Climate Change: Emerging Issues for Clean Water Agencies

NACWA White Paper

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I. INTRODUCTION

In recent years, and particularly in recent months, federal and state governments in the United States have begun to engage more publicly on the climate change issues. Despite the debate about the causes and effects of climate change, legislation and regulation regarding climate change have already occurred at the state and local levels, and action has ramped up at the federal level as well. Litigation involving climate change has also already occurred, with new cases in the future a virtual certainty. The operations of publicly owned treatment works (POTWs) may be impacted both by the actual physical effects of climate change and by new climate change mitigation policies. Accordingly, it is critical for the National Association of Clean Water Agencies (NACWA) and its member agencies to participate in the ongoing discussions regarding climate change to ensure that the interests of the clean water community are represented and advanced.

The U.S. Environmental Protection Agency (EPA) is devoting resources to understanding and planning for climate change effects. On March 1, 2007, Benjamin Grumbles, EPA's Assistant Administrator for Water, released a memorandum describing the Office of Water's plans to address the issue of climate change. The memorandum stated that "climate change may have impacts on water resources and watersheds and affect our efforts to ensure progress under the Clean Water Act, Safe Drinking Water Act, and various ocean and coastal laws."[1] This memorandum also established a Climate Change Workgroup within the National Water Program. The workgroup has been preparing a climate change strategy, which will reportedly cover both the physical effects of climate change on water resources and the effects of greenhouse gas emission reduction requirements. A draft report on the strategy is expected to be released for public comment later this year.

As efforts increase to curb greenhouse gas emissions and possibly slow climate change, wastewater treatment agencies may be asked or required to reduce their emissions, to participate in renewable energy programs, or to engage in other mitigation efforts. According to EPA, if climate change occurs or continues to occur, it may result in alterations to atmospheric temperature, precipitation form and distribution, storm intensity, water temperature, and water chemical composition, as well as cause sea level rise.[2] All of these potential changes may have a physical impact on the operations of wastewater treatment facilities. This paper provides background information on these potential impacts of climate change on planning and operations for wastewater treatment facilities. Recent actions regarding climate change in the legislative, regulatory, and legal forums are discussed, and their possible effects on the clean water community are examined.

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[1] Grumbles, Benjamin H., *Memorandum on Climate Change and the National Water Program*, United States Environmental Protection Agency, Office of Water, March 1, 2007, pg. 1.
[2] Id at pg. 3.

II. EMISSIONS REDUCTION EFFECTS ON WASTEWATER TREATMENT

Legislation that seeks to slow climate change is targeting reductions in greenhouse gas (GHG) emissions, and wastewater treatment facilities may eventually be subjected to emission reduction requirements. These efforts are likely to concentrate on the largest emitters of GHGs first, although with time, more emitters may be brought under the regulations. Emission reduction efforts for wastewater treatment would most likely target methane (CH_4) and nitrous oxide (N_2O), since these are the most significant greenhouse gases associated with wastewater treatment. Carbon dioxide (CO_2) produced from combustion of methane in boilers and co-generation systems, which are regulated under the Clean Air Act, may also face emission reduction requirements in the future that are separate from requirements on wastewater treatment processes. How greenhouse gas emissions are inventoried in the U.S., and how emissions reduction programs might operate, are described in this section.

A. Greenhouse Gas Inventory

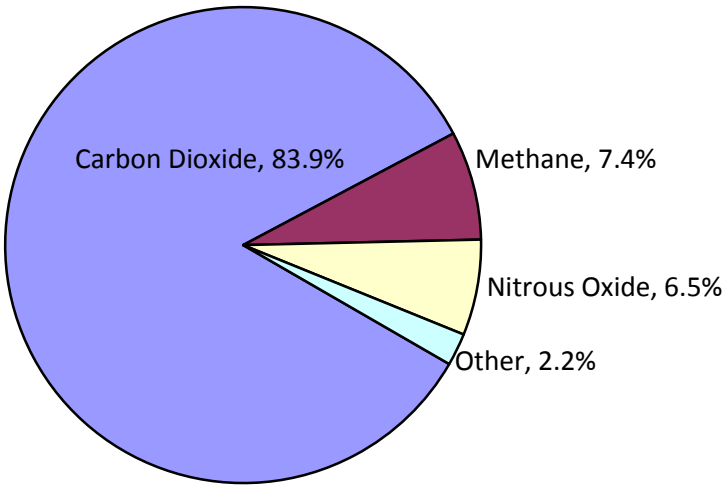
The U.S. signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, and as part of its obligation under the UNFCCC, EPA prepares its annual *Inventory of U.S. Greenhouse Gas Emissions and Sinks*. For this *Inventory*, EPA uses emissions estimation procedures that are consistent with the methodology recommended by the Intergovernmental Panel on Climate Change (IPCC), which was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme. The IPCC methodology allows consistent international comparisons of emissions. While the U.S. *Inventory* is currently used only for information purposes, not for any regulatory actions, it could be used as a key resource as regulatory and legislative initiatives on climate change progress.

The *Inventory* describes the major sources of greenhouses gases in the U.S. that are anthropogenic (directly caused by human activities or resulting from natural processes affected by human activities). Emissions that are biogenic (naturally occurring and part of the natural carbon balance) are not included in the *Inventory*. Carbon dioxide emissions are not estimated for wastewater treatment because the IPCC methodology considers the carbon dioxide produced in the treatment process as a biogenic gas.[3] The carbon dioxide emissions can be viewed as a natural result of humans consuming carbon-based food and beverages, with the emissions again being used by trees and plants to grow and not adding to the atmospheric concentration of carbon dioxide. The nitrous oxide and methane associated with wastewater treatment are considered anthropogenic since they are not cycled in this manner and they contribute to atmospheric concentrations of GHGs.

[3] IPCC 2006, *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds), Published: IGES, Japan, p. 6-6.

The *Inventory* considers the mass emissions of gases that can contribute to climate change both directly and indirectly, along with the potential of each gas to increase global warming. The Global Warming Potential (GWP) is defined by the IPCC as the ability of a gas to trap heat in the atmosphere, and it is compared to a reference gas, carbon dioxide. Emissions are expressed in teragrams (Tg, equal to one million metric tons) of carbon dioxide equivalents. The GWP of carbon dioxide is 1.0, while the GWP of methane is 21, indicating that methane is 21 times more effective at trapping heat in the atmosphere as an equal mass of carbon dioxide.[4] Nitrous oxide is even more effective at trapping atmospheric heat, with a GWP of 310. As shown in Figure 1, carbon dioxide, methane, and nitrous oxide make up the vast majority of the total 7260.4 Tg of carbon dioxide equivalents greenhouse gas emissions in the U.S.

Figure 1. Contributions to total 2005 U.S. greenhouse gas emissions in Tg of carbon dioxide equivalent.



In the 2005 *Inventory*, the most recent *Inventory* published by EPA, wastewater treatment ranks seventh in methane emissions and sixth in nitrous oxide emissions, as shown in Table 1. The wastewater treatment source category includes industrial and domestic wastewater that is treated in central systems such as POTWs, or in on-site systems such as septic tanks or small package plants. As reported in the *Inventory*, 21 percent of U.S. domestic wastewater is treated in septic systems or other on-site systems, while the remainder is treated in centralized systems. The top industries for both methane and nitrous oxide emit a much greater amount than wastewater treatment; however, wastewater still accounts for almost five percent of all methane emissions in the U.S.

[4] EPA Office of Atmospheric Programs, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1995-2005*, April 2007, p. 1-6 to 1-8.

Table 1. Top 10 U.S. sources for methane and nitrous oxide emissions in 2005. (In 2005, total methane emissions were 539.3 Tg CO_2 equivalents and total nitrous oxide emissions were 468.6 Tg CO_2 equivalents.)

Methane (CH_4)			Nitrous Oxide (N_2O)		
Source	2005 Emissions (Tg CO_2 Equivalents)	Percent Change, 1990-2005	Source	2005 Emissions (Tg CO_2 Equivalents)	Percent Change, 1990-2005
Landfills	132.0	-18.0	Agricultural Soil Management	365.1	-1.8
Enteric Fermentation	112.1	-3.1	Mobile Combustion	38.0	-5.7
Natural Gas Systems	111.1	-10.7	Nitric Acid Production	15.7	-2.2
Coal Mining	52.4	-36.0	Stationary Combustion	13.8	1.5
Manure Management	41.3	33.7	Manure Management	9.5	0.9
Petroleum Systems	28.5	-17.3	Wastewater Treatment	8.0	1.6
Wastewater Treatment	25.4	2.5	Adipic Acid Production	6.0	-9.2
Forest Land Remaining Forest Land	11.6	63.7	Settlements Remaining Settlements	5.8	0.7
Stationary Combustion	6.9	-13.5	N_2O Product Usage	4.3	0.0
Rice Cultivation	6.9	-3.2	Forest Land Remaining Forest Land	1.5	0.8

NACWA reviewed the emissions estimate methods used for wastewater treatment in the *2005 Inventory* and submitted comments to EPA with recommendations for improving their accuracy. EPA must have sufficient justification to vary from the IPCC guidelines in its estimates, and NACWA is therefore working on collecting data to show that the actual nitrogen content in wastewater in the U.S. may be less than half of the estimate used in the *Inventory*. The lower nitrogen content in wastewater would result in significantly reduced estimates of nitrous oxide emissions from wastewater treatment.

NACWA's comments on the *2005 Inventory* also addressed the apparent overestimation of methane emissions from wastewater treatment. The *Inventory* uses a methane correction factor of 0.8 for anaerobic systems to account for the amount of influent organic matter

that is actually biodegraded and converted to methane. However, well-recognized sources[5] indicate that at a maximum, about two-thirds of the organic matter in domestic wastewater is biodegradable, meaning that a methane correction factor of 0.67 is more reasonable for anaerobic systems. Fully anaerobic systems for treating domestic wastewater are also rare in the U.S. Most U.S. wastewater utilities use aerobic treatment systems that remove organic matter and reduce the amount of organics available to produce methane. These systems include suspended and fixed film reactors, facultative lagoons that combine aerobic and anaerobic processes, and wetlands that use largely aerobic treatment. A methane correction of less than 0.67 would therefore be appropriate to account for at least partial aerobic degradation of organic material.

EPA has expressed a willingness to look at any data NACWA can provide to back up the Association's recommendations to revise the methane and nitrous oxide estimation methods. If EPA does revise its estimation methods for a future *Inventory*, the estimates for all previous years will also be recalculated so that accurate comparisons can be made across time.

B. Cap-and-Trade Systems for Emissions Reduction

Again, although EPA's *Inventory* is currently only used for information purposes, it could be used as the basis for regulation in the future. One proposed bill, H.R. 620, referenced the *Inventory* for entities that would be covered by the legislation, while other proposed bills give EPA the authority to determine who will be covered. Climate change is receiving increased attention in the 110th Congress, and consensus seems to be growing among federal and state lawmakers that something must be done to curb human impact on climate as global population and industrial growth continue to increase.

The six Senate bills dealing with climate change that are most widely discussed are Lieberman-Warner (S. 2191), Sanders-Boxer (S. 309), Kerry-Snowe (S. 485), McCain-Lieberman (S. 280), Feinstein-Carper (S. 317), and Bingaman-Specter (S. 1766). Similar companion legislation is pending in the House. With the exception of S. 317, which only caps emissions at electric generation facilities, each bill covers entities that contribute to global warming according to the amount of greenhouse gases emitted per year. None of the bills are expected to go to the floor any time soon; however, S. 2191 enjoys bipartisan support and is expected to be the leading vehicle for an emissions limitations and trading system, also known as cap-and-trade, to reduce greenhouse gas emissions.

All six of these bills use a cap-and-trade system, in which a government agency sets a limit or cap on the emissions of certain pollutants. Companies or other entities are given credits or allowances that allow them to emit a certain amount of pollutants without penalty, and the total amount of credits they hold must be less than or equal to the set cap. If

[5] Tchobanoglous, G., F.L. Burton, and H.D. Stensel, *Wastewater Engineering: Treatment and Reuse*, Metcalf & Eddy, Inc., 4th Edition, McGraw-Hill, New York, 2003, and Grady, C.P.L. Jr., G.T. Daigger, and H.C. Lim, *Biological Wastewater Treatment*, 2nd Edition, Marcel Dekker, NY, 1999.

companies want to increase their allowable emissions, they must conduct a "trade" and buy or borrow credits from entities that release less than their credits allow. Strict penalties are enforced if entities emit more greenhouse gasses than allowed by their available credits. The penalties and revenues would be placed in a new trust fund for climate change initiatives.

A cap-and-trade system is a market-based approach to reducing emissions. Although a government agency sets the emissions cap, the companies trading emissions credits determine whether or not they will maintain, reduce, or increase their emissions, based on the cost of changing their emissions status versus the cost of buying or selling credits. Some cap-and-trade systems also allow non-polluting organizations, such as environmental groups, to buy credits. These organizations could then buy credits but not use them, causing the price to rise on the remaining credits if there is sufficient demand.

The establishment and operation of a cap-and-trade program, and its effects on the clean water community, would be greatly affected by the method for allocating credits. Methods could differ based on whether credits would be auctioned or freely distributed; how credits may be saved or traded among different entities; and how entities may receive credit for participating in other environmentally-beneficial projects. These issues are described below.

1. **Allocation of Credits.** The method of determining and allocating credits to emit greenhouse gases is at the crux of any cap-and-trade statute. Whether non-emitters or low emitters, such as nuclear energy plants and wastewater treatment facilities, should be in the credit market is an important decision. Another key question is whether essential public services, including wastewater treatment, will be dealt with differently than other industries. Pollution allowances could either be purchased or allocated, and the distribution method is a vital issue for how the market will function. Purchased allowances, particularly auctioned allowances, may encourage lower emissions since covered entities would pay for all of their emissions. Revenue from purchased allowances could also help finance low-energy technology research, infrastructure development, and other program costs. Free credits would not require costs to be absorbed by shareholders and consumers, but may discourage emissions reductions below the set cap. A declining cap system could motivate innovation and emissions reductions in anticipation of lower future caps, though. A potential hybrid approach would give free credits to regulated industries, but put a price on credits for unregulated emitters. Should wastewater be covered under a credit system, the way in which the allowances are determined will have far-reaching impacts on operations and the financial position of municipal wastewater treatment agencies.

2. **Banking and Borrowing Allowances.** Also at the center of the system of credits is whether industries should be able to bank unused credits or borrow credits in a national, or even international, market. This is a particularly interesting issue for the clean water community, as wastewater treatment operations may be able to reduce emissions more efficiently relative to high-emitting industries. Should the market price for credits

skyrocket as heavy polluters scramble for credits, the clean water community may stand to profit from a competitive trading advantage by selling unused credits to heavier polluters that need more allowances for their own emissions. A wastewater agency's ability to profit would depend on several factors: whether the allowances were free or purchased, what the current emissions projections are for wastewater, the extent that improvement is possible, and whether inter-industry trading is permitted. One disadvantage to participating in any credit market approach is that both the seller and buyer need to adopt exhaustive and comprehensive recordkeeping and reporting of their activities to prove the validity of their credits and compliance with emissions caps.

3. **"Safety Valve" Provision.** A highly contentious option also being examined is the "safety valve" provision, which would set a maximum price for GHG emissions to ensure that the economy is not unduly burdened by the limitations. Critics of the provision believe a safety valve would undermine the integrity of any eventual legislation by discouraging deep-pocketed companies from full compliance. Proponents argue that the valve would be set at a sufficiently high price to encourage compliance, but not so high and rigid as to interfere with the market's ability to adjust naturally and potentially cause large-scale economic dislocation in the event of unanticipated complications with the legislation. A safety valve provision could limit profits of wastewater agencies selling credits.

4. **Emissions Reduction Targets.** The proposed bills vary with regard to the level of GHG reduction targets required, as well as whether the reduction should be absolute or intensity-based. The absolute emissions target caps would be a fixed number, while the intensity-based caps would be indexed against relative growth of the economy, for example, the Gross Domestic Product (GDP). Critics of the intensity-based caps argue that such a scheme may make economically advantageous behavior environmentally disadvantageous. However, if GDP is less vigorous than expected, the intensity cap could be more stringent than an absolute cap. A hybrid approach could also be used that would implement both cap types depending on various other factors.

5. **Offsets.** Even if the wastewater sector is not directly covered under a cap-and-trade system, other provisions, such as offsets for investments in green infrastructure, would significantly impact the water sector. Instead of reducing their own emissions, offsets would allow covered entities to reduce emissions in another arena where it is more economical. Emitters could offset their emissions by investing in various projects that would generate emissions offsets, such as methane gas recapture, geological and biological sequestration, renewable energy, and energy efficiency. Critics argue that offsets may detract from the importance of climate change and discourage more drastic emissions-reducing behaviors by providing a false sense of security and allowing those polluters with deep pockets to pay others to reduce emissions rather than reducing emissions themselves. Proponents of offsets argue that they are more economically efficient, representing another part of a comprehensive climate change strategy that all individuals and businesses can invest in at a reasonable cost.

   All of the congressional bills currently in the pipeline provide for offset credits, but vary in caps on offset credit use and the types of offset projects. Potential synergies may develop

between clean water agencies and an offset market. Water facilities may be able to sell offset credits generated through methane recapture, as well as align reforestation efforts with green infrastructure goals. For example, reforestation projects may be strategically located to double as a riparian forest buffer for stormwater run-off. Credits could also be provided for land application of biosolids, replacing other fertilizers that contribute to greenhouse gas emissions. Potential for offset credits also exists if a community served mostly by anaerobic, on-site septic systems that are large methane producers is brought into a centralized, aerobic POTW, resulting in a net decrease of methane production.

6. **Early Reductions.** For NACWA members, early reductions are an important feature under discussion because many agencies have voluntarily reduced greenhouse gas emissions through processes such as methane gas recapture. Early reductions would give credit to measures already taken, create incentives to take proactive measures before a bill takes effect, and potentially encourage innovative thinking. Improved methane recapture may be a lucrative asset on the offset market as the price of emissions credits rises. Therefore, it is important to ensure that credit for early reductions is part of a cap-and-trade system to protect utilities that voluntarily engage in facility improvements from losing any economic benefit resulting from their efforts.

7. **Energy Efficiency.** Within some of the potential cap-and-trade legislation are energy efficiency performance standards that require retail electricity suppliers to reduce peak demand and overall consumption of electricity. Wastewater utilities could be asked to decrease their electrical power use if their electric suppliers needed to decrease demand. Renewable energy sources may also become more important. Both Kerry-Snowe and Sanders-Boxer have a Renewable Portfolio Standard (RPS), which mandates that electric suppliers must purchase a certain percentage of electricity from renewable sources as defined in the Energy Policy Act of 2005, except for municipal solid waste and wood contaminated with plastics or metals, or tires. The methane generated from wastewater treatment is not listed as a renewable source in the Energy Policy Act of 2005, but its inclusion in the RPS could be an important opportunity for utilities to profit from methane production.

8. **State Preemption.** In the absence of federal climate change legislation, state and local governments have instituted their own climate change programs. California's Global Warming Solutions Act of 2006 is the most aggressive program, requiring GHG emissions to be at 1990 levels by the year 2020 and establishing a goal of an 80 percent reduction below 1990 levels by 2050. Eight states in the northeast participate in the Regional Greenhouse Gas Initiative (RGGI), which has a goal to reduce carbon emissions from electricity generation by 10 percent by the year 2019. An important question for states with progressive programs is whether those initiatives will be preempted by the federal climate change bills that are currently on the table. More than twelve states have stricter emissions standards than the federal government's proposed requirements, and that number continues to grow. The six federal climate change bills are silent on whether they would preempt existing state and regional regulatory initiatives and requirements such as those currently underway in California and the northeast. Without federal pre-emption, there will be no practical mechanism to trade a credit across state lines or internationally.

C. Summary of Implications for Wastewater Treatment

If federal GHG emission reduction legislation is eventually passed, it may have far-reaching impacts on the operations of wastewater treatment agencies. These impacts may be direct, through a cap-and-trade regime, or may indirectly link to the wastewater community through offset and energy efficiency requirements. Many questions still remain surrounding the intricacies of potential climate change legislation and resulting impacts on the clean water community. The different options for regulating GHG emissions vary greatly in their impact on wastewater treatment facilities, and a variety of factors will control the clean water community's response to legislation. Wastewater utilities may be forced to reduce emissions and participate in a cap-and-trade program, but utilities may actually benefit from properly crafted climate change legislation. Methane produced by wastewater treatment may be more widely utilized as a renewable energy source. In the area of offsets and credit trading, utilities may be able to more efficiently reduce emissions and sell offsets to higher emitters. Furthermore, wastewater utilities may benefit from potential offset options proposed in climate change legislation, such as the use of green infrastructure in urban areas and land application of biosolids.

III. PHYSICAL EFFECTS OF CLIMATE CHANGE ON WASTEWATER TREATMENT

As federal, state, and local governments grapple with climate change policies, it is important to note that the extent of human influence on climate change and the potential impacts of climate change are still uncertain. Many scientists predict that altered weather patterns will result from climate change, with the effects varying by geographic region. Some regions may experience more precipitation, while some may receive less, and regardless of overall precipitation amounts, storm intensities may increase. Temperature patterns could also change, resulting in different temperature and chemical characteristics in bodies of water. Sea level rise, caused by thermal expansion and the melting of glaciers and ice caps, could affect coastal development. These impacts of climate change on water resources are being considered by both EPA and Congress.

A. EPA Consideration of Climate Change Impacts

EPA's work on climate change is directed toward mitigation efforts, research on causes and effects, and adaptation to climate change. The focus of the Office of Water is primarily on adaptation, which is defined as "the impact of climate change on water resources and on the capacity to meet the requirements of the Clean Water Act in a changing environment."[6] The Office of Water's Climate Change Workgroup is coordinating with EPA's Office of

[6] Grumbles, Benjamin H., *Memorandum on Climate Change and the National Water Program*, United States Environmental Protection Agency, Office of Water, March 1, 2007, pg. 3.

Research and Development (ORD) and Office of Air and Radiation on climate change research and adaptation plans relating to water resources.

A draft report released by ORD, *A Screening Assessment of the Potential Impacts of Climate Change on the Costs of Implementing Water Quality-Based Effluent Limits at Publicly-Owned Treatment Works in the Great Lakes Region,* suggested that additional treatment may be required in the future to remove certain pollutants if predicted precipitation patterns result in lower base flow conditions. However, the report did not adequately consider that should such dramatic climate changes occur, water quality criteria and water usage patterns may also change significantly and, therefore, current criteria are not a good basis for predictions of what will be required from wastewater treatment plants in the future. Another consideration not covered in the report is how more stringent effluent standards will require a higher level of treatment, resulting in more energy consumption by wastewater utilities that may in turn result in a net increase of greenhouse gas emissions. Also, water conservation may play a positive role in alleviating some of the stress to the wastewater treatment systems and water resources.

Another draft report released by ORD, *A Screening Assessment of the Potential Impacts of Climate Change on Combined Sewer Overflow* (CSO) *Mitigation in the Great Lakes and New England Regions,* suggested that due to climate-related changes in precipitation patterns, some CSO long-term control plans may no longer meet the CSO Control Policy. The report further suggested that some communities may want to consider including margins of safety in their long-term control planning to account for broader climate changes. While acknowledging the importance of considering how climate change may impact the water sector, NACWA believes that it is premature to recommend any major modifications in long-term control plans given the uncertainty in both the analyses and the underlying climate models used to conduct them. Of the two climate change models used for one of the CSO analyses, one model indicated that there would be more CSOs in the future, while the other model indicated fewer CSOs in the future.

EPA is considering climate change impacts on many other environmental issues, and has released reports on other water-related topics such as watershed planning,[7] invasive aquatic species,[8] and biological indicators.[9] Further research and planning at EPA and other government agencies is expected to continue and expand in the future.

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[7] EPA National Center for Environmental Assessment, *Climate and Land Use Change Effects on Ecological Resources in Three Watersheds: A Synthesis Report*, August 2007 draft.
[8] EPA National Center for Environmental Assessment, *Effects of Climate Change on Aquatic Invasive Species and Implications for Management*, August 2007 draft.
[9] EPA National Center for Environmental Assessment, *Climate Change Effects on Stream and River Biological Indicators: A Preliminary Analysis*, August 2007 draft.

B. Congressional Consideration of Climate Change Impacts

Congress is also making some efforts to better understand the impact of climate change on water resources. On June 6, 2007, the Senate Subcommittee on Water and Power heard testimony from two panels of witnesses from across the country on the impacts of climate change on water supply and availability in the U.S., and discussed the need for more coherent data through higher resolution regional climate monitoring. The panelists discussed how the regional variability for creating long-term control plans for CSOs is an issue for the entire country. Whether regional concerns focus primarily on increased runoff, drought, snowmelt, or rising sea levels, more precise models are vital for making good decisions. Both panels emphasized how the impact of climate change on water infrastructure will vary greatly according to region (and even locality within a region), especially in the western U.S. The focus was on the need for more precise models to understand the impact of climate change on various localities because topographical differences can greatly change water flow patterns.

Climate change impacts on water resources are considered in proposed legislation and green infrastructure is cited as a method for dealing with some of these impacts. For example, H.R. 2701, introduced by Rep. James Oberstar (D-Minn.) in June 2007, would establish a 21st Century Water Commission, specifically tasked with assessing the impact of climate change on water resources and quality. The bill links increased sewage overflow problems with climate change and would make changing storm dynamics a priority for the Commission. The bill also calls for "holistically designed water resources projects, conservation of existing water resource infrastructure" and efforts "to increase the use of nonstructural elements (including green infrastructure and low impact development techniques)".[10] It states that policy shifts must reduce biases against nonstructural and low impact development techniques when managing stormwater, specifically noting the use of "vegetated stream side buffers, wetlands, or other topographical features that can slow, filter, and naturally store streamside runoff...utilize natural design techniques that infiltrate, filter, store, evaporate, and detain water close to its source...[and] minimize the use of impervious surfaces in order to slow or infiltrate precipitation".[11]

Climate change-related legislation encouraging green infrastructure could benefit clean water agencies already using or planning to use these techniques. Green infrastructure often has the added benefits of reducing carbon pollutants and lowering ambient air temperatures. These added benefits should be emphasized so that clean water agencies receive credit for all of the environmental advantages provided by these projects.

Other proposed legislation contains provisions that intend to encourage better use of water resources. A bill introduced by Sen. Jeff Bingaman (D-N.M.) in June 2007, S. 1766, contains the most specific references to wastewater. It addresses climate change impacts

[10] Transportation Energy Security and Climate Change Mitigation Act of 2007 Bill at Title VII, sec. 701. Pages 71-72.
[11] Transportation Energy Security and Climate Change Mitigation Act of 2007 Bill at Title VII, sec. 701. Page 72.

on natural resources by establishing a Climate Adaptation Fund, which could be used to "facilitate the planning, design, and construction of projects to conserve water or otherwise enhance water use efficiency, including facilities to reclaim and reuse wastewater."

C. LEGAL ISSUES INVOLVING CLIMATE CHANGE

In 2007, the Supreme Court provided key precedent on climate change issues. *Massachusetts v. EPA,* a climate change case decided by the Supreme Court in April 2007, is the most far-reaching federal case on climate change to date. In this case, the Supreme Court held in a 5-4 decision that GHGs are covered as pollutants under the Clean Air Act, conveying authority to the EPA to regulate their emission from motor vehicles. The Court also held that the EPA may refuse to regulate the gases *only* if the agency can demonstrate "that greenhouse gases do not contribute to climate change, or if it provides some reasonable explanation as to why it cannot or will not exercise its discretion to determine whether they do [contribute to climate change]."[12] The Court further recognized that "the harms associated with climate change [are]...serious and well-recognized".[13] The ruling establishes EPA authority to regulate GHGs, states that the EPA should regulate unless it can give a good reason, and accepts climate change as a real issue.

Additionally, the Supreme Court ruled that the plaintiffs in *Massachusetts v. EPA* were able to establish a causal link between GHG emissions and public health and welfare injuries. The Court determined that this link was sufficient to give the plaintiffs standing to bring the case. Considering the difficult standard for standing in Supreme Court cases and the inherent difficulty surrounding the source identification and regulation of transient gases, the finding of standing is significant. Additionally, the Court's ruling opened the door to other potential climate change suits. Some believe that the *Massachusetts v. EPA* ruling could lead to an increase in climate change nuisance cases, and that these new suits may "follow a pattern similar to those of tobacco, asbestos, and other 'toxic tort' categories."[14] Such nuisance cases tend to shape broader public policy and thus should be monitored closely and taken seriously.

IV. CONCLUSION

The growing popular consensus that human-caused GHG emissions are driving climate change, whether accurate or not, is already impacting the legislative, regulatory, and judicial landscape. Already various levels of government, organizations, private businesses, and individuals are engaging in the climate change discussion and taking action. This

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[12] Keteltas, Gilbert S. "Climate Change Lawsuits." The National Law Journal. April 30, 2007. *See also*, "Court Rules 5-4 in Massachusetts v. EPA." http:/environmentaldefense.org/article.cfm?contentID=5623.
[13] *Massachusetts v. EPA,* 127 S. Ct. at 1442.
[14] Dahl, Richard, "A Changing Climate of Litigation," *Environmental Health Perspectives,* Vol. 115, April 2007. www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1852662.

issue will undoubtedly impact the clean water community in the coming years, and thus NACWA and its members need to be engaged in order to protect the interests of the clean water community. NACWA does not need to comment on the validity of the science supporting climate change, nor its potential causes. Indeed, the Association's membership is split between those that believe climate change is a human-made problem and those that do not. Regardless of the cause, it is clear that federal, state, and local governments are moving forward with climate change initiatives, and NACWA will be involved in those discussions to ensure that the interests of its members are protected.