periods and extreme events.</li> <li>Increase in use of chemical dosing to manage water quality issues.</li> </ul> <p><b>Clean water</b></p> <ul style="list-style-type: none"> <li>Demand management to ensure security of water supplies during drought conditions.</li> <li>Increasing use of demand management as an alternative to developing new resources.</li> <li>Leakage management is likely to become increasingly important in future climate change scenarios because of increasing uncertainty in water resource availability and growing consumer demand.</li> <li>Development of new water resources and storage areas.</li> <li>Use of desalination plants to manage peak demands during drought conditions.</li> </ul>

Business model system	Impacts and consequences	Risk management responses
	<p>OPEX costs.</p> <ul style="list-style-type: none"> <li>• Changes in the water quality of surface and ground water resources leading to increased treatment costs and the introduction of additional treatment processes.</li> <li>• Changes in seasonal water demand profiles from domestic and commercial customers.</li> <li>• Increasing risk of algal blooms creating water treatment problems.</li> <li>• Deterioration in raw water quality creating treatment problems and increasing risk of customer complaints, public health issues and breach of water quality standards.</li> <li>• Increased temperatures may create more favourable conditions for bacteriological failures of treated water. Risk of increased complaints and prosecution.</li> <li>• Increase in the frequency and severity of drought events.</li> <li>• Changes to the seasonal distribution and intensity of rainfall will affect the recharge of reservoirs and ground water, and flows in surface water resources.</li> </ul> <p><b>Waste water</b></p> <ul style="list-style-type: none"> <li>• Septicity in sewers is likely to increase due to reduced flows during summer and increased temperatures. Increasing number of complaints and risk of legal action. Impact on waste water treatment process and risk of discharge consent failures.</li> <li>• The rate of bacterial decay will increase in higher temperatures leading to odour problems in sewerage systems and waste water treatment works.</li> <li>• Higher temperatures create favourable conditions for fly infestations at waste water treatment works. Increased risk of complaints and legal action.</li> <li>• Vermin infestations in sewerage systems due to increased temperatures.</li> <li>• Hotter drier summers and lowering of groundwater levels create opportunities for exfiltration from sewers leading to pollution. Risk of contamination of water resources.</li> <li>• Increasing risk of raw sewage discharges from combined storm overflows during intense storm events leading to pollution of watercourses and legal action.</li> <li>• Increased risk of foul flooding from sewerage systems due to changes in precipitation. Failing to meet OFWAT levels of performance standards, resulting in financial penalties.</li> </ul>	<ul style="list-style-type: none"> <li>• Increased use of chemicals to manage water quality issues.</li> <li>• Existing assets replaced before 'book' asset life reached, premature asset write-off.</li> <li>• Review operational management of assets. Additional maintenance.</li> <li>• Changes to the design of water treatment works. Introduction of new water treatment processes.</li> <li>• The increased use of metering as part of an optimal approach to balancing supply and demand is likely to become a feature of the UK water industry. Companies should assess the role and pace of additional metering in their long-term water resource plans. There are significant cost and revenue implications arising from the installation of meters.</li> </ul> <p><b>Waste water</b></p> <ul style="list-style-type: none"> <li>• Chemical dosing of sewerage systems.</li> <li>• Sewer jetting and flushing, odour management control systems and dosing</li> <li>• Fly management systems and chemical dosing.</li> <li>• Vermin management, sewer baiting and pest control programmes.</li> <li>• Sewer lining and replacement of sewers.</li> <li>• Additional storage capacity provided at CSOs, new pumping systems and redesign of sewerage network. Separation of storm drainage from foul sewage.</li> <li>• Changes to sewer design standards.</li> <li>• Foul flooding improvement schemes.</li> <li>• Review operational management of assets. Additional maintenance.</li> <li>• Changes to waste treatment works design.</li> <li>• New assets.</li> <li>• Existing assets replaced before 'book' asset life reached, premature asset write-off.</li> <li>• Increasing use of sludge injection to land, additional storage facilities, and odour abatement measures at waste water treatment works. Increased OPEX and CAPEX.</li> </ul>

Business model system	Impacts and consequences	Risk management responses
	<ul style="list-style-type: none"> <li>Changes in flows at sewage treatment works due to increase in winter rainfall, decrease in summer rainfall, and increase in short duration, intense storms will have implications for the operational management of assets. Increased risk of works failing consents due to hydraulic overloading and treatment process issues.</li> <li>Increased temperatures and warmer wetter winters will increase the rate of biological activity at waste water treatment works creating opportunities to reduce OPEX due to increase in treatment efficiency.</li> <li>Sludge disposal to agricultural land may become more difficult due to increase in nuisance (odour) complaints in higher temperatures.</li> <li>Increase in temperatures will increase methane generation providing opportunities for additional energy generation.</li> <li>Potential opportunities to apply more sludge to land due to growth in non-food crops (e.g. biofuels)</li> <li>Increasing temperatures are likely to cause a detrimental reduction in dissolved oxygen in surface waters. This could increase the need for further treatment because of the reduced ability of receiving waters to cope with sewage and pollution.</li> </ul>	
Customers	<p>Generic</p> <ul style="list-style-type: none"> <li>Demand management will play an increasing role, reducing revenue</li> <li>Metering has been shown to reduce average household water use by about 10% (National metering trials 1993).</li> <li>In heavily metered areas, water companies' revenues are affected by increased water efficiency. It may not be in the companies' best financial interests to promote water efficiency. Ofwat has introduced a revenue correction mechanism to be implemented at the end of each price review period.</li> <li>Widespread metering will enable new and innovative tariffs to be developed. Ofwat is encouraging where it can be demonstrated to be cost beneficial for consumers with bills broadly reflecting the true cost of water.</li> <li>A rise in the number of sewer flooding incidents is likely to create adverse customer reaction and dissatisfaction.</li> <li>Water companies will continue to be the subject of adverse media and customer comment during both drought and flood events.</li> </ul>	<p>Generic</p> <ul style="list-style-type: none"> <li>New charging and tariff strategies could be used to manage demand. If consumers are more aware of the true cost of the water they use, they can make informed choices about their water use.</li> <li>Ofwat has considered the use of seasonal, rising block and other innovative tariffs. A number of these are now being trialled by the companies. Seasonal tariffs mean that customers will pay more for water when resources are at their most stretched, for example, during extended drought conditions. This could become an important adaptation tool in some areas to prevent water shortages. Rising block tariffs may provide incentives to customers to use less water throughout the year.</li> <li>Alternative sewerage charging systems that encourage sustainable use of surface water, by providing rebates have been considered. Encouraging the development of permeable areas by providing financial incentives has been trialled in the USA.</li> <li>The development of innovative business models enabling a reduction in revenue to be offset by deferring capital investment in new assets may be an option for some companies.</li> </ul>
Workforce	<p>Generic</p> <ul style="list-style-type: none"> <li>The impact of climate change on operational processes (increasing</li> </ul>	<p>Generic</p> <ul style="list-style-type: none"> <li>Health and safety policies and risk assessments should ensure that the implications</li> </ul>

Business model system	Impacts and consequences	Risk management responses
	<p>temperatures, water-borne diseases and infections) may have additional health and safety implications.</p> <ul style="list-style-type: none"> <li>• Assets and operational processes designed according to past climate data will be used under different climatic conditions.</li> <li>• Safety headrooms may be compromised.</li> <li>• Reputational and litigation implications are significant.</li> <li>• Employer and public liability insurance cover may be compromised if companies fail to take climate change into account during health and safety risk assessments.</li> </ul>	<p>arising from changing climatic conditions on assets and operational processes are assessed. New assets and processes should include revised safety thresholds.</p>

**Table 2: Investment value driver: regulatory impacts**

Business model system	Impacts and consequences	Risk management responses
Asset design	<p>Generic</p> <ul style="list-style-type: none"> <li>• The impacts and consequences for asset design and operation identified in Table 1 will have implications for the future costs of new assets. Design standards and treatment process may change in response to the pressures to maintain compliance with legal consents and deliver services with significant supply and demand changes.</li> <li>• Regulatory authorities (EA and DWI) will review consents and standards as climatic changes become more apparent and create risks to the environment and to customers.</li> <li>• It is intended that the 2010-15 price limits will be decided with greater emphasis placed on the need to take a longer-term view of climate change and sustainability. Each company's business plan must be consistent with its 25 years strategic direction statement. This should overcome a major concern that the regulatory process does not allow companies to take a long term view of climate change. Ofwat's response to company submissions in PR09 will provide evidence of the regulators position.</li> </ul>	<p>Generic</p> <ul style="list-style-type: none"> <li>• Industry regulators need to understand that climate change will be a driver for increasing capital and operational costs. The regulatory funding determinations need to reflect these upwards cost pressures.</li> <li>• Tightening consents and standards will place great pressure on the companies to manage their existing assets and avoid asset write-off with the consequential implications for the regulatory asset base.</li> <li>• Companies will need to persuade OFWAT that additional treatment processes are required and funded.</li> <li>• An 'overlap' CAPEX programme as part of the price review has been agreed allowing projects that begin in the period 2010-15 to end in the following five-year period. Extending the time horizon enables companies to identify the optimal investment pattern over time. This also promotes a phased approach to meeting the challenges presented by climate change.</li> <li>• Each company is required to produce water resource management plans (WRMPs). These long-term plans set out how the companies will address the future challenges of maintaining the balance between supply and demand. The Environment Agency's WRMP guidance includes specific details on how companies should incorporate climate change in their plans.</li> <li>• Increasing use of energy efficient process and equipment. Pressure to secure OFWAT acceptance of upward pressure on costs.</li> </ul>

Business model system	Impacts and consequences	Risk management responses
<p><b>Asset operation and performance</b></p>	<p><b>Generic</b></p> <ul style="list-style-type: none"> <li>Maintaining asset performance is likely to require changes to maintenance programmes and greater operating costs.</li> <li>Increased capex and opex will be necessary to replace damaged assets.</li> <li>A changing climate could affect assets in a range of ways, some of which are likely to be unpredictable. This may for example, include an increase in burst mains or sewer collapses because of changes in soil moisture content.</li> <li>Regulatory authorities (EA and DWI) will review consents and standards as climatic changes become more apparent and create risks to the environment and to customers.</li> </ul> <p><b>Clean water</b></p> <ul style="list-style-type: none"> <li>The Government has acknowledged that on their own, measures to control demand are unlikely to be sufficient to meet future requirements. On the supply side, new water resources are likely to be required if the levels of service that consumers expect are to be met.</li> <li>Demand management will play an increasing role, increasing OPEX and CAPEX costs, reducing revenue.</li> <li>The introduction of competition and water rights trading has the potential to have significant implications on the asset base and revenue of individual companies.</li> <li>Deterioration in raw water quality creating treatment problems and increasing risk of customer complaints, public health issues and breach of water quality standards.</li> <li>Increased temperatures will create more favourable conditions for bacteriological failures of treated water. Risk of increased complaints and prosecution.</li> <li>Changes in the demand for water driven by climatic conditions and the expectations of customers on service delivery will become important issues for water companies to manage.</li> </ul> <p><b>Waste water</b></p> <ul style="list-style-type: none"> <li>Sewers may be placed under increasing stress as they will have to operate at capacity more often because of more frequent, intense precipitation</li> </ul>	<p><b>Generic</b></p> <ul style="list-style-type: none"> <li>Regulators must acknowledge the impact of climate change on capital investment and operational business plans.</li> <li>The impact of climate change on asset life, operational performance, maintenance and capital investment expenditure should be assessed.</li> <li>Current and future climate risks should be incorporated into standard risk management procedures and into the regulatory price determination process.</li> <li>The industry regulator’s economic models need to reflect that climate change is and will continue to have an impact on water and waste water services.</li> <li>Companies may have to consider how they fund climate change resilience if Ofwat does not fully accept the actions proposed to manage climate change.</li> <li>Media relations exercises and customer education on the impacts of climate change.</li> <li>Extensive stakeholder engagement exercises will be extremely important.</li> </ul> <p><b>Clean water</b></p> <ul style="list-style-type: none"> <li>New charging and tariff strategies could be used to manage demand. If consumers are more aware of the true cost of the water they use, they can make informed choices about their water use.</li> <li>Ofwat has considered the use of seasonal, rising block and other innovative tariffs. A number of these are now being trialled by the companies. Seasonal tariffs mean that customers will pay more for water when resources are at their most stretched, for example, during extended drought conditions. This could become an important adaptation tool in some areas to prevent water shortages. Rising block tariffs may provide incentives to customers to use less water throughout the year.</li> <li>Demand management will play an increasing role and will require customer acceptance if it is to prove successful.</li> <li>Ofwat believes that companies will have to change the way they operate to meet the changing demands of customers due to climate change. Although the previous attempts by the regulator to introduce competition have failed, Ofwat has stated by introducing competition progressively into the water and sewerage sectors, it hopes to bring about innovation. As a result, it is expected that competition would deliver improved performance on key climate change issues.</li> <li>The customer response and attitude to increased competition is not clear.</li> <li>Ofwat has also set out its view that market forces can drive efficiency in the use of water resources. It is suggested that a competitive market in water rights trading could help to reveal the economic value of water, and encourage innovation in water efficiency and the development of new water resources.</li> </ul> <p><b>Waste water</b></p> <ul style="list-style-type: none"> <li>Alternative sewerage charging systems that encourage sustainable use of surface water, by providing rebates have been considered. Encouraging the development of permeable areas by providing financial incentives has been trialled in the USA.</li> </ul>

Business model system	Impacts and consequences	Risk management responses
Customers	<p><b>Generic</b></p> <ul style="list-style-type: none"> <li>• Company responses to challenges presented by climate change will have to be matched with customer expectations of how these challenges will be met. It is inevitable that customers will feel the impact of climate change through the levels of service they receive and the price they pay for water and sewerage services. Customers in market surveys consistently value a secure and safe supply of water above all else. Their priorities are clear and delivering these priorities is likely to become increasingly challenging under climate change.</li> <li>• Ofwat has stated that it will set price limits that protect consumers' interests, both now and in the future, by taking account of climate change. It is not clear what the implications will be for Company's investment plans if Ofwat decides that the price premium to be paid for climate change resilience is too great to pass onto consumers.</li> </ul>	<p><b>Generic</b></p> <ul style="list-style-type: none"> <li>• Companies will have to spend more time developing a greater awareness and understanding with their commercial and domestic customers.</li> </ul>

## Acclimatise

Acclimatise specialises in climate change risk management operating at both strategic and project levels. We have a portfolio of tools that enable businesses and governments to adapt to inevitable climate change. We bridge the gap between the scientific community and the corporate world, reviewing the latest science, providing clear guidance on corporate and financial risks and the opportunities arising from climatic change.



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