European Water Association

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A PRELIMINARY OPINION OF THE EUROPEAN WATER ASSOCIATION (EWA) ON THE SUBJECT OF THE CONSEQUENCES OF CLIMATE CHANGE FOR WATER MANAGEMENT

SUMMARY

S1 The purpose of the Preliminary Opinion is to set the scene. It is not intended to be a definitive analysis of the consequences of the present and predicted changes in weather for water management. The EWA brings together a very wide range of professionals who are members of the national Member Associations (see Annex I). The EWA offers the European Commission access to this industry expertise as part of its pursuit to find the right courses of action for the future. This opinion is intended to be a working document that will undergo revision during the development of climate change policy within the EU.

S2 The EWA recognises the potential severity of the consequences of climate change and the breadth and complexity of the challenge. The impact will vary from Northern to Southern Europe and to some extent from East to West. Some likely impacts relevant to water managers include an increase in evaporation; a decrease in storage due to melting of snow, ice and glaciers; increasing salinisation of groundwater; and stormwater problems associated with intense rainfall coupled with a greater risk of flooding. At the same time regulators, utility managers and water resource managers will be facing much higher temperatures, periods of low water flow and drought situations. These changes will have a major effect on the ecology and biodiversity within river basin systems and the characteristics of watercourses.

S3 All of these impacts will also have an impact on agriculture, water supply and wastewater treatment, flood risk and management, especially in urban areas, and wetland ecosystems which will come under increasing stress during drought periods. In addition there will be impacts on inland waterways and on coastal resort areas which will also face the problem of rising sea levels.

S4 From the evidence available it is clear that climate risk factors have to be built into current and future water cycle management. There will be impacts on ecosystems, water quality and resource availability, not to mention existing assets/infrastructure which could be vulnerable to the changing climatic conditions. Flexibility will therefore be a crucial issue in adapting to climate change in view of the present uncertainty and funds should be available to support the practical consequences of this and the development of appropriate climate change mitigation strategies.

S5 It is equally important that the European Union reviews it funding support for research as well as capital projects, ensuring that climate change is a factor in project evaluation and is a core component of the relevant research projects and technology platforms. Future funding must be geared towards supporting the National Adaptation Strategies being developed by EU member states. Full account must also taken of the potential migratory impact of peoples from countries bordering the EU and beyond where climate change impacts may be more severe.

S6 The EWA would strongly encourage and support the EU in the preparation of an overarching European Water Vision. Climate change impact response affects all aspects of

water management and should be considered as part of an overall long term plan for water management in Europe for the next 20 to 25yrs focussing for example on Water Resources and Treatment, Used Water Recovery, Flood Management and Biodiversity.

S7 The EWA also believes that climate change factors need to be incorporated into the design of water supply and reticulation systems and sewerage systems; climate change risk factors and/or "remaining risks management" need to more widely considered in flood risk management; water resource planning must incorporate the social and economic impacts of climate change in addition to the resource implications and the EU needs to ensure that 'climate change' considerations are incorporated into EU directives and other legislation. There will undoubtedly be pressures on quality (lower water flow levels will lead to higher concentrations of pollutants for example) and ecological standards due to the climatic changes and this needs to be recognized, as does the issue of monitoring which will become more necessary as the climate changes and existing systems need to be modified. The EWA believes that through proper and timely implementation of relevant existing EU legislation, most of the consequences resulting from climate change can be dealt with in an appropriate manner. However, the relevant directives should be reviewed as part of a 'climate change proofing' exercise.

S8 The EWA also believes that there should be greater integration between R&D programmes and the technology platforms, such as the Water Supply and Sanitation Technology Platform (WSSTP), under the Environment Technology Platform (ETAP). The research programmes must start producing data that is useable by all the practitioners in the water sector.

S9 The EWA urges the European Commission to adopt a set of common climate change scenarios against which mitigation and adaptation strategies can be developed. The UK Climate Impacts Programme (UKCIP) offers a model that could be applied across Europe. Equally the EWA would like to see one web-based portal that gives access to all ongoing and planned research projects supported by the EU, so that member states can get rapidly review all the projects and obtain access to findings. There must also be a review of where the gaps are in current research.

S10 Within the EU and member states, there already exists a significant amount of data relating to areas at risk of flooding or groundwater sources at risk from nearby landfill sites or other developments; maps of sensitive areas etc. Consideration should be given to bringing all this data together and the various risk maps overlaid so the areas that are most vulnerable to climatic changes can easily be identified.

S11 It is considered imperative that the EU reviews all it's existing and planned legislation to ensure that climate factors have been taken into account and future climate changes are not exacerbated by current and future directives.

This paper aims to set out some broad themes and concepts and some recommendations for the EU in terms of Water Management and policy development in relation to climate change.

WHAT ARE THE LIKELY CHANGES IN CLIMATE

1 There is now consensus that the climate is changing, it is the extent of change that is the subject of debate and there are many models that describe the impact of climate change. The difficulties that investors, utility plant designers, operators, local authority drainage managers, local municipal planners and others have to face is how much climate change will affect them and how quickly they must make plans to adapt to the effects. In many cases it may be necessary to make investment in advance of major problems developing, on the basis of model predictions – such as in flood risk management, water and sewerage systems. Equally there maybe a need to step back and review investment plans and priorities in light of the climate change predictions and scenarios - is all investment being made within an appropriate framework? However, there will need to be consensus as to the like scenarios that will develop in Europe against which potential changes can be outlined. The EU should set out the agreed scenarios.

2 The frequency and intensity of precipitation patterns throughout the European region will change as will sea levels and associated storm surges. The light and frequent summer rainfall of North West Europe could become characterised by intense thunderstorms more typical of Southern Europe. Extreme meteorological events are likely to become more commonplace and this could also affect local micro-climates. Extended periods of drought are likely to occur in southern Europe which may face increased risk of desertification. These changes have to be taken into account for managing water resources and ecosystems, for managing water uses and for designing and managing water related assets.

THE CONSEQUENCES OF CHANGES IN TEMPERATURE

Water Consumption

3 There is a need to establish if and how average per capita consumption will change across Europe, though each country has different patterns of usage and different population demographics. However, it is reasonable for regions within the European Union to pose the question about changes in water consumption, which will be affected as average temperatures rise, accepting that the answers will be different country to country. It also makes sense to ask the question, when designing water and wastewater treatment systems, drainage networks etc. whether or not there will be a need to include a climate change factor for design horizons. In the UK, systems are modelled for a range of storms - for wastewater, for example, this includes theoretical storm return periods up to around 30 years. However, historical data in this context may not necessarily be helpful. So how should systems be modelled in the future?

4 Further, to avoid excessive flow problems, UK planning regulations require that where new buildings replace green areas, the runoff into the local watercourses from the new paved area must be retained at the same level as from green areas. Modern design concepts should therefore include a risk matrix that reflects the potential impacts of climate change. Equally water resources planners and wastewater treatment planners must account for the changes in water consumption and review the water systems already in existence to see if they need upgrading. They may also be a need to make a sustained effort to reduce water demand, promote water efficiency and develop appropriate water pricing. In addition, in some countries drought could become a more severe problem than flooding, this also needs to be designed for when planning water efficiency schemes.

Prudence in Water Use

5 Higher temperatures will inevitably lead to greater demand for water. This will cause extra stresses on water resources. The EWA considers it prudent to plan on the basis that in areas at risk of climate change, the social, environmental and the economic value of water to all consumers, will rise. The Water Framework Directive (WFD) does focus on cost recovery pricing but the EWA believes that this does not go far enough and water prices will need to reflect the true cost of the service delivered, social, economic and environmental value. Customers should also be encouraged to use water wisely all the time not just when droughts occur and there will need to be a major learning exercise as, for example, the water rich areas of Northern Europe learn the habits of the water scarce areas of Southern Europe in terms of water resource management.

Reticulation and Treatment

6 Higher temperatures should aid the efficiency of biological processes used in water treatment, particularly for wastewater treatment. It may even be cheaper to run processes in warmer climates. For example it is known that some processes, which need fermentation of the semi-solid products of wastewater treatment need to be heated less or do not require insulation. Methods of wastewater treatment more suited to hotter climates may become viable.

7 However, this may also lead to greater biological activity in wastewater sewers causing septicity with the release of malodorous gases. These will create more problems with the management of sewers, pumping stations and treatment plants. The wastewater will be less treatable, there will be more public nuisance problems and there will be increased corrosion of the existing assets.

8 Higher temperatures can also lead to problems in public water supply with upper limits acceptable for public consumption being breached and in northern Europe, species of 'cyanobacteria' emerging that are common in Southern Europe and the Mediterranean region. In the hot summer of 2006 cyanobacteria typical of Southern Europe emerged in Holland requiring increased chlorination of public supplies, which also caused problems as the level of chlorine by-products nearly breached limits set in the Drinking Water Directive.

Evapotranspiration and Irrigation

9 If there are higher temperatures there will be more evapotranspiration and this could lead to an increase in water demand by agriculture. Crops will need to be watered and irrigated differently depending on how rainfall changes at the same time and there will be changes in the crops grown as agriculture adapts to climatic change. Water resources planners must therefore work with the agricultural industry to ensure that irrigation techniques become more effective in the application of water for irrigation with a greater use of drip feed systems which are less wasteful than spraying. The EU should review if the true cost of water (economic and environmental) is reflected in the charges paid by the agricultural sector. There should be a Europe-wide system of charging which reflects the value of the water as a resource in and as an economic input into crop production. Abstraction charges for water should also be incentivised with charges being higher when the water is used as part of a spray irrigation system. This would then drive appropriate investment based on economic and environmental criteria, not only would better irrigation techniques be used, farming practices would change and high water demand crops would not be grown in water stressed areas.

Pollution

10 It is known that surface water bodies with higher temperatures will suffer more from pollution discharges. In addition, where water is used for cooling and discharged back into rivers, more constraints and efforts may have to be put on limiting the induced increase in temperature downstream. However, the needs of energy/electricity generating industry (e.g. nuclear, coal and gas which uses water as coolant) need to be borne in mind and constraints on water use may lead to problems of security of electricity supply. All power stations that are running currently, must comply with Best Available Techniques (BAT), therefore more effort should go to research and technical improvements allowing these industries to utilise less water. Large scale energy saving initiatives should also be implemented at the same time. A further factor for the energy industry is the effectiveness of water abstracted for cooling as the water temperature rises over time, a problem that could become significant in periods of low rainfall and low river flows.

Seasonal Regime of Snow Melts

11 The general increase of temperature may reduce the amount of water stored in snow and ice stored in winter and released in rivers in spring and summer. Moreover, the snow and glacier melt may begin earlier in spring, thus changing the seasonal regimes of rivers which is likely to have effects at the scale of large rivers such as the Rhine and others in Europe whose flows are linked to snow melt.

CONSEQUENCES OF HYDROLOGIAL EXTREMES

12 Changes in rainfall patterns will lead to events as widely different as water scarcity and flash flooding. Where there are changes in rainfall, there will be several consequences which will engage water resource planners, flood risk managers and utility managers involved in design and operations.

Water Resources

13 At a time when there will be more demands on water resources, there is the potential that less will be available, and water scarcity could become a major resource and environmental problem. The best recharge of water resources occurs with slow availability of water such as constant light rain or slow snow melt. High intensity rainfall particularly after a long dry period in which the permeability of soil is decreased leads to rapid run-off and poor recharge. This variation will put great pressure on groundwater sources; so it is possible for a water utility manager and water regulator to be managing a water shortage and flood at the same time – which is a difficult media and political message. This could reduce the reliability of groundwater resources, in particular, and may result in the need to construct more multipurpose surface water reservoirs. Existing storage and retention systems such as reservoirs could become inadequate to meet demand as rainfall becomes more variable.

14 Changes in land use and land cover will occur as a result of climate change and these could further influence the availability of water resources. The EWA believe it will be important to consider how land use in a catchment can be modified to increase water availability and act as natural storage, for instance by slowing down rapid runoff from high rainfall events and by encouraging water to infiltrate to groundwater bodies. Experience gained in climates with low and variable rainfall could be modified and adopted for use. It is also important to ensure that spatial planning and land use is integrated by bringing the spatial planners together with the water resources managers. The work of the FLOWS (http://www.flows.nu/) and ESPACE (http://www.espace-project.org/) programmes should therefore be taken account of as part of this integration process.

15 In some areas total rainfall or snowmelt could reduce over a year and this will have consequences for water resource availability. So, water prudence in treatment, distribution and use will be essential, but this only delays the need for further action. Economically, it is likely that as an alternative or as a step before the development of new fresh water resources, techniques such as demand management, water recycling and water re-use will become more viable at both collective and individual levels.

16 The EWA is very much of the view that sea and brackish waters must be seen as the third water resource along with ground and surface waters. Desalination of at least brackish waters will become economically sustainable and in some places even desalination of sea water may be the solution, particularly in countries that begin to see a reduction in water availability. However, this is an energy intensive option and may contribute to climate change; therefore more effort is needed to reduce the power demand of this option and more fundamental research is required into improving the efficiency of desalination.

17 Regions which have not been water rich, have already had to face the economic and social consequences arising from this and will be in a position to share knowledge with regions facing the problem for the first time. These new sources of water have often been rejected in water rich regions on the basis of cost or aesthetics – but thinking must change.

18 Use of grey and rain water within residential and commercial property for non-potable purposes is growing in some member states and this can reduce demand for potable water considerably. Development of water quality standards for grey and rain water for these purposes would help development of this trend. The EWA considers that the technologies of water recovery from treated municipal waste water, grey and rain water from homes for all purposes need greater attention, in particular, there needs to be a long campaign to shape public perceptions on the potable uses of such recovered waters. It is worth noting that less than 1% of water used in typical homes is for potable uses. Continuing to use potable water of drinking quality for all household water consumption is therefore not sustainable in the face of climate change. Good practice from drier areas such as Australia where dual piped systems and significant recycling/re-use of grey water is already commonplace should be more

widely adopted in Europe. At the moment is acceptable to used recovered water for uses such as power station cooling, but rarely for potable purposes unless the water is returned to a watercourse for a short distance before re-abstraction.

19 The EWA is of the opinion that the term municipal wastewater or sewage should no longer be used and it urges policy makers to adopt the term 'used water' and the concept of 'used water recovery'. Indeed in some countries this more positive terminology is already employed.

20 The EWA also believes that EU member states should be encouraged to use the latest technologies employed in the management of water resources. This could be facilitated through the EU Water Supply and Sanitation Technology Platform. The Water Supply and Sanitation Technology Platform (WSSTP) is one of the technology platforms that are set up within the European Environmental Technology Action Plan (ETAP) that was adopted by the European Commission in 2004. It is a European initiative, open to all stakeholders involved in European water supply and sanitation and major end-user groups.

Flooding

21 This is already one of the most evident of the deleterious effects of climate change. Of all the climate change impacts flooding may well have the most severe consequences and is recognised as having the potential to undermine the sustainability of the European economy in addition to the grave threat to human life and potential for widespread damage and disruption. The flooding can be coastal, fluvial, and pluvial. Flooding can also occur from underground sewerage and drainage systems and higher groundwater levels if winter rainfall and recharge to aquifers increases. The EWA recognises that there is a difficult political message in persuading the residents of Northern Europe that drought and flooding will co-exist in water management strategies, but the residents of Southern Europe are well aware of this apparent paradox arising out of more erratic and extreme weather patterns. It is very clear that recent summers have been extremely warm and that autumn rainfall/snowmelt has caused flooding in some countries. Drainage for new development will need to be adapted to take into account flow retention to greenfield levels.

22 Flood risk management is now a very important element of catchment-wide water cycle management. A holistic long term view needs to be taken which works with nature and incorporates flexibility to adapt to climate change. It is much more than just building flood defences although these may have their place in a portfolio of measures including source/run-off control techniques, strategic flood pathway management and flood receptor/consequences management. Proper consideration of source control techniques such as sustainable drainage systems, land management and 'farming of water' is required. Such approaches provide opportunities to manage both water demand, improve infiltration and recharge of aquifers and reduce the volume and intensity of surface water run-off; leading to a win-win for water resources and flood risk management. A move towards more strategic management of the flood pathways through strategically located detention and retention areas to serve both flood management and water resources purposes will enable improved synergy in the management of the flood/drought double threat described earlier. The management of the consequences of flooding through designing appropriately for exceedance, better planning and control of developments, use of flood resistant and resilient building techniques and better education/ preparedness of occupants of areas at risk of flooding will minimise the actual loss/damage when inevitably a higher event than can be accommodated by the flood defence systems occurs. In the Netherlands, the Government is already 'making room for water' in its planning procedures. Similar principles are involved in the UK 'making space for water' initiative.

23 The whole of the surface water cycle from source through to discharge to the sea can therefore be better managed through a conveyance and treatment train, suited for each catchment area to ensure better management of water resources, flooding, water quality and the natural environment.

24 Periods of rainfall can be so intense that the rainwater can overwhelm surface water and highway drainage systems. The phenomena of flash flooding and pluvial flooding are becoming more a major risk in Northern Europe and the design of drainage systems in more temperate regions will, with changing weather patterns, have to include climate change risk factors into systems design and knowledge transfer should be encouraged and supported from people working in areas already prone to high intensity rainfall events. This calls for an integrated design of conveyance systems including

retention, individual retention and infiltration measures, and urban design accounting for the "ways of water". Where networks and storm tanks cannot cope, or would be too expensive, the appropriate design of streets and squares can to some extent reduce city vulnerability and surface flow hazards. In dealing with pluvial flood risk the EWA believe that 'pluvial extreme event planning' as a part of surface water management plans should be considered for urban areas whereby vulnerable depressions in the topography and critical flowpaths should be identified and mitigation measures examined together with possible contingency evacuation procedures, all in conjunction with improved pluvial event forecasting and warning.

25 Rainfall in a catchment can aggregate to be so excessive that it causes flooding in the lower catchment, particularly in low lying areas. So flood risk management is now a very important branch of water cycle management and this may require to protect cities from increased storm surges as well as rising sea level and fluvial flooding. However, management is also about making sure that new development takes place, where possible, on land with lower flood risk. Developments should also be designed so that they do not increase flood runoff and catchments should be managed to reduce flood response through sensitive land use.

26 There is also a need to develop awareness of flood issues among the public and develop customer friendly and robust flood warning systems, the use of 'soft' engineering techniques, such as the re-creation of wetlands as floodwater storage areas and the incorporation of flood protection and flood resilience features into the design of homes and highways which have to be constructed in flood risk areas.

27 The EWA is actively involved in these topics and seeks to harness the synergy of experience and knowledge of experts throughout Europe. The EWA urges all concerned to rethink the prevailing philosophy with the emphasis on flood risk management rather than flood protection.

Changes in Sea Level

28 In coastal and estuarine areas, flood risk can be further compounded by or solely due to changes in sea level as a consequence of higher temperatures leading to thermal expansion of seawater., melting of ice caps and glaciers. Europe is particularly vulnerable with approximately 50% of the population living around the coast and they could see a rise in sea level of possibly more than one metre over the next 100 years, which, together with greater storm surge levels, will increase coastal erosion, threaten wetlands, and lead to an increase in saltwater intrusion, which could affect groundwater supply sources. However, the less predictable aspects of storm surge and increased wave activity associated with an increase in 'storminess' due to climate change, may be a more immediate problem to deal with than the long term rise in sea levels. It is therefore important that flood risk management is an essential part of management strategies in coastal and estuarine areas and because coastal areas are likely to become prohibitively expensive or almost impossible to protect, it will be necessary to consider the social consequences of allowing natural coastal realignment in such cases. Integrated coastal zone management will be an important strategic tool as measures employed to reduce erosion in some locations could reduce the sediment supply to natural features such as beaches and shingle ridges 'down-drift' which may alleviate coastal flood risk in lower lying coastal areas.

29 The EWA recognises that climate risk factors are already included in flood risk management but is of the opinion that they should be used more widely, both for design criteria for flood management measures and for determining the possible failure of structures. It is particularly important to consider the social consequences where there is a change in policy e.g. from protect to no active intervention. In the UK no compensation is currently given to landowners unless there is a specific scheme of realignment; standard flood insurance cover for buildings does not include coastal erosion. Lessons should be shared across Europe, particularly where people are involved in a process of resettlement.

Sewerage and Sewer Overflows

30 Municipal wastewater is collected in sewers and delivered to treatment works. It is very difficult, even impossible, to stop infiltration of ground or stormwater into the total sewer and drain reticulation systems; indeed some systems are designed to collect rainwater. Under these circumstances, there will be

overflows on the sewer network and at the treatment works to decant off excess flows at times of storm. These flows may well be partially treated; the overflow settings are set to ensure that in all but exceptional events the municipal wastewater is treated fully. However, changing rainfall patterns, could lead to a situation where more municipal waste water will be discharged untreated from the overflows more frequently. There is no doubt that overflows can have serious hydraulic and quality effects on receiving waters. Even separate surface water sewers can contribute to flooding and overflows from these systems can be contaminated – say from highway drainage or cross-connections in domestic property. Equally there maybe a problem of exfiltration as the systems are overwhelmed and groundwater sources become contaminated.

31 The EWA recognises that one of the most traumatic aspects of flooding is the presence of municipal 'used' waters in the flood water and the EWA urges all designers to make sewerage systems to be as flood resilient as possible where rain intensities are set to increase. The EWA is aware that the Commission is concerned about current problems of this aspect and supports any actions taken to reduce such pollution; however it is also mindful of the cost implications and urges the Commission to consider this aspect as part of a longer term strategy.

32 Flood waters are a complex mix of excess environmental waters spilling over from rivers or from surface water sewers which are not big enough and the excess municipal used water diluted with rainfall run-off water and flooding may occur because surface water sewers are not able to cope with the combined flows. The problem is that if the landscape is flooded, under more intense periods of rainfall, there is nowhere for municipal wastewater to go and in worst case scenarios the flood water may even enter the sewer system and flush out sewage back into homes. There may need to be measures to reduce use and discharge volumes by the public during emergencies and there will need to be an appropriate information system in place. There will also be a need for the provision of increased storage in the reticulation and treatment system and use of suitable devices to enable this to happen. There will also need to be more real-time flow management systems in place.

33 Questions must be posed about Sustainable Sewerage Designs. Designers and regulators should now add a climate change factor to design calculations and consider questions such as:

- How can existing drainage and sewerage systems be modified in line with expected climate change impacts?
- How can 'horizon design rainfall' calculations be incorporated into design parameters?
- What is the best for a new system – combined or separate? The balance of the answer for new developments may tip more towards the latter than it has in the past. However the EWA recognises that there are differences in attitudes to these two approaches between European Union member states.
- What can be done on old systems to increase storage of the excess flows, so that they can be treated when the storm is finished?
- What can be done to improve the quality of excess flows?

34 The contribution of combined sewer overflows to the receiving water quality is also a very important issue which will also embrace the outrage of public perception in seeing pollution occur. The EWA supports the Commission in pursuing these aspects under the Water Framework Directive. This is discussed in more detail later.

Reticulation and Wastewater Treatment

35 Rainfall per se should not affect the design and capacities of treatment works. But the dangers posed by flood waters will create additional design and management strategies. Extra precautions must be included to defend electrical assets, boreholes and treatment plants during times of flooding. Furthermore, raw water resources may become contaminated or even damaged and contingency plans will be needed to maintain wholesome potable supplies.

36 The changes in rainfall patterns and surface water volumes could influence the design capacities of sewer and wastewater treatment works in order to avoid foul water flooding as explained earlier. But lower flows and higher temperature will combine to change the volumes and character of the used water. In some locations with existing combined sewers, it will vary in one year from being low flows of

strong and even septic quality with a tendency to deposit solids in sewers, through to very high flows of possibly better quality but with increased risk of surcharging and flooding. So this may well affect the treatability of sewages in such changed circumstances. Again the experiences of Southern Europe will be helpful – but even in those regions the variations may become more extreme and there may be a need for further changes in practice. So the retro-fitting of changes to a reticulation and/or treatment system will need different approaches to the design of new systems.

37 A change in weather could even affect sewage sludge treatment and disposal. For example a warmer climate might mean that sludge digestion is easier in itself but sludges may be less treatable. Equally changes in farming practices might alter demands for the use of treated sludge as a fertiliser on farmland. Warmer weather might also change the public health profiles of communities leading to shifts in attitudes towards the sanitisation of sludges before use. All these are uncertain factors which need to be explored.

38 Further research work is required to explore the impacts of flooding on distribution networks where they are under water, how do they function? What are the key problems? How can they still operate effectively under such conditions? These are also key questions to answer.

OTHER CONSEQUENCES FOR THE MANAGEMENT OF WATER IN THE ENVIRONMENT

38 So far this Opinion has been focussed on looking at changes in temperature and rainfall as separate issues but not only are they linked as meteorological factors, but the consequences are often linked together. For example, changes in irrigation practices and wastewater treatment plant design, but the combined effects will be observed most evidently in the natural environment.

39 Clearly there will be significant changes in the natural environment, for example species disappearing from habitats and appearing elsewhere, loss of forested areas, increased water scarcity, changes to soil fertility and the impacts on species biorhythms. This will have consequences for water based ecosystems and have a resultant impact on the ecological status of many water bodies.

40 Higher temperatures will allow foreign species from warmer climes introduced by accident or design to flourish, possibly to the detriment of local ecologies. The EWA urges that closer cooperation be established with the International Union for the Conservation of Nature (IUCN) in order that biodiversity changes are incorporated into EU thinking.

41 Higher temperatures and dry conditions may lead to a breakdown of soil structure and an increased dust burden in the atmosphere. This may be exacerbated by faming practices which are not environmentally friendly, as happened during the drought in the early twentieth century in central USA. Loose soils are washed easily into water bodies at times of intense rainfall. So one effect of climate change in some areas will be increased sediment burden in environmental waters with consequences for water quality and wildlife including aquatic species. It will also increase the costs of reservoir and surface water treatment management. Increased sediment release might also reduce channel capacity and increase flood risk.

42 Some of these issues might by mitigated through recycling of bio-solids to land and the planting of protective bands of trees and hedges alongside watercourses. Where this is not possible, farming methods should be practiced which cause the least disruption of soils and prevent sediment from running off, such as contour ploughing, injection of agrochemicals, arable exclusion or low intensity farming practice zones alongside watercourses and of course, avoiding deforestation where-ever possible. Soil compaction should also be avoided to promote rainfall absorption into the ground and reduce runoff rates. These practices will also improve moisture retention and encourage infiltration, lessening the impacts of increased rainfall variability - this could also be important in flood mitigation.

43 Changes in climate will also influence soil chemistry and microbiology with consequent changes in runoff quality. Furthermore, it may also result in changes in the use of fertilisers and other agrochemicals such as herbicides and pesticides. This will influence the aquatic ecosystem detrimentally and once again

will increase the costs of treating surface water for potable purposes. Where the agrochemicals also penetrate into groundwater, exacerbating problems which occur now, these waters will also require more treatment and will be more expensive to use.

44 The EWA supports the continuing effort in research to develop more environmentally friendly chemicals and farming practices and to the development of more robust strains of crops able to withstand climatic changes. The EWA also urges the EU to undertake further research into soil stabilisation techniques.

CONSEQUENCES OF CLIMATE CHANGE ON LONG TERM INFRASTRUCTURE DECISIONS

45 Climate change and its impacts will continue throughout the long lifetime of water-related assets: multipurpose dams, dikes, tanks, civil engineering structures for treatment facilities, but also assets which protect against natural mountain area hazards, for example mud flows, rock slides, including protective vegetation. Furthermore, these assets are to face not only climate change, but also demographic changes (population increase and migrations), economic changes, land use pattern changes and changes in social attitudes.

46 Long term investment decisions are therefore to consider significant future changes over time (both general trends and changes in random events), with a high uncertainty. The design of long life assets has also to consider the needs for adaptability and modularity. It is essential that current investment decisions do not exacerbate the management issues of adapting to climate change.

47 On the other hand, decentralised and semi-decentralised options (small loops, recycling at various scales) will gain in importance as an alternative to increasing the capacity of existing reticulated systems. This requires an assessment of the sustainability of options where the mix of centralised assets and decentralised equipment evolves over time.

48 It is also important that regulators who oversee investment in the water industry are encouraged to review planned spending taking into account climate change and the need to be able to cope with greater variability in weather patterns.

EU Policy and Funding

49 It is also essential, given all the potential impacts outlined in this opinion, that the effects of climate change are taken into account when developing new directives or revising existing legislation. Indeed, for some pieces of legislation, it may be necessary to provide supplementary guidance on climate change. Equally, the EU funding streams such as Cohesion, Structural for EU members and ISPA for the pre–accession countries must have the project assessment criteria reviewed to take account of the impact of climate change and projects submitted must be designed accordingly. Currently Cohesion and Structural funding is being geared towards supporting adaptation/mitigation projects in EU member states but existing schemes for say water and wastewater treatment must be reviewed as well to ensure that they are climate resilient and are not adding to the problem. Equally it is important to assess these projects in light of expected climatic changes to ensure that new facilities are not sighted in areas that will become prone to flooding.

50. The EWA recognises that the EU and national governments are sponsoring considerable research in the climate change area, including that related to water management. It is therefore vital that the academic, policy and user communities interact closely. It is also important that the various technical platforms such as the Water Supply and Sanitation Technology Platform (WSSTP) and other platforms established under the Environmental Technology Action Plan (ETAP) should be encouraged to incorporate climate change within their core objectives. The EWA is prepared to input into these programmes as appropriate.

51 The EWA would like to see the EU develop a portal that has information on all the relevant research programmes being undertaken with respect to climate change. It is imperative that the results of research programmes such as ESPACE (European Spatial Adaptation to Climate Change) and PESETA (Projection of Economic Impacts of Climate Change in Sectors of the European Union based on Bottom-up Analysis) are integrated into the adaptation plans of EU member states. It is also important to know about all the various research projects being undertaken - not only is this important in terms of future adaptation, it may help to identify where there are gaps in the existing research.

52 One area the EWA would like to see developed is the 'over-laying' of all the relevant risk and hazard maps produced by the EU and the member states. At a glance it would then be possible to identify not only the areas most at risk but those that are extremely vulnerable as they are a sensitive area or they contain an important raw water source or there is infrastructure such as water treatment plants.

CONCLUSIONS

These general conclusions underpin what has already been produced in the summary and the specific conclusions and recommendations provided under each topic heading:

53 The EWA recognises the potential severity of the consequences of climate change and the breadth and complexity of the challenge. From the evidence available it is clear that climate risk factors have to be built into current and future water cycle management henceforth. Flexibility will be a crucial issue in adapting to climate change in view of the present uncertainty of predictions. Funds should be available to support the practical consequences of this and the development of appropriate climate change mitigation strategies.

54 EWA would also encourage and support the preparation of an overall European Water Vision. Climate change impact response affects all aspects of water management and should be considered as part of an overall long term plan for water management in Europe for the next 20 to 25yrs focussing for example on Water Resources and Treatment, Used Water Recovery, Flood Management and Biodiversity.

55 It is equally important that the European Union reviews it funding support for research and capital projects, ensuring that climate change is a factor in project evaluation and is a core component of the relevant research projects and technology platforms. It is also essential that all the research projects are co-ordinated and the information (even on ongoing projects) is made available through a single portal for all member states to access and take into account when developing their adaptation plans.

56 Clearly the EU must review all existing Directives and those being planned to ensure that climate change is being factored into the implementation. This process will help to identify the directives that may not be aligned with or might even be counter-productive to the broad EU strategy for managing climate change. Such a review will also highlight areas of potential problems, where climatic changes are likely to cause countries to fail against defined standards. The review team should have executive authority to be able to recommend changes that could be part of supplementary guidance.

EWA, Hennef, November 2007

ANNEX I

European Water Association

The European Water Association (EWA) is an independent non-governmental and non-profit making organisation dealing with the management and improvement of the water environment. It was founded on 22 June 1981 as the European Water Pollution Control Association. The scope of the Association was enlarged in 1999 with the change of name to the European Water Association.

It is one of the major professional associations in Europe that covers the whole water sector, wastewater as well as drinking water and water related waste. With member associations from nearly all European countries EWA consists of most European Union Member States, including all countries from Central and Eastern Europe which joined the European Union on 1 May 2004. Other European countries represented within the EWA are Croatia, Romania, Ukraine, Serbia and Montenegro, Norway, and Switzerland.

The aim of EWA is to provide a forum for the discussion of key technical and policy issues affecting the growing European region. This is done through conferences, workshops, meetings and special working groups of experts all organised on an international basis together with regular publications.

EWA informs its members on the development of EU legislation and standardisation and seeks to influence the drafting when appropriate. It has close contacts with the European Commission (DG Environment), the European Committee for Standardization (CEN), the European Environment Agency (EEA) and the European Parliament.

Through this exchange of knowledge the objective of EWA is to contribute to sustainable water management, a safe water supply and the protection of the water environment.

Today, EWA consists today of about 25 European national associations each representing professionals and technicians for wastewater and water utilities, academics, consultants and contractors as well as a growing number of corporate member firms and enterprises. EWA thus represents about 55,000 professional individuals working in the broad field of water management.

Our vision
As a major and influential European organisation representing water professionals through their National Associations, EWA promotes the sustainable management of the total water cycle for Society's needs coupled with excellent service provided by informed and expert people.

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