Strategic Action 32: The NWP intends to participate in the interagency development and implementation of federal strategies through the National Ocean Council Strategic Action Plans and the ICCATF.

Many federal agencies manage or use coastal and ocean resources to support commerce, maintain national security, and ensure environmental sustainability. The NWP intends to participate in development and implementation of federal strategies so that coastal and ocean environments are protected and are prepared for climate change adaptation and mitigation, especially through the NOC. The National Ocean Policy identifies nine priority objectives, including to "strengthen resiliency of coastal communities and marine and Great Lakes environments and their abilities to adapt to climate change impacts and ocean acidification" and "increase knowledge to continually inform and improve management and policy decisions and the capacity to respond to change and challenges." The NOC is developing a strategic action plan for this objective that will also serve as the National Action Plan (NAP) for Oceans and Coasts under the ICCATF. The NWP intends to continue to participate in writing and implementing this strategic action plan.

D. Water Quality

VISION: Our Nation's surface water, drinking water, and ground water quality are protected, and the risks of climate change to human health and the environment are diminished, through a variety of adaptation and mitigation strategies.

This section focuses on the NWP's strategy for responding to climate change impacts on water quality, using both regulatory and nonregulatory controls. Regulatory controls include WQS, TMDLs, and the NPDES, as well as drinking water regulations such as the UIC program. Nonregulatory controls include promotion of GI and LID strategies and other collaborative approaches. (Larger landscape strategies are covered in the Watersheds and Wetlands section). This section also discusses strategies for maintaining water quality while encouraging the adoption of alternative sources of energy and fuel technologies that reduce greenhouse gas emissions.

GOAL 12: The NWP protects waters of the United States and promotes management of sustainable surface water resources under changing climate conditions.

As detailed in the *2008 Strategy*, climate change is expected to impact surface waters in several ways, affecting both human health and ecological endpoints. For example, it is projected that warmer air temperatures in many locations will heat surface water temperatures to levels that will decrease the water's ability to hold dissolved oxygen, leading to growth of harmful algal blooms and hypoxia. Warmer air temperatures may also lead to more evaporation, which could cause lower flows and higher salinity, as well as higher concentrations of other substances. Lower flows and greater salinity would likely cause an increase in impaired waters, even if actual pollutant loadings from dischargers do not increase. In many parts of the country, precipitation events are expected to become more extreme, increasing runoff with associated increases in pollutant loads, increasing variability of streamflow and associated sedimentation, and expanding flood risk.

Strategic Action 33: The NWP intends to encourage states and communities to incorporate climate change considerations into their water quality planning.

Sensitivity to impacts combined with adaptive capacity is a measure of vulnerability, and understanding vulnerability is necessary as the basis for adaptation planning. That is, the extent of climate change impacts on different ecosystems, regions, and sectors will depend not only on their sensitivity to climate change, but also on their adaptive capacity or resiliency. In order to facilitate adaptation of water programs and increase resiliency of water resources, states and tribes can use existing water quality and watershed planning programs and resources (e.g., CWA Sections 106, 604(b) and 319(h) planning funds) to conduct detailed assessments or develop plans to increase their adaptive capacity and prioritize adaptive responses. For example, agencies or local or interstate planning organizations can use section 604(b) funds to address climate change as part of comprehensive water quality planning efforts.[5] In addition, the CWA Section 319(h) grant program can be an important resource to states for implementing nonpoint source management projects that protect vulnerable priority waters and sources of drinking and that restore impaired waters.

For more information on how NWP intends to work to protect the quality and resilience of watersheds, please see Goal 3, Strategic Action 10 in the Watersheds and Wetlands section, page 39.

Integrated Municipal Stormwater and Wastewater Plans

An integrated planning process can help define a critical path to achieving the objectives of the Clean Water Act by identifying efficiencies in implementing competing requirements that arise from separate wastewater and stormwater projects, including capital investments and operation and maintenance requirements. This approach can also lead to more sustainable and comprehensive solutions, such as green infrastructure, that improves water quality as well as supports other quality of life attributes that enhance the vitality of communities.

— EPA policy memo available at: http://cfpub.epa.gov/npdes/integratedplans.cfm (EPA, 2012d)

Strategic Action 34: The NWP intends to encourage green infrastructure and low-impact development to protect water quality and to make watersheds more resilient.

Preserving the ability of the land to absorb water helps to preserve the natural function of wetlands and watersheds while also controlling pulses of stormwater. Both GI and LID incorporate approaches to managing stormwater in a way that will reduce runoff. GI and LID management approaches and technologies use infiltration, evapotranspiration, and capture and reuse of stormwater to maintain or restore natural hydrologies (EPA, 2011j). They employ principles such as preserving and re-creating natural landscape features and minimizing imperviousness to create functional and appealing site drainage that treats stormwater as a resource rather than a waste product (EPA, 2011k). EPA is actively promoting these kinds of practices through its Green Infrastructure

[5] Section 604(b) of the CWA establishes a grant program to fund state, local, and interstate water quality planning efforts under CWA sections 205(j) and 303(e). This provision requires states to reserve 1% of their Clean Water State Revolving Fund allotment, or $100,000, whichever is greater, for planning. Under section 205(j), many states pass through at least 40% of these funds to local or interstate planning organizations.

Strategy (EPA, 2012c), available at http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm.

The NWP intends to promote the use of GI and LID through tool development, stormwater permitting, outreach, and assistance programs to support states and permittees in evaluating benefits and co-benefits of GI and LID approaches. The NWP intends to consider focusing its regulatory and permitting efforts not only on new development, but also on redevelopment. This Strategic Action supports the Agency goal to incorporate climate change science and scenario information in five rulemaking processes by 2015.

Strategic Action 35: The NWP intends to promote the consideration of climate change impacts by NPDES permitting authorities.

As authorized by the CWA, the NPDES permit program reduces water pollution by regulating point sources that discharge pollutants into waters of the United States (EPA, 2009c). To help NPDES permit writers prepare for possible climate change impacts to surface waters, the NWP intends to evaluate and develop, as needed, technical tools for permit writers to improve their decision-making processes related to the impacts of climate change, such as use of precipitation and streamflow data and other data or models.

To promote water quality on a watershed scale, the NWP intends to continue to encourage the use of flexible watershed approaches, such as watershed-based permitting and water quality trading, for building surface water resiliency to climate change impacts. The NWP also intends to consider the need for, and appropriateness of, reflecting climate projections in NPDES permitting (e.g., precipitation projections).

The NWP intends to evaluate the anticipated effect of climate change on critical low-flow stream conditions, and encourage NPDES permitting authorities to incorporate revised low-flow stream estimates into NPDES permit effluent limit development where appropriate. The NWP also intends to continue to encourage NPDES permitting authorities to consider anticipated climate change impacts (e.g., warmer surface waters) when evaluating applications for 316(a) variances from thermal effluent limitations.

Strategic Action 36: The NWP intends to encourage water quality authorities to consider climate change impacts when developing wasteload and load allocations in TMDLs where appropriate.

Under Section 303(d) of the CWA, states, territories, and authorized tribes are required to develop lists of impaired waters (i.e., "the 303(d) list"). These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes after the implementation of effluent limitations or other

The Chesapeake Bay TMDL and Climate Change

"EPA and USGS will work in conjunction with the states to conduct an analysis by 2017 to consider accounting for uncertainties of climate change in TMDL allocations. USGS has begun initial assessment of changes in pollution loads in the watershed under different climate and land-use scenarios. Initial results will be available in 2012 and be used to further plan assessments for TMDL allocations. Enhanced assessment will begin in 2016."

— Chesapeake Executive Order Strategy, p. 41 [CBPO, 2010]

pollution control requirements. The law requires jurisdictions to develop TMDLs for these waters. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards (EPA, 2011l).

The NWP intends to look for opportunities for states or EPA to consider potential climate change impacts when developing TMDLs. The NWP intends to explore the use of tools such as models to help states evaluate pollutant load impacts under a range of projected climatic shifts. This would be done in a way that takes into account the best available data as well as any uncertainties in the models or data.

TMDLs are developed and implemented using an adaptive management approach, in which adjustments can be made as environmental conditions, pollutant sources, or other factors change over time. Thus, as more information and tools become available, there will be opportunities to make adjustments in TMDLs to reflect climate change impacts.

Strategic Action 37: The NWP intends to identify and work to protect designated uses that are at risk from climate change impacts.

A designated use establishes the water quality goals for a specific water body and serves as the regulatory basis for establishing controls beyond technology-based requirements. The water quality standards regulations, implementing CWA section 303(c), require that states and authorized tribes specify appropriate water uses to be achieved and protected. These uses are identified by taking into consideration the use and value of the water body for public water supply; for protection and propagation of fish, shellfish, and wildlife; and for recreational, agricultural, industrial, and navigational purposes. In addition, the CWA places additional emphasis on achieving, wherever attainable, "water quality which provides for the protection and propagation of fish, shellfish, and wildlife and for recreation in and on the water" [Section 101(a)(2)]. EPA's regulation interprets and implements these provisions through requirements that WQS protect the uses specified in Section 101(a)(2) of the Act unless those uses have been shown to be unattainable.

EPA's regulations require that when removing a designated use, the state must provide an analysis (i.e., a Use Attainability Analysis [UAA]) to demonstrate that the designated use is not feasible to attain based on one of the established regulatory factors. Additionally, states are required to conduct a review of their WQS at least once every three years. As part of that triennial review, states examine whether any new information has become available for water bodies where water quality standards specify designated uses that do not include the uses specified in Section 101(a)(2) of the Act. If such new information indicates that the uses specified in Section 101(a)(2) are attainable, the state shall revise its WQS accordingly.

The water quality standards regulation specifies circumstances under which a designated use may or may not be removed or revised. If a designated use is an existing use for a particular water body, the designated use cannot be removed unless a use requiring more stringent criteria is added.

To target protective efforts, the NWP intends to identify designated uses that are important to states and tribes, necessary to meet the goals of the CWA, and vulnerable to climate change

impacts. For example, recreational uses such as swimming, boating, and fishing may be affected by changes in precipitation levels, which may lead to increased impairments. Cold water fisheries may need particular consideration, since such uses may be particularly susceptible to changes in water temperature. To protect existing uses and water quality, the NWP intends to focus on implementation of antidegradation requirements, which, at a minimum, require maintenance and protection of existing uses and the level of water quality necessary to protect the existing uses.

The NWP also intends to work with stakeholders to better understand how a state could conduct Use Attainability Analysis (UAA), using the six attainability factors in EPA's current regulations, where climate change may be the primary cause of nonattainment and where impacts cannot be remedied.

Strategic Action 38: The NWP intends to clarify how states can update aquatic life water quality criteria on more regular intervals, using the best and most accurate science and data related to both changing climate conditions and how pollutants react.

Section 304(a)(1) of the CWA requires EPA to develop criteria for water quality that accurately reflect the latest scientific knowledge regarding pollutant concentrations and environmental or human health effects (EPA, 2011p). From time to time, these criteria are updated to account for advances in the science. States, tribes, and territories may adopt these criteria or other scientifically defensible criteria into their water quality standards. The NWP encourages states to update criteria using the best and most accurate science and data related to both the changing climate conditions and how pollutants react to the changing conditions on a pollutant by pollutant basis.

In addition, since climate changes will affect hydrologic conditions, the NWP intends to incorporate the best available science in an informational document to assist states and tribes that are interested in protecting aquatic life from these impacts.

GOAL 13: As the nation makes decisions to reduce greenhouse gas emissions and develop alternative sources of energy and fuel, the NWP intends to work to protect water resources from unintended adverse consequences.

Just as it takes energy to treat and distribute water supplies, it takes water to generate and produce energy and fuels. Well-designed or rehabilitated water infrastructure can reduce energy demand, and careful energy planning can reduce water demand. Using a systems approach, consolidated water infrastructure, energy, and transportation planning can directly and indirectly reduce the demand for both water and energy. While Goals 1 and 2 in the Infrastructure section of this *2012 Strategy* discuss improving the energy profile of water infrastructure, this goal identifies actions that may reduce the adverse effects of new energy technologies on water resources, consistent with the recently published *Principles for an Energy-Water Future* (see Appendix A).

Strategic Action 39: The NWP intends to continue to provide perspective on the water resource implications of new energy technologies.

Production of energy and fuel rely on access to water, and may in turn contribute to water quantity and quality problems. Further, while alternative sources of energy and fuel are important for reducing emissions of GHGs and offer a number of win-win energy choices, they too bring water resource challenges. As technologies evolve, the NWP intends to provide perspective on how the nation's energy choices affect water resources.

Strategic Action 40: EPA intends to provide assistance to states and permittees so that geologic sequestration of CO_2 is responsibly managed to protect and preserve underground sources of drinking water.

EPA finalized requirements for geologic sequestration in December 2010, under the authority of the SDWA's UIC Program (EPA, 2010e). These requirements are designed to protect underground sources of drinking water (USDWs). The rule builds on existing UIC Program requirements, with tailored requirements that address carbon dioxide injection for long-term storage to ensure that wells used for geologic sequestration are appropriately sited, constructed, tested, and monitored during and after injection (i.e., during a post injection site care period), and closed in a manner that ensures USDW protection. The NWP intends to focus on implementation of these requirements to protect USDWs.

Strategic Action 41: EPA will also continue to work with States to help them identify polluted waters, including those affected by biofuels production, and help them develop and implement Total Maximum Daily Loads (TMDLs) for those waters.

EPA finalized the Renewable Fuel Standard rulemaking in early 2010 (EPA, 2011m). The rulemaking implements a statutory provision that requires 36 billion gallons per year of biofuels be used by 2022. As the production and price of corn and other biofuel feedstocks increase, there may be impacts to both water quality and water quantity. Runoff from agricultural land carries contaminants such as fertilizers, pesticides, and sediment. More agriculture generally requires more irrigation, which increases the demand for water and the amount of water flowing directly off land and carrying pollutants into nearby water bodies. The degree to which fertilizers, pesticides, and sediment affect water quality depends on a variety of management factors, including nutrient and pesticide application rates and application methods, conservation practices and crop rotations, and acreage and intensity of tile drained lands.

Runoff from agricultural nonpoint sources is not directly controlled under the NPDES permit program. Nonpoint source pollution is addressed via state pollution control programs. These programs are supported with CWA Section 319 grant funding and include an array of regulatory and voluntary approaches depending on the state. In addition, water quality trading is a tool that can allow permitted point source facilities facing higher pollution control costs to meet their regulatory obligations by purchasing environmentally equivalent (or superior) pollution reduction credits from another source at lower cost. In some trading programs, nonpoint sources such as agricultural operations may be included in trading if pollution reductions can be sufficiently documented. EPA will also continue to work with states to help them identify

polluted waters, including those affected by biofuels production, and help them develop and implement TMDLs for those waters.

Under the CWA, all point sources of pollution to a water of the United States, including ethanol plants, are required to have a permit to discharge to water bodies for both industrial process water and stormwater. NPDES permits for ethanol plants take into account the minerals, toxic pollutants, and biological oxygen demand resulting from the production process.

In order to adapt to the increased storage of biofuels, such as ethanol and biodiesel, in underground storage tanks (USTs), EPA is working with its partners to gain a better understanding of UST system materials compatibility; functionality of leak detection technologies; and the fate, transport, and remediation issues associated with biofuel releases. Unlike other fuel components, ethanol is corrosive and highly water soluble. As a result, special precautions must be taken to ensure that UST system components are both compatible and functional with ethanol blends (EPA, 2009a). EPA's ORD provides methods, models, and tools needed to remediate leaking UST sites and address fate and transport issues of leaking contaminants. EPA also proposed guidance (EPA, 2010f) that will clarify how UST owners and operators can comply with EPA's compatibility requirement, which states that owners and operators must use a system made of or lined with materials that are compatible with the substance stored in the UST system.

EPA will continue to explore these and other options for mitigation of risks related to the production and storage of biofuels, including ethanol-blended fuels, and possible impacts to water quality.

Strategic Action 42: EPA intends to provide informational materials for stakeholders to encourage consideration of alternative sources of energy and fuels that are water efficient and maintain water quality.

To learn more about how NWP plans to encourage energy efficiency for water utilities, please see Goal 1, Strategic Action 2 in the Infrastructure section.

Alternative energy sources provide decreased reliance on fossil fuels. However, they still require access to water, and may still place added stress on water supplies. EPA intends to develop a website that consolidates EPA information on the energy/water nexus, as well as water and energy efficiency information for various sectors (forthcoming; includes EPA-OAR; EPA-R9, 2011). In order to reduce the possibility of adverse impacts to water quality and supply, EPA intends to seek opportunities and explore options to continue to develop and update outreach materials for stakeholders in concert with federal agencies such as DOE and its Renewable Energy Technology Program (DOE, 2012) and state water science agencies.

Strategic Action 43: As climate change affects the operation or placement of reservoirs, the NWP intends to work with other federal agencies and EPA programs to understand the combined effects of climate change and hydropower on flows, water temperature, and water quality.

Hydropower generation is considered a renewable energy resource because the water supplying it is renewable. A hydroelectric power plant converts the downstream movement

of water into electricity by directing the water, often held at a dam or reservoir, through a hydraulic turbine that is connected to a generator. Although power plants are regulated by federal and state laws to protect human health and the environment, there are a wide variety of environmental impacts associated with power generation technologies. In addition, climate change is likely to affect the amount, timing, and temperature of water used for hydropower, creating competition for water supply, affecting operational decisions, and altering the background condition of the aquatic system. The NWP intends to work with other federal agencies and programs to understand and address these combined impacts. For example, NWP could work with the DOE Wind and Water Power Program (DOE, 2011, DOE 2012) as well as with the Department of the Interior and other signatories of the Federal Hydropower Memorandum of Understanding (BOR, DOE, USACE) to further coordination and integration of hydropower and other water resource uses (BOR, 2010).

GOAL 14: The NWP intends to work to make hydrological and climate data and projections for water resource management available, when needed, in collaboration with other EPA programs and federal, state, interstate, tribal, and other partners.

Many of the NWP's programs are currently faced with a lack of sufficient data to assess national program effectiveness. Whether the data don't exist or are just not easily or publicly available differs by program, but lack of access to current data and consolidated analyses is a fundamental problem. As more climate models and vulnerability assessment tools become available, the NWP intends to work with partners from inside and outside EPA to collect, assimilate, and disseminate historic and projected information from the best sources available. The strategies in this section aim to gather, enhance, and improve access to the data that the NWP and its partners need for water resource management under changing climate conditions.

Strategic Action 44: Monitor climate change impacts to surface waters and ground water.

In order to respond to effects resulting from a changing climate, the NWP intends to understand the impacts to inland and coastal surface and ground waters. The NWP intends to support interagency monitoring networks by coordinating and collaborating with the EPA/State National Aquatic Resource Surveys (EPA, 2011n) and other agencies' monitoring programs, as well as the Federal Advisory Committee on Water Information (ACWI), to encourage them to add the ability to track and evaluate changes to water resources availability and quality using historical, reliable, long-term monitoring networks. The NWP also intends to continue to contribute to ACWI's Subcommittee on Ground Water to establish and maintain a National Ground Water Monitoring Network to describe trends in interstate and regional changes in ground water quality and availability. Further, states should understand that funding is available to assist in water quality monitoring, including surface water and ground water, under Sections 106 and 319 of the Clean Water Act. See also Strategic Action 2.

Strategic Action 45: Develop new methods for use of updated precipitation, storm frequency, and observational streamflow data, as well as methods for evaluating projected changes in low flow conditions, in collaboration with other federal agencies.

EPA intends to work to update hydrological data and methods in collaboration with federal consortia (e.g., ICCATF, the Office of Science and Technology Policy's Subcommittee on Water Availability and Quality [SWAQ], the USGCRP, the Climate Change and Water Working Group [CCAWWG], the Integrated Water Resources Science and Services [IWRSS]) and engage partners (e.g., ACWI, Water Environment Research Foundation [WERF], the Water Research Foundation [WRF]) and others to develop and standardize a process to revise precipitation, temperature, and storm event data nationwide to incorporate expected changes in commonly used data.

Of particular concern are the storm frequency, duration, and intensity estimates (e.g., 10-year, 24-hour storm events; 100-year, 24-hour storm events) and low-flow conditions in rivers and streams at the Hydrologic Unit Code 12 watershed level.

Updating precipitation records and statistical methods, and developing projections of future precipitation patterns, will enable a fundamental shift in modeling methods, which currently rely on historical data that may no longer be representative of current and future conditions. These efforts will fully consider the uncertainty inherent in predictions of the pace and magnitude of future climate-change related effects, especially at a local level.

Strategic Action 46: The NWP intends to work to enhance flow estimation using NHDPlus.

The NHDPlus is a comprehensive set of digital spatial data that encodes information about naturally occurring and constructed bodies of water, paths through which water flows, and related entities (USGS, 2011). It provides full characterization of the flow network, identification of unregulated and regulated gages and reaches, and network-based interpolation and adjustment of flows. In order to enhance flow estimates in the face of climate change, the NWP intends to support enhancements to NHDPlus as a cost-effective means of providing more accurate flow estimates for permitting, TMDLs, watershed planning, and other uses.

E. Working With Tribes

VISION: Tribes are able to preserve, adapt, and maintain the viability of their culture, traditions, natural resources, and economies in the face of a changing climate.

Native Americans have distinct cultural and spiritual connections to the water and land. The collective wisdom of elders and ancestors has allowed them to carefully use and manage the land for centuries. Changes to the earth's climate provide a new set of challenges for tribes seeking to maintain and protect their resources and the safety and health of their people.

Indian tribes are involved in protecting and restoring tens of thousands of square miles of rivers, streams, and lakes, as well as ground water in over 110,000 square miles of Indian Country in the United States. Because tribes may be regulators for water programs and water resource managers for their communities, it is important that tribes are able to provide ongoing input and participate in NWP strategies and actions on climate change. It will be important