

**U.S. EPA Region 5
Regional Climate Change Adaptation
Implementation Plan**

Draft: September 18, 2013

Disclaimer

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Preface

The U.S. Environmental Protection Agency (EPA) is committed to identifying and responding to the challenges that a changing climate poses to human health and the environment.

Scientific evidence demonstrates that the climate is changing at an increasingly rapid rate, outside the range to which society has adapted in the past. These changes can pose significant challenges to the EPA's ability to fulfill its mission. The EPA must adapt to climate change if it is to continue fulfilling its statutory, regulatory and programmatic requirements. The Agency is therefore anticipating and planning for future changes in climate to ensure it continues to fulfill its mission of protecting human health and the environment even as the climate changes.

In February 2013, the EPA released its draft *Climate Change Adaptation Plan* to the public for review and comment. The plan relies on peer-reviewed scientific information and expert judgment to identify vulnerabilities to EPA's mission and goals from climate change. The plan also presents 10 priority actions that EPA will take to ensure that its programs, policies, rules, and operations will remain effective under future climatic conditions. The priority placed on mainstreaming climate adaptation within EPA complements efforts to encourage and mainstream adaptation planning across the entire federal government.

Following completion of the draft *Climate Change Adaptation Plan*, each EPA National Environmental Program Office, all 10 Regional Offices, and several National Support Offices developed a *Climate Adaptation Implementation Plan* to provide more detail on how it will carry out the work called for in the agency-wide plan. Each *Implementation Plan* articulates how the office will integrate climate adaptation into its planning and work in a manner consistent and compatible with its goals and objectives.

Taken together, the *Implementation Plans* demonstrate how the EPA will attain the 10 agency-wide priorities presented in the *Climate Change Adaptation Plan*. A central element of all of EPA's plans is to build and strengthen its adaptive capacity and work with its partners to build capacity in states, tribes, and local communities. EPA will empower its staff and partners by increasing their awareness of ways that climate change may affect their ability to implement effective programs, and by providing them with the necessary data, information, and tools to integrate climate adaptation into their work.

Each Program and Regional Office's *Implementation Plan* contains an initial assessment of the implications of climate change for the organization's goals and objectives. These "program vulnerability assessments" are living documents that will be updated as needed to account for new knowledge, data, and scientific evidence about the impacts of climate change on EPA's mission. The plan then identifies specific priority actions that the office will take to begin addressing its vulnerabilities and mainstreaming climate change adaptation into its activities. Criteria for the selection of priorities are discussed. An emphasis is placed on protecting the most vulnerable people and places, on supporting the development of adaptive capacity in the tribes, and on identifying clear steps for ongoing collaboration with tribal governments.

Because EPA's Programs and Regions and partners will be learning by experience as they mainstream climate adaptation planning into their activities, it will be essential to evaluate their efforts in order to understand how well different approaches work and how they can be improved. Each *Implementation Plan* therefore includes a discussion of how the organization will regularly evaluate the effectiveness of its adaptation efforts and make adjustments where necessary.

The set of *Implementation Plans* are a sign of EPA's leadership and commitment to help build the nation's adaptive capacity that is so vital to the goal of protecting human health and the environment. Working with its partners, the Agency will help promote a healthy and prosperous nation that is resilient to a changing climate.

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DRAFT

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EPA Region 5

Draft Climate Change Adaptation Implementation Plan

Background

Executive Order 13514 (“Federal Leadership in Environmental, Energy, and Economic Performance”), issued by the President on October 5, 2009, called on the Interagency Climate Change Adaptation Task Force to develop recommendations for adapting to climate change impacts both domestically and internationally. On October 5, 2010, the Task Force delivered its initial report and first set of recommendations to the President. A key recommendation in the report called for every federal agency to develop and implement a climate change adaptation plan addressing the challenges posed by climate change to its mission, operations, and programs.

On June 2, 2011, the EPA Administrator issued a Policy Statement on Climate Change Adaptation with a charge to develop a Climate Change Adaptation Plan for EPA by June 2012. This charge included the development of Program and Regional Office Implementation Plans. In response to these directives, EPA established a new cross-EPA work group on climate change adaptation planning. The work group developed the first ever Climate Change Adaptation Plan for EPA and delivered it to The White House Council on Environmental Quality (CEQ) on June 29, 2012. The draft Plan was released for public comment on February 7, 2013. EPA’s Program and Regional Offices have developed their own Climate Change Adaptation Implementation Plans. The purpose of this Plan is to provide an overview of how EPA Region 5 will incorporate climate change considerations across the work of the region.

To promote consistency, the Agency-wide Climate Change Adaptation Plan identified eight “Common Areas of Focus” as required sections for all of the Implementation Plans:

1. Vulnerability assessments
2. Priority actions on climate adaptation
3. Agency-wide strategic measures on climate adaptation
4. Legal and enforcement issues
5. Training and outreach
6. Partnerships with tribes
7. Vulnerable populations and places
8. Evaluation and cross-office pilot projects

I. Vulnerability Assessment

Regional Climate Change Impacts

According to the U.S. Global Change Research Program (USGCRP, 2009), the following issues are among key areas of concern for the Midwest:

- During the summer, public health and quality of life, especially in cities, will be negatively affected by increasing heat waves, reduced air quality, and increasing insect and waterborne diseases. In the winter, warming will have mixed impacts.
- The likely increase in precipitation in winter and spring, more heavy downpours, and greater evaporation in summer would lead to more periods of both floods and water deficits.
- Increased storm intensity will lead to an increased risk of water pollution to the Great Lakes and Mississippi River basins from combined sewer overflows, sediments, and other threats to water quality.
- While the longer growing season provides the potential for increased crop yields, increases in heat waves, floods, droughts, insects, and weeds will present increasing challenges to managing crops, livestock, and forests.
- Native species and ecosystems are very likely to face increasing threats from rapidly changing climate conditions, including pests, diseases, and invasive species moving in from warmer regions.

Climate change impacts may impose significant costs on communities and people in the Midwest. For example, many communities are facing the need to update water infrastructure to control combined sewer overflows and protect water quality. Given the increased storm intensities anticipated in the Midwest, additional infrastructure investments may be necessary. While this plan prioritizes actions such as green infrastructure to help make communities more resilient to increased storm intensity, additional traditional infrastructure may still be required, and both approaches impose costs on communities. Given the complexity and potential magnitude of climate change and the lead time needed to adapt, preparing for these impacts now may reduce the need for far more costly steps in the decades to come.

Without proper adaptation, climate change impacts may also bring about additional costs through health impacts on both the general and vulnerable populations. The latter of may suffer greater consequences due to health disparities such as asthma and lack of access to quality housing, heating and cooling systems and drinking water.

Regional Vulnerabilities

Given the general climate change impacts in the Region, the following identifies vulnerabilities that we believe, at this time, are most significant to Region 5 divisions and offices. Many of the vulnerabilities identified in this Regional assessment have already been established in the *High-Level Vulnerability Assessment* in the Agency-wide Plan. The best professional judgment of Regional program staff was used in determining further vulnerabilities. This assessment relies on the scientific findings of the Intergovernmental Panel on Climate Change (Field et al, 2007

and Denman et al, 2007) and USGCRP, 2009. Except where otherwise noted, the environmental conditions described derive from the findings in these reports. A detailed explanation of Region 5's vulnerabilities to climate change is included in *Appendix A, "Region 5 Vulnerability Assessment Table."*

The assessment of Region 5's vulnerabilities is a dynamic process. The extent to which vulnerabilities have been identified and are understood varies across goals. The science of climate change will improve over time, providing greater weight of evidence to evaluate the consequences of existing and expected impacts. Region 5 will continue work with its federal, state, tribal and local partners to identify new vulnerabilities and improve our understanding of known vulnerabilities.

Goal 1: Taking Action on Climate Change and Improving Air Quality

a) Criteria Air Pollutants

Higher temperatures and weaker air circulation in the United States (U.S.) will lead to more ozone formation even with the same level of emissions of ozone forming chemicals. In addition to the six nonattainment metro areas in the Region, there are several attainment areas that are violating the ozone standard based on recent monitoring data.

- Increases in tropospheric ozone could lengthen the ozone season and make it more difficult to achieve or maintain attainment.

Wildfires are not a large contributor to particulate matter (PM) issues in the Great Lakes states. However, hotter temperatures and increased drought could increase the incidence of wildfires and increase dust in the air from dry soil. Droughts can also cause restrictions on water use and an increase in the price of water. This would make it more expensive or difficult for industries to control storage piles, which could also create more PM.

- Increased PM from wildfires and drought could increase PM concentrations and associated respiratory and cardiovascular health impacts in affected areas.
- Additional PM could also increase deposition of some contaminants to the Great Lakes.

Higher temperatures would likely cause an increase in use of air conditioners and therefore an increase in the demand for electricity.

Increased demand for electricity could increase the emissions of PM, as well as carbon monoxide (CO), sulfur dioxide (SO₂) and nitrogen dioxide (NO₂) from electric generating units. However, energy efficiency efforts and measures to promote cleaner electricity generation may counteract the impacts of this increased demand.

b) Indoor Air Environments

Increased temperatures and extreme weather may cause residents to spend more time indoors with windows closed, increasing exposure to indoor air pollutants. Extreme weather conditions may bring about other indoor air issues, including:

- Power outages or damage to heating, ventilation and air conditioning (HVAC) systems due to extreme weather increases the potential for the misuse of generators and combustion sources such as gas stoves. If improperly operated, these combustion sources can cause elevated levels of CO and nitrogen oxides (NOx) if their exhaust builds up indoors.
- Residents may weatherize buildings to increase comfort and indoor environmental quality in addition to saving energy. Although in general these actions should be encouraged, this may lead to a reduction in ventilation and an increase in indoor environmental pollutants unless measures are taken to preserve or improve indoor air quality. EPA has developed practical guidance for improving or maintaining indoor environmental quality during home energy upgrades or remodeling in single-family homes and schools. EPA's guidance and protocols may need to be revised to include state and local considerations for projected climatic changes. In addition, these programs may need to increase partnerships with other agencies to address training needs and workforce development for building owners, managers, and others, as well as develop new tracking mechanisms to assess the effectiveness of weatherization and remodeling techniques as they relate to indoor environmental quality.

Flooding may increase damage to buildings, leading to poor environmental conditions such as mold and pest infiltration. Increased temperatures, including warmer winters with fewer days of temperatures below freezing, may also increase the type and number of pests.

- Outdoor and indoor air impacts will increase health risks, particularly for vulnerable populations including individuals with respiratory conditions, children and the elderly, as well as those confined to alternate/emergency shelters during extreme weather situations. Exposure to environmental asthma triggers in homes and schools may also increase.

Goal 2: Protecting America's Waters

a) Water Quality

Climate change is expected to increase air temperatures, which in turn is likely to increase water temperatures in surface water bodies. Climate change is also expected to change weather patterns, resulting in more frequent intense storms and polluted runoff, separated by periods of drought. Various water quality impacts are possible, including increased pollutant concentrations and lower dissolved oxygen (DO) levels, as well as an increased threat of invasive species in the Great Lakes. These changes are likely to have impacts on EPA water programs and will affect our ability to achieve Clean Water Act (CWA) goals in the following ways:

- Increasing numbers of water bodies may be impaired;
- Revisions to monitoring programs may be needed to assess new conditions.
- New water quality models and data may be needed.

- Requests by states to revise water quality standards (WQS), including designated uses and water quality criteria that protect those uses may be more frequent, as water quality impacts become increasingly serious and lasting.
- Permitting and pollution control programs may see a new workload of permit limit revisions to reflect new environmental conditions and revised uses.
- Water quality degradation may impact the availability of water of sufficient quality needed for uses, most notably public water supplies.

b) Pollution Control – Point Source

Climate change is expected to change weather patterns, resulting in more frequent intense storms and polluted runoff, separated by periods of drought.

- Current wastewater collection and treatment systems may not be adequately designed for future conditions.
- Combined sewer systems may not meet performance expectations and water quality objectives in long term control plans EPA and the states have negotiated with communities.
- Storm water collection systems may be inadequate to remove pollutants or prevent flooding.
- In communities with both combined and separate sewer systems, wastewater infrastructure may be stressed by extreme, variable flows.
- EPA and state wastewater regulatory programs will see workloads increase or evolve as we respond to these challenges and to increased expectations from communities regarding assistance on new resilient practices such as green infrastructure, integrated municipal wet weather planning, and energy efficient practices.

c) Pollution Control – Nonpoint Source (NPS)

Climate change is expected to change weather patterns, resulting in more frequent intense storms and polluted runoff, separated by periods of drought.

- Management practices funded or promoted in the CWA section 319 program may not perform as expected, or may be washed out in extreme events.
- As resource managers adapt to changing precipitation patterns, practices may change in ways that increase NPS pollution (e.g., increased tile drainage to more efficiently drain heavy precipitation).
- Climate change may create new demands on EPA and states for outreach to promote environmentally protective, climate resilient practices.

d) Drinking Water/Other Uses

More frequent heavy downpours and floods could increase the amount of sediment and contaminants mobilized and transported to surface waters used for drinking water. Warmer water temperatures can create conditions suitable for pathogens and harmful algal blooms, and the lowering of water tables can expose formations and oxidize arsenic, which makes the

contaminant more soluble in water.

- The drinking water program will need to address impacts to drinking water supplies associated with changes in drinking water quality, quantity, and infrastructure.
- Changes in water quality may result in more Safe Drinking Water Act (SDWA) violations, which would increase the workload of the regional and state compliance officers.

Climate change may adversely affect availability of surface and ground water supplies for drinking water, irrigation, etc.

- Increased evaporation associated with warmer temperatures and increased drought conditions could reduce the amount of water available in surface drinking water supplies, as well as reduce the amount of ground water recharge.
- Increased demand for water, whether for drinking or other uses, may coincide with decreasing water availability and quality. Education about water conservation and source water protection will be increasingly important within all sectors and levels of government.
- Where drought conditions affect the presence of surface waters, it may be difficult to establish jurisdiction to implement federal CWA programs to protect vulnerable resources like wetlands.

Water infrastructure decisions made under prior climate scenarios may not be resilient in future climate conditions.

- Increased temperature fluctuations could result in increased frequency of main breaks; flooding can damage water infrastructure; and reduced water levels could require intake structure modifications. Infrastructure costs would increase the demand for funding through the Drinking Water State Revolving Funds.

e) Great Lakes

Changes in average temperature and precipitation patterns have begun to have noticeable impacts on the Great Lakes ecosystem. For example, extreme storm events have resulted in unprecedented sediment inputs to the lakes, and Lake Superior had rare algal blooms in 2012. These trends are projected to continue with higher water and air temperatures and increased evaporation rates.

- Ice cover on the Great Lakes is expected to decline, leading to increased evaporation in winter. Climate change will also affect some lake levels, with some models showing a significant decrease.
- Heightened storm intensities are projected to increase flooding, combined sewer overflows, beach closures, waterborne diseases, wildfires and other stressors on the Great Lakes ecosystem.

- EPA's ability to achieve the objectives of the Great Lakes Restoration Initiative (GLRI) and fulfill the commitments of the Great Lakes Water Quality Agreement of 2012 may be compromised by climate change impacts.

Goal 3: Cleaning Up Communities and Advancing Sustainable Development

a) Risk of Contaminant Release

Region 5 has a significant universe of contaminated sites due to our industrial legacy. Increased flood and drought conditions may impact the mobilization of contaminants at these sites and alter the time, cost and effectiveness of cleanups.

- Drier conditions might cause severe erosion issues on terrain and constructed landfills.
- Corrective actions may need to be altered to ensure they are protective given the potential for increased flooding.
- Flood events could wash away constructed remedies and increase contamination to the environment. Standing water could bring contaminants to the surface and increase exposure potential.
- Potential contaminant releases may pose an increased risk of adverse health impacts, with environmental justice and other vulnerable populations most at risk as they may reside close to these sites.

b) Emergency Response

Increased precipitation may lead to increased riverine flooding, resulting in additional hazardous waste and domestic white goods removal and cleanup.

- Availability of emergency response teams to react quickly may be stressed as extreme weather related events become more frequent.
- The need for emergency response and debris/waste management due to storms resulting in large-scale releases of chemicals and generation of debris from flooded/damaged and/or demolished buildings may also increase. Existing waste management capacity may not be adequate to meet the demands of an increased debris stream resulting from more frequent storms.
- Increased extreme temperatures will impact the health and safety of response workers.

If climate change leads to more intense weather events and increases EPA's involvement in disaster response and remediation, then core program work in all media could be affected due to a scarcity of available staff and resources.

- The need to activate the Response Support Corps and other staff to respond to emergency/disaster situations within the Region and in support to other Regions may have an adverse impact on the Region's ability to consistently and effectively implement core activities and address identified national and regional priorities.

c) Clean up and Corrective Action

The increase in heavy precipitation events that are likely to occur in the Midwest as a result of climate change may cause an increase in flooding risk; droughts are also expected to become more common.

- Flooding often produces significant debris that must be quickly managed by local communities in the region.
- Landfill design and controls may become inadequate to protect the environment and human health. The impact of flooding on non-hazardous disposal facilities and their engineered systems is significant as municipal solid waste landfills are only required to design for handling run-on or run-off from a 25-year storm.
- Drought conditions may affect the performance of vegetative caps on closed landfills which may result in increased leachate generation and/or emissions from landfills.
- Contaminated sites where groundwater is involved may have to consider different remedies that reflect the possibility of long term drought, as well as the purging effect of flooding. Groundwater, gas, and leachate monitoring systems may all be affected. States and local governments may need assistance in evaluating the impacts on these facilities.

Goal 4: Ensuring the Safety of Chemicals and Preventing Pollution

a) Exposure to Toxic Chemicals

- Damage to homes, buildings and other community infrastructure as a result of extreme weather events may increase risk of exposure to lead, polychlorinated biphenyls (PCBs), halogenated flame retardants, asbestos and other chemical applicants. Incidents of flooding may increase Persistent Bioaccumulative and Toxic (PBT) chemical impacts to surface water.
- Increased release of toxics resulting from flooding and severe weather may exacerbate exposure and children are particularly vulnerable to this risk. Existing risk assessment methodologies may need adjustment to assure that chemical exposure models reflect changing climate conditions.

b) Exposure to Pesticides

Climate change may drive changes in crops and agricultural practices, including introduction of new genetically modified organisms (GMOs) with new pesticidal traits or immunities and change how, where, and the quantity of pesticides used due to increased pest pressure.

- Increased application amounts, as well as extreme precipitation events and flooding, may result in increased exposure risks and surface water impacts from pesticide application.
- Increased levels of carbon dioxide in the atmosphere may make weeds more difficult to control leading to increases in herbicide use and increased risks of surface and ground water contamination. Existing risk assessment methodologies may need adjustment to assure that pesticide use and exposure models reflect changing climate conditions.

- Weather changes may also result in pesticide use, application or active ingredient changes that may merit increased or more frequent EPA review or study of specific pesticide uses, applications, or effects.

c) Pollution Prevention

Increased precipitation and extreme weather events may play a more prominent role in the Pollution Prevention (P2) Program.

- The P2 Program could respond to these changes in a variety of ways, such as building the adaptive capacity of industries to address the impacts of climate change, including supply chain disruption, changing energy uses, and market demands.

Goal 5: Enforcing Environmental Laws

The enforcement of environmental laws is considered within each program area.

a) National Environmental Policy Act (NEPA)

The uncertainties associated with climate change present challenges to EPA's ability to:

- Effectively comment to other federal agencies on potential environmental impacts of proposed projects; and
- Help to ensure that proposed projects are able to adapt to a changing climate.

Region 5 Facilities and Operations

Climate change will not only impact Region 5's program work, but may also have impacts on its facilities and operations. Region 5's main office and regional laboratory are located in downtown Chicago. Region 5 also has facilities in Westlake, Ohio, and Grosse Ile, Michigan. In addition, the Great Lakes National Program Office (GLNPO) has two research vessels.

- Extreme heat, increased heavy precipitation events and poor air quality may increase the health risks of EPA Region 5 employees engaged in field work or force delays in such work.
- Increased demands on electrical grids during heat waves could impact Region 5's facilities, causing greater need for back-up power sources and contingency planning.
- Severe storms and heat waves could impact public transportation systems, thus preventing Region 5 employees from commuting in to work. Increased risk of floods and extreme events in Region 5 may increase staff demands to provide Emergency Response support. Staff away from the office for periods of time may pose a challenge to the completion of core programmatic work.

Region 5 has the Homeland Security Work Plan (HSWP) which is a series of tasks and focus areas for each division to help with regional preparedness and readiness. Tasks and focus areas range from databases and mapping tools to external partnerships and regulatory activities. To

prepare for a disruption in the Region's ability to work in our facilities, the Region 5 Continuity Plan is also covered in the HSWP and includes tasks such as increasing the ability to work from alternate locations and preparing for the closing of our offices. The HSWP is revised annually to reflect any changes or new areas that need to be addressed.

II. Regional Priority Actions

The vulnerabilities described in the previous section require that Region 5 adapt to the impacts of climate change and adjust the work of its programs accordingly. The following criteria were used to identify Priority Actions to adapt to climate change:

1. The action addresses Regional and/or national objectives; it is part of EPA's core activities and programs.
2. Legal authority exists for the action.
3. The action is achievable in a reasonable timeframe using existing resources or a moderate shift of resources.
4. The action has benefits: it reduces the impact on the environment, avoids maladaptation, and increases the effectiveness of EPA's programs in light of climate change impacts.
Note: Some of these actions will also provide mitigation co-benefits in that they will also result in reduction of greenhouse gas emissions. These actions are highlighted in green in the Program- Specific Priority Actions discussion that follows.
5. The action addresses vulnerable populations, areas, and/or ecosystems.

Regional Priority Action Themes

Although the specific needs and actions vary by program area, there are several Priority Action themes that cut across the Region. As practical, actions in these areas will be implemented at the Regional level to avoid duplication of work. In addition, actions identified by specific program areas, as described below, may also address these themes.

Training

Train staff on climate change adaptation (see also *Section V, Training and Outreach*):

- a. Core training—Increase basic level of climate change understanding of all technical staff; such training is currently being developed by Headquarters (HQ).
- b. Targeted training—Increase staff understanding of potential climate change impacts on specific program areas.
- c. Incorporate climate change considerations into health and safety training.

Internal Collaboration

Inform EPA national program offices on regional climate change impacts to identify needs and inform rulemaking and guidance development/revision; revise regulations and guidance, in coordination with other Regions and HQ, to reflect climate change impacts.

Outreach

Provide outreach and technical assistance to States, tribes, federal agencies, and other partners regarding impacts, vulnerabilities, and incorporating climate change considerations into environmental program activities and coordinating actions, as appropriate:

- a. Provide access to up-to-date data (e.g., precipitation and stream flow statistics) and tools to factor climate change into programmatic and regulatory decisions;
- b. Identify data and tool needs and seek ways to fill them (e.g., inform HQ, Office of Research and Development (ORD));
- c. Develop processes jointly with States and tribes to incorporate new data into regulatory decisions (e.g., State Implementation Plan (SIP) development);
- d. Anticipate and streamline regulatory decision-making processes affected by climate change (e.g., water quality variance requests) to promote timely, protective decisions.
- e. Incorporate climate change considerations into planning work and grant-related processes (e.g., NEPA documentation; state program negotiations, tribal environmental agreements);

Resources

Allocate resources to address climate change vulnerabilities to programs:

- a. Reassess workload and staffing priorities, as necessary, to accommodate climate change adaptation work, including potentially increasing emergency/disaster response work demands.
- b. Revise inspection and field work priorities as appropriate to reflect climate change considerations (e.g., target sites that appear to be vulnerable to climate change, such as hazardous waste landfills located in areas with increased flooding).

Program-Specific Priority Actions

The actions below are priority actions to address important climate change vulnerabilities on Region 5 programs.

Air & Radiation Division

- 1. Address adverse impacts to air quality from climate change, particularly ground-level ozone concentrations.**

Link to Vulnerability Assessment: Higher temperatures and weaker air circulation due to climate change will increase ozone formation. In addition, other impacts of climate change, including wildfires and increased demand for electricity due to greater need for air conditioning, could increase emissions of PM and other criteria pollutants.

Goal: Meet air quality standards in the Region despite the additional challenges that climate change will present.

Actions:

- a. To the extent that it becomes apparent that a changing climate is preventing attainment of national air quality standards, Clean Air Act provisions may require identification of additional control measures to reduce criteria pollutant emissions. Region 5 will work with EPA HQ to determine appropriate actions if and when such control measures are needed. Such actions may include:
 - **Consideration of Supplemental Environmental Project (SEPs) that would reduce emissions of ozone precursors;**
 - Targeting of enforcement and permit review; and
 - **Promoting options for reducing criteria pollutant emissions in anticipation of expected adverse climate change impacts, including Ozone Advance, PM Advance, and output-based standards.**

2. Address increased adverse impacts to indoor air quality (IAQ) from climate change.

Link to Vulnerability Assessment: Increased temperatures and extreme weather conditions may worsen existing indoor air quality problems and exposure to indoor air pollutants may increase if weather extremes cause residents to spend more time indoors.

Goal: Continue to improve indoor air quality in the Region and balance energy-saving measures with ventilation and indoor air quality.

Actions:

- a. Continue to promote Indoor airPLUS and Healthy Indoor Environment Protocols for Home Energy Upgrades. Indoor airPLUS builds on ENERGY STAR requirements for new homes and provides additional construction specifications to provide indoor air quality protections in new homes. The Protocols provide a set of best practices for improving indoor air quality in conjunction with energy upgrade work in homes and are intended for voluntary adoption by weatherization assistance programs, federally funded housing programs, private sector home performance contractors, and others working on residential energy upgrade or remodeling efforts.
- b. Add information on climate change impacts as they relate to IAQ to stock outreach presentations for schools, health care professionals, etc. Incorporate these messages into collaborative IAQ work with state and local health departments, Habitat for Humanity, HUD, etc., so that our partners are aware of these impacts and the need to weatherize and make other building improvements with IAQ in mind.

Water Division**1. Target highly vulnerable public water systems for source water protection.**

Link to Vulnerability Assessment: Both the quantity and quality of drinking water sources are

likely to be adversely affected by climate change. Source water quality degradation, increased demands for water in the face of extreme temperatures, drought and other stresses exacerbated by climate change will impact some public water systems, and the people served by them.

Goal: Source water protection is increasingly used at highly vulnerable systems to minimize risk and make our drinking water sources and water systems more resilient to climate change impacts.

Actions:

- a. Develop a process to identify highly vulnerable systems. Water Division and its partners will develop a prioritization scheme to identify the highly vulnerable public water systems to highlight those water sources and systems most at risk to climate change effects. This might involve analyzing compliance information or raw water quality data trends to identify those most susceptible to particular impacts of climate change.
- b. Provide targeted outreach and compliance assistance. Apply targeted outreach and compliance assistance on measures to reduce negative effects of climate change to those most in need of additional support. Depending on the mechanism for prioritizing highly vulnerable public water systems, the applicable programmatic tools from across the water program to aid groups of systems receptive to assistance will be utilized.
- c. Coordinate adaptation activities with federal, state, and tribal partners. Leverage assistance from external partners such as the Indian Health Service and technical assistance providers, as well as the states, to provide a coordinated set of adaptation practices. Use source water protection tools to improve resilience of highly vulnerable water systems. Where necessary, use enforcement actions to compel adoption of approaches other than, or in addition to, treatment (i.e., Source Water Protection (SWP) and other Sustainable Water Infrastructure (SWI) practices) to increase resiliency and return water systems back to compliance.

2. Increase climate-readiness at water utilities

Link to Vulnerability Assessment: Wastewater, drinking water and storm water utilities will be under increasing strain to maintain compliance and achieve performance and water quality objectives in the face of climate change, as precipitation events are expected to become more extreme throughout the region and may overwhelm infrastructure.

Goal: Resilience of drinking water and wastewater utilities to climate change is increased through application of SWI practices.

Actions: Continue promoting SWI practices to make water utilities more resilient to climate change impacts, emphasizing the following:

- a. Incorporate SWI conditions into NPDES permits, where appropriate. Water Division and state partners will identify SWI approaches that are amenable to NPDES permit conditions, for example, green infrastructure and asset management, and develop model

language for incorporation into NPDES permits. EPA will track and report to states, providing case examples and best practices to promote replication.

- b. Incorporate SWI considerations into compliance assistance and enforcement settlements, where appropriate. Provide information to facility operators on SWI tools and resources as a regular part of our municipal inspection program including the Climate Ready Water Utilities (CRWU) initiative and the Climate Resilience Evaluation and Awareness Tool (CREAT). Water Division and state partners will identify SWI approaches that are amenable to NPDES enforcement settlements, for example, green infrastructure and asset management, and develop model language for consideration in settlement negotiations, orders, etc.
- c. Begin tracking EPA enforcement actions for the incorporation of sustainable practices. Incorporate new fields in the Water Enforcement Tracking database for tracking sustainable practices and populate the fields to provide a full accounting of existing efforts. As it becomes available, performance information will be incorporated. The results will be used to identify best practices and lessons learned to inform future efforts and promote replication by states.
- d. Promote energy management at utilities as resources allow. Conduct energy management outreach, as resources allow, to replicate the success of initial efforts in the Indiana energy management pilot. Using the information acquired from these demonstrations, promote the benefits of energy management and its potential role in utility climate-readiness, in collaboration with states, professional organizations and others.

3. Improve information on climate change impacts on surface water quality and quantity available and used for regulatory and assistance actions.

Link to Vulnerability Assessment: Climate change is expected to cause changes in surface water characteristics such as water quality (chemical, physical, and biological), stream flow characteristics, and lake levels. The regulatory and assistance programs EPA, states and tribes use to protect water quality will require up-to-date information about surface water characteristics to ensure that they remain effective. Monitoring programs may not presently be designed and managed to acquire appropriate data.

Goal: High quality, up-to-date information on water resources is collected through state monitoring programs; such information is factored into regulatory and standards programs (e.g., NPDES, WQS and TMDL) and assistance efforts (e.g., NPS management).

Actions:

- a. Identify, with state and tribal partners, critical water resources information necessary to inform program work as climate changes. Such information is likely to include chemical and biological metrics needed to determine the health of water bodies or to demonstrate changes/trends in water quality.

- b. Identify, with partners, potential information sources. Critical water resources information identified will potentially be available through sources such as other federal agencies, while other information is appropriate for state monitoring programs. The most cost-effective approach for meeting our data needs will collectively be identified.
- c. Incorporate climate change into state and tribal monitoring strategies. Where appropriate, incorporate appropriate metrics and other climate-related adjustments into state and tribal monitoring strategies. To the extent that the revisions necessitate trade-offs or require additional resources, approaches to meet those needs will be jointly developed.
- d. Ensure that up-to-date climate-related information is factored into regulatory, standards and assistance programs. Ensure existing state operating procedures and practices are adjusted, as necessary, to access and use up-to date monitoring data, stream flow metrics, etc. for development of water quality standards, TMDLs, permit conditions and other regulatory decisions. Promote transparency by ensuring that documentation of regulatory decisions clearly identifies where climate change-related information factors into a decision, e.g., standard revision submissions, permit fact sheets.

4. Streamline and standardize water quality standards decision-making processes to ensure timely, protective decisions.

Link to Vulnerability Assessment: As the effects of climate change place more stress on our waters, more submissions from states and tribes for WQS revisions are likely. These may come in two forms: variances from existing criteria, and revised standards (criteria and/or use designations).

Goal: State processes for considering WQS changes are efficient and decisions are well-supported; EPA is able to timely act on changes submitted by States.

Actions:

- a. Determine, in consultation with headquarters (Office of Waste/Office of Science and Technology), the flexibility allowed to change designated uses in surface waters that are adversely impacted by climate change and communicate clear guidance to states and tribes.
- b. Identify and replicate “best practices” among the states and tribes.
 - i. Identify and implement efficient procedures to process large numbers of similar variance requests.
 - ii. Identify and implement efficient procedures to process large numbers of use designation revisions. For example, Ohio routinely submits multiple use designation change packages including anywhere from 30 to 150 use change proposals, which EPA can review as a package. If other states could be encouraged to submit these types of multiple use change rule packages, this would further enhance the efficiency

of our reviews.

- c. Ensure that any approach to streamline a WQS process is exercised transparently and that decisions are well-supported by data.

Great Lakes National Program Office

1. Continue to restore and maintain the chemical, physical, and biological integrity of the Great Lakes ecosystem in the face of climate change

Link to Vulnerability Assessment: Climate trends are changing the Great Lakes in a variety of ways (e.g., the Lakes themselves are getting warmer, storm frequency and intensity are increasing, lake levels are changing, etc.). The Great Lakes are expected to be increasingly vulnerable to toxic and nutrient loadings, invasive species and habitat loss.

Goal: Impacts of climate change to the Great Lakes ecosystem are decreased by applying the latest climate change information to GLRI projects and other GLNPO efforts.

Actions:

- a. Adjust long-term ecosystem monitoring programs to fulfill the U.S. commitments under Annex 10 (Science) of the Great Lakes Water Quality Agreement. Current climate change information will be taken into account when assessing the timing, frequency, scheduling, and geographic scope of water quality and fish monitoring programs. Adjustments may occur annually or as needed during monitoring activities. Climate change-related indicators (ice cover, water and air temperature, lake levels, critical ecosystem indicators, etc.) will be assessed and reported on an ongoing basis through the State of the Lakes Ecosystem Conference (SOLEC) and other channels to advise management actions at a regional and local scale.
- b. Integrate climate change knowledge into GLRI-funded projects, as well as other GLNPO funding mechanisms (e.g., Legacy Act, Sustain Our Great Lakes), to ensure the latest science informs project design. Climate change impacts will be required to be considered in all appropriate GLRI Request for Application (RFA) categories annually. For remaining categories, credit for attention to climate change in applications will be provided. When feasible, guidance and examples as to how to consider climate change in applications will be provided to applicants in RFAs. A GLRI RFA category for capacity-building of local governments and resource decision-makers in the Great Lakes to implement climate change adaptation actions will be offered.
- c. Direct necessary revisions to Great Lakes strategic implementation documents, while working with federal, state, tribal and binational partners, using the latest climate change information. Guide development, revision and implementation of both Remedial Action Plans for Areas of Concern and Lakewide Management and Action Plans, in collaboration with the appropriate partners, with the latest climate change information as

required under the Great Lakes Water Quality Agreement. In addition, the next update of the GLRI Action Plan will factor the latest scientific information on climate change.

Superfund Division

1. Revise current Superfund processes to reflect new protocols.

Link to Vulnerability Assessment: Increased temperatures and flood and drought conditions will impact mobilization of contaminants at sites and may alter the time, cost, and effectiveness of cleanups. As a result, recommended processes and remediation techniques may need to be changed.

Goal: Ensure that standard processes and procedures in the Region consider climate change impacts and reflect any changes from Program Offices.

Actions:

- a. Review existing Superfund processes to identify where climate change will require process and template changes. Superfund processes include: Remedial Investigation/Feasibility Study (RI/FS), Record of Decision (ROD), Remedial Design/Remedial Action (RD/RA), Five Year Reviews, and language in Brownfield grants terms and conditions (T&C) that considers climate change in evaluating cleanup alternatives.
- b. Adjust requirements and language in Superfund processes to reflect the new protocols. This includes reviewing and revising how to:
 - i. Evaluate alternative remedies for sites that may be impacted by floods and changing water tables, such as landfills on floodplains;
 - ii. Choose remediation techniques that incorporate vegetation that might be more tolerant of heat, excessive rain, or drought;
 - iii. Manage severe erosion issues on terrain and constructed landfills, with larger rain events contributing to additional erosion concerns;
 - iv. Account for water table fluctuations that might impact changing plume direction and increase smear zones;
 - v. Redesign corrective actions to manage frequent flooding that may bring contaminants to the surface and increase exposure potential;
 - vi. Manage changes in construction season due to warmer or erratic weather; and
 - vii. Manage increases in sedimentation and scouring due to larger rain events at sites.
- c. Train staff on these new protocols. Once new procedures have been accepted and guidelines are changed, ensure that staff are trained and will follow the new protocols.

2. Enhance flexibility of Emergency Response to climate change conditions.

Link to Vulnerability Assessment: There will be an increased need for emergency response due

to frequency of events and duration of response activities. Changing climatic conditions can also pose additional hazards for staff.

Goal: Improve the flexibility of the Emergency Response team to an anticipated increase in events.

Actions:

- a. Assess how changing climatic conditions in the Midwest will impact Emergency Response. Evaluate how changing climatic conditions will impact the ability of staff to respond to emergency situations, including staff readiness, equipment needs, availability of staff, and duration of response action.
- b. Evaluation of resource needs. Determine how Superfund will adjust staff flexibility and availability, training, and equipment to ensure timely responses to events. This will also include improvements in communication channels with state and local authorities. Additionally, an increase in training and cross program coordination for Regional Science Council (RSC) and Incident Management Team (IMT) members will be necessary to prepare for more frequent response.
- c. Implementation. Create an implementation plan to acquire or train staff, and to acquire equipment.

3. Disseminate climate change information related to risk, safety, requirements, and alternative remedies to states and tribes.

Link to Vulnerability Assessment: Increased temperatures and flood and drought conditions will impact mobilization of contaminants at sites and may alter the time, cost, and effectiveness of cleanups. As a result, recommended processes and remediation techniques may need to be changed.

Goal: Inform state and tribal partners of any new or revised recommendations on emergency response, remedial cleanup, and Brownfields grants terms and conditions.

Actions:

- a. Review list of state contacts and tribes that should receive new information related to emergency response, new or modified investigation strategies, remediation techniques, risk based cleanup factors and ranking, disposal of hazardous waste and domestic white goods, and Brownfield cleanup alternatives.
- b. Disseminate new fact sheets and information to state and tribal partners. HQ will be developing new guidelines on risks, safety, new requirements, and alternative remedies.
- c. Ensure content on Region 5 website reflects current information related to revised processes and requirements under climate change conditions by working with IT/web content/GIS departments.

- d. Pursue additional opportunities to share information with states and tribes, through meetings, conferences, webinars, etc.

Land & Chemicals Division

1. Maintain and improve available information on managing disaster debris to support planning and emergency response.

Link to Vulnerability Assessment: An increase in heavy precipitation events may cause an increase in flooding risk which often produces significant debris that must be quickly managed in the region. State, local, and federal emergency response personnel will need up-to-date information to help them plan for debris management and find facilities that can safely manage, and when possible, recover or recycle various types of debris.

Goal: High quality and up-to-date information is maintained and readily available for use by federal, state, and local emergency response personnel to support planning for and managing large volumes of debris that may be generated by storm or heavy precipitation events.

Actions:

- a. Verify, maintain, and annually update at least 1/3 of the records currently maintained in the Disaster Debris Recovery Database in consultation with state and local officials as well as private sector information sources.
 - b. Continue to provide technical assistance and support to state disaster debris planning efforts and maintain and update the planning resources and mapping tools available on Region 5's website:
(http://www.epa.gov/region5/waste/solidwaste/debris/disaster_debris_resources.html).
 - c. Ensure awareness of the Disaster Debris Recovery Database and mapping tool and planning resources by conducting at least one presentation annually to local and state emergency planners and response personnel.
- ### 2. Maintain and improve pesticide producer information and target pesticide (FIFRA) and chemical (EPCRA-TRI/TSCA) inspections to identify and address sites that appear to be vulnerable to climate change.

Link to Vulnerability Assessment: Increased precipitation events and flooding may result in increased exposure risks and impacts from industrial chemicals and pesticides. For example, chemical manufacturers, processors and formulators might be located in areas of measurably increased flooding. Improved data about these facilities will help EPA and other stakeholders to identify and prioritize potential impacts.

Goal: Improved information within managed databases and targeted inspections under FIFRA and EPCRA-TRI/TSCA which will be used to identify chemical facilities and pesticide establishments that may require re-assessments or additional attention.

Actions:

- a. Add geographical information on flood-prone areas to the selectivity criteria to target pesticide producing establishments for inspection under FIFRA and chemical manufacturing/processing facilities for inspection under EPCRA 313 / TSCA.
- b. Target establishments and facilities located in flood-prone areas for inspection, with our State partners under FIFRA, to address bulk chemical containment requirements.
- c. Maintain and update location and other available information on pesticide producer establishments on an annual basis. The Region, in collaboration with the regulated community, will ensure that applications for new establishment registrations under FIFRA and the cancellation of establishment registrations for those facilities no longer engaged in pesticide production.
- d. Develop a database and map of TSCA and TRI regulated chemical manufacturers, processors and formulators for the Region using new TSCA CDR and TRI information. This map can be used to better target sites that may be more vulnerable to climate change.
- e. Create a list of chemicals, in consultation with the Chemicals of Emerging Concern (CEC) Network, other Divisions/Offices, OCSPP, and ORD, whose risk may need to be re-assessed or which may have a higher potential for the need for a chemical-specific mitigation and/or elimination strategy in different climate change scenarios.

NEPA Program

1. Address climate change impacts as a required component of a NEPA analysis.

Link to Vulnerability Assessment: New construction or upgrades that require a NEPA analysis, (infrastructure, energy, land use, transportation, etc.) will likely be impacted by climate change. Impacts resulting from NEPA projects may exacerbate existing environmental and health issues both directly and indirectly. Projects may need to weigh both positive and negative impacts.

Goal: All NEPA projects (Environmental Impact Statements and Environmental Assessments) will identify and analyze the effects of climate change on the proposed project as well as the impact of the project on climate change.

Actions:

- a. Develop a framework of expected analysis that will be conducted by the lead agency and included in NEPA documents. EPA will determine what information is relevant for

inclusion for the proper analysis of the association between the proposed project and climate change. Specific factors, data, and information that EPA will look for in a NEPA review will be clearly listed, defined and disseminated to other federal agencies in a programmatic manner.

- b. Coordinate early with lead agencies (federal, state, local, and tribal) that submit NEPA documents for review. Common language across federal agencies and implementation of permitting standards will be captured in NEPA documents. The NEPA documents will reflect both EPA guidelines (expected from CEQ) as well as adhere to the individual agency's guidelines to analyze climate change, and climate change priorities and adaptations. It is imperative to coordinate this analysis early in the scoping process. By identifying concerns and working with lead agencies from the onset of a project, many of the adverse impacts (both direct and indirect) can be adapted and/or mitigated.

III. Agency-wide Strategic Measures on Climate Change Adaptation

The *FY 2011-2015 EPA Strategic Plan* contains the Agency's first strategic performance measures for integrating climate change adaptation into its activities. These strategic performance measures commit the Agency to integrate adaptation planning into five major rulemaking processes and five major financial assistance mechanisms by 2015. They also call for the integration of adaptation planning into five major scientific models or decision-support tools used in implementing Agency environmental management programs. Region 5 will support these measures through the following:

1. Integrate Adaptation Planning into Rulemaking Processes
 - Provide information on regional climate change impacts to EPA national program offices to inform rulemaking and guidance development/revision; revise regulations and guidance, in collaboration with other Regions and EPA HQ, to reflect climate change impacts.
 - Explore, with the states, how state rules may need to be changed as a result of climate change.
2. Integrate Adaptation Planning into Financial Assistance Mechanisms
 - Explore opportunities to incorporate climate change adaptation considerations into competitive funding announcements in accordance with the October 18, 2011, EPA guidance memo jointly issued by the Office of Policy and the Office of Grants and Debarment. This may include a climate change adaptation criterion wherever it is relevant to the program's mission and outcomes.
 - GLNPO will include consideration of climate change as a grants scoring criterion and ensure that scientific information on climate change impacts and adaptation is incorporated into projects funded by GLRI and other mechanisms (e.g., Sustain Our Great Lakes, Great Lakes Legacy Act). Include consideration of climate change as a criterion in reviewing/scoring competitive grants.
 - Region 5 Indian Environmental Office (IEO) and EPA Headquarters American Indian Environmental Office will jointly determine how to appropriately and

effectively use Indian General Assistance Program (GAP) funds to plan or respond to climate change impacts, and share information on lessons learned with other Regions.

3. Integrate Adaptation Planning into Models or Decision-Support Tools

- Identify opportunities to incorporate climate change adaptation considerations into models or decision-support tools. Provide information to EPA national program offices to identify needs and inform the development of such tools.

IV. Legal and Enforcement Issues

The EPA derives its authority to act from the laws passed by Congress. The Agency is committed to ensuring that its actions are constitutional, authorized by statute, consistent with Congress's vision and intent, and otherwise legally supported. Congress has given the Agency the broad mandates to protect human health and the environment. This mandate affords the Agency with the broad legal authority to support climate change adaptation work. However, specific questions may arise in the course of adaptation planning and implementation that cannot be answered without a legal review of Agency policies and/or guidance as well as court precedents.

Region 5 Divisions and Offices and Office of Regional Counsel will continue to work closely on matters related to climate change adaptation. To date, the work on climate change adaptation has not faced significant legal issues.

- The Region will address any legal and enforcement issues that may arise through the Office of Regional Counsel, in consultation with the Office of General Counsel and the Office of Enforcement and Compliance Assurance (OECA), as necessary.
- In addition, Region 5 will confer with OECA on the inclusion of climate change considerations in compliance and enforcement activities.

V. Training and Outreach

A central element of the Region's efforts to adapt to a changing climate will be to increase staff awareness of how climate change may affect their work by providing them with the necessary data, information, and tools. Strengthening adaptive capacity of staff within the Region is necessary to anticipate and plan for future changes in climate and incorporate considerations into our programs, policies, and operations.

Through the development of a regional climate change adaptation training module, consistent training will be provided to all Regional staff. A workgroup formed out of the Region's Mid-Level Leadership Development Program is currently developing the structure and content for training on Regional impacts of climate change, as well as program-specific training and discussions to further outline changes that need to be made to core work processes. In addition,

the Regional Climate Change Adaptation Team will continue in its efforts to educate, foster buy-in, and plan for program resiliency.

Adaptation requires coordination across sectors and should build on the existing efforts and knowledge of stakeholders. States, tribes, and local communities share responsibility for protecting human health and the environment with EPA. Working with these partners will be critical for efficient, effective and equitable implementation of climate change adaptation strategies, which will evolve over time.

Region 5 will:

- Provide general and program-specific training opportunities to our staff and management to increase their understanding of climate change vulnerabilities in our Region, and how to best incorporate climate change adaptation into our work.
- Encourage our partners to integrate climate change adaptation effectively into their work. Share existing decision-support tools and training opportunities on climate change adaptation, especially where training is local or available on-line.
- Develop a regional climate adaptation communication strategy to engage and inform partners.
- Build adaptive capacity and encourage climate adaptation planning depending upon state, local, and tribal needs and conditions.
- Engage the Midwest Natural Resources Group of federal agency senior managers to promote cooperation on climate change adaptation.

VI. Partnerships with Tribes

EPA values its unique government-to-government relationship with Indian tribes in planning and decision making. This trust responsibility has been established over time and is further expressed in the *1984 EPA Policy for the Administration of Environmental Programs on Indian Reservations* and the *2011 Policy on Consultation and Coordination with Indian Tribes*. These policies recognize and support the sovereign decision-making authority of tribal governments. Supporting the development of adaptive capacity among tribes is a priority for the EPA. Tribes are particularly vulnerable to the impacts of climate change due to the integral nature of the environment within their traditional lifeways and culture. There is a strong need to develop adaptation strategies that promote sustainability and reduce the impact of climate change on Indian tribes.

EPA engaged tribes through a formal consultation process in the development of the Agency's *Climate Change Adaptation Plan*. Tribes identified some of the most pressing issues as erosion, temperature change, drought and various changes in access to and quality of water. Tribes recommended a number of tools and strategies to address these issues, including improving access to data and information; supporting baseline research to better track the effects of climate change; developing community-level education and awareness materials; and providing financial and technical support. At the same time, tribes challenged EPA to coordinate climate change activities among federal agencies so that resources are better leveraged and administrative

burdens are reduced.

This Implementation Plan identifies specific steps that will be taken to partner with tribal governments on an ongoing basis to increase their adaptive capacity and address their adaptation-related priorities. These collaborative efforts will benefit from the expertise provided by our tribal partners and the Traditional Ecological Knowledge (TEK) they possess. TEK is a valuable body of knowledge in assessing the current and future impacts of climate change and has been used by tribes for millennia as a valuable tool to adapt to changing surroundings. Consistent with the principles in the 1984 Indian Policy, TEK is viewed as a complementary resource that can inform planning and decision-making.

Networks and partnerships already in place will be used to assist tribes with climate change issues, including Regional Tribal Operations Committees, the Institute for Tribal Environmental Professionals and GAP. Additionally, efforts will be made to coordinate with other Regional and Program Offices in EPA, since climate change has many impacts that transcend media and regional boundaries. Transparency and information sharing will be a focus, in order to leverage activities already taking place within EPA Offices and tribal governments.

Tribes in Region 5 are increasingly concerned about the effects of a changing climate on their communities, resources and traditional cultural practices. Many tribal populations are already experiencing climate change impacts; for example, moose populations and wild rice cultivation have already been adversely impacted on tribal lands.

Region 5 is committed to an ongoing partnership with the tribes to strengthen their capacity to address climate change impacts and address their adaptation-related priorities. The Region will:

- Integrate climate change adaptation into existing funding mechanisms to help tribes incorporate and consider climate change in their environmental programs. Region 5's IEO will ensure that the GAP funds it manages are used appropriately and effectively to plan for and respond to climate change impacts.
- Provide outreach and technical assistance on climate change impacts and adaptation that is specific to tribal needs and assists in meeting their environmental regulatory responsibilities. Region 5 will use existing regional forums/resources, including the annual Tribal Environmental Program Management conference, Region 5 Tribal Operations Committee meetings, and Tribal Caucus calls or meetings, as appropriate, for outreach and/or training. Region 5 will leverage limited resources and avoid duplication of efforts through coordination of training and outreach efforts with other federal agencies (through the Region 5 Memorandum of Understanding Workgroup), Headquarters, and other partners.
- Provide opportunities for meaningful tribal participation in regional climate change efforts and facilitate communication with the tribes to gather updated information on climate change impacts they are experiencing to inform programmatic work as appropriate.

VII. Vulnerable Populations and Places

The effects of climate change have the potential to have an adverse impact to specific vulnerable populations, contingent upon their geographic location and demographic information. Impacts may vary depending upon a population's susceptibility to the health effects of environmental pollution, economic status, education level, income source and access to relevant information. For example, children, the elderly, and individuals with respiratory problems are more vulnerable to poor indoor and outdoor air quality, both of which may worsen in a changed climate. In general, environmental justice issues may be amplified by the impacts of climate change. One of the principles guiding EPA's efforts to integrate climate change adaptation into its programs, policies and rules calls for its adaptation plans to prioritize helping people, places and infrastructure that are most vulnerable to climate impacts, and to be designed and implemented with meaningful involvement from all parts of society.

This Implementation Plan identifies key programmatic vulnerabilities and the priority actions that will be taken to address those vulnerabilities over time. As the work called for in this Plan is conducted, the communities and demographic groups most vulnerable to the impacts of climate change will be identified. The Agency will then work in partnership with these communities to increase their adaptive capacity and resilience to climate change impacts. These efforts will be informed by experiences with previous extreme weather events (e.g., Hurricane Katrina and Superstorm Sandy) and the subsequent recovery efforts.

Region 5 will integrate consideration of vulnerable populations and environmental justice into our actions as this plan is implemented. Region 5 intends to build on existing partnerships with tribal and environmental justice programs to ensure such populations are represented in climate change impact analysis. Finally, we will explore opportunities to share information, case studies, and experiences related to climate change adaptation among tribes and other vulnerable populations with HQ and other regional offices, federal agencies, and non-governmental organizations.

VIII. Measuring & Evaluation

Region 5 will evaluate its climate change adaptation activities, particularly our Priority Actions, to assess progress toward mainstreaming climate change adaptation into programs, policies, rulemaking processes, and operations. Region 5 will develop a work plan based on the Priority Actions, including additional details on actions and assignment of roles and responsibilities. Using this work plan, the Region will conduct an annual evaluation of our progress and performance under this Implementation Plan. Based on the lessons learned through these evaluations, Region 5 will make any necessary adjustments to its approach.

Region 5 recognizes that the integration of climate change adaptation planning will occur over time. This will happen in stages, and measures should reflect this evolution.

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Appendix A: Region 5 Vulnerability Assessment Table

Office	Climate Change Impact ^a	Likelihood of Impact ^b	Focus of Associated EPA Program	Example of Risks if Program were Impacted	Likelihood EPA Program will be affected by Impact ^c	Regional Importance of Vulnerabilities	Variation in importance across the Region
ARD	Increased tropospheric ozone pollution in certain regions	Likely ¹	Protecting public health and the environment by setting National Ambient Air Quality Standards (NAAQS) and implementing programs to help meet the standards	Could become more difficult to attain NAAQS for ozone in many areas, including areas with existing ozone problems as well as those currently in attainment.	High	Five of the six Region 5 states already struggle with attaining the ozone standard in large urban areas. Increases in tropospheric ozone could result in more nonattainment areas and lengthen the ozone season.	Important across Region, but new non-attainment areas could be in smaller metro areas and in the northern part of the Region.
ARD	Increased frequency or intensity of wildfires	Likely ²	Protecting public health and the environment by setting National Ambient Air Quality Standards (NAAQS) and implementing programs to help meet the standards	Could complicate Agency efforts to protect public health and the environment from risks posed by particulate matter (PM) pollution in areas affected by more frequent wildfires.	Medium	Currently wildfires are not a large contributor to PM issues in the Great Lakes States; however, a significant increase in wildfires could change this profile. Could also increase deposition of certain contaminants to the Great Lakes.	Forest areas are mostly in the northern part of the Region.
ARD	Increasing extreme temperatures	Very Likely ³	Protecting public health and the environment by setting National Ambient Air Quality Standards (NAAQS) and implementing programs to help meet the standards	Could complicate efforts to attain NAAQS for various criteria pollutants and increase public health risks, including risks for the young, the elderly, the chronically ill, and socioeconomically disadvantaged populations.	Medium	Increased temperatures and extreme weather events could increase demand for electricity (for example, through increased use of air conditioning units), which would require more electricity creating greater pollution from EGUs, back-up generators, and peaker plants. This could increase difficulty of meeting NAAQS for O ₃ , PM _{2.5} , SO ₂ , NO ₂ , and CO.	Important across Region, but risks higher in urban areas and areas with more sources.
ARD	Increasing extreme temperatures Increasing heavy precipitation events	Very Likely ³ Likely ³	Protect public health by promoting healthy indoor environments through voluntary programs and guidance	Could increase public health risks from indoor air pollution, including risks for the young, the elderly, the chronically ill, and socioeconomically disadvantaged populations	Medium	Susceptible individuals across Region 5 will be impacted by potentially greater exposure to air pollution, both indoors and outdoors. More time spent inside during extreme weather, mold issues as a result of flooding and storms, and inappropriate energy efficiency measures (i.e., making buildings too "tight") could all increase IAQ problems.	Important across the Region, but particularly in EJ areas and areas with high density of more susceptible populations.

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Office	Climate Change Impact ^a	Likelihood of Impact ^b	Focus of Associated EPA Program	Example of Risks if Program were Impacted	Likelihood EPA Program will be affected by Impact ^c	Regional Importance of Vulnerabilities	Variation in importance across the Region
ARD	Increasing extreme temperatures Increasing heavy precipitation events	Very Likely ³ Likely ³	Atmospheric deposition initiatives Ecosystem protection from Agency emissions reduction programs	Effects on ecosystems, including the Great Lakes, to increased atmospheric deposition of sulfur, nitrogen, and mercury (and potentially increased methylation of mercury). Also impacts compliance with water quality standards and TMDLs.	High	Mercury is a high priority in Region 5 in both the Great Lakes and inland lakes. All of our states have water bodies impaired by mercury. Increases in mercury deposition, as well as sulfur and nitrogen, would further stress our ecosystems.	Very important across the Region.
EJ	Increasing heavy precipitation events Increasing flood risk	Likely ³ Likely ⁷	Drinking water, wastewater and stormwater infrastructure	Inadequate water supply for human consumption (Contaminated wells, water systems) Damage to water infrastructure from intense storms	High	EJ communities will need added assistance and attention if these events compound already existing concerns.	Regionwide
GLNPO	Changes in temperature Increased water temperatures Increasing heavy precipitation events	Very Likely ³ Very Likely ⁹ Likely ³	GLRI, GLQWA	Overall climate change impacts to Great Lakes water quality and ecosystem characteristics	High	As a result of its working relationship with Canada under the new GLWQA commitments, GLNPO will be put under increased pressure to develop and coordinate with Canada monitoring, modeling, downscaling and other climate efforts, including capacity building and sharing information needed by GL resource managers. States, tribes and other GLRI partners will face increasing pressure to address various local impacts to Great Lakes resources and begin adaptation efforts. This will increase	Lake Superior, a “cold water” lake, will be extremely affected by climate change in general. The nature of the fish species, aquatic species, wildlife habitat will all be tremendously affected (more so than the other lakes) by climate change.

Appendix A: Region 5 Vulnerability Assessment Table

Office	Climate Change Impact ^a	Likelihood of Impact ^b	Focus of Associated EPA Program	Example of Risks if Program were Impacted	Likelihood EPA Program will be affected by Impact ^c	Regional Importance of Vulnerabilities	Variation in importance across the Region
						<p>pressure on GLRI programs and funding sources.</p> <p>GLNPO will face an increased workload to understand the science of climate change in the Great Lakes and monitor climate change variables in assessments of the overall health of the Lakes.</p> <p>GLNPO will face an increased workload in outreach/communication in helping partners, local communities, cities, etc, adapt to a changing climate.</p>	
GLNPO	Increased frequency or intensity of wildfires	Likely ²	Protecting public health and the environment by setting National Ambient Air Quality Standards (NAAQS) and implementing programs to help meet the standards	Could complicate Agency efforts to protect public health and the environment from risks posed by particulate matter (PM) pollution in areas affected by more frequent wildfires	Medium	<p>More forest fires will increase emissions of mercury and other contaminants, thereby hindering progress in reducing mercury in the Great Lakes ecosystem under our binational commitments in the new Great Lakes Water Quality Agreement 2012 (GLWQA), and may complicate mercury reduction efforts under GLRI Toxics Focus Area.</p> <p>May also prevent the achievement of the mercury reduction goals of the Lake Superior Zero Discharge Demonstration Program.</p>	Lakes Superior, Huron, Michigan
GLNPO	Effects on response of ecosystems to atmospheric deposition of sulfur, nitrogen, and mercury	Likely ⁵	Ecosystem protection from Agency emissions reduction programs	<p>Based on evolving research, could have consequences for the effectiveness of ecosystem protections under those programs.</p> <p>Watershed, aquatic</p>	Medium	Changes in atmospheric deposition patterns of these and other toxic chemicals could adversely affect EPA's ability to fulfill its commitments to reduce toxic chemicals in the Great Lakes ecosystem under the GLWQA and the GLRI Toxics Focus Area. Could potentially affect the ecosystem	Lakes Superior, Huron, Michigan

Appendix A: Region 5 Vulnerability Assessment Table

Office	Climate Change Impact ^a	Likelihood of Impact ^b	Focus of Associated EPA Program	Example of Risks if Program were Impacted	Likelihood EPA Program will be affected by Impact ^c	Regional Importance of Vulnerabilities	Variation in importance across the Region
				ecosystems and wetlands will be at risk from runoff contamination from sulfide mining in the Upper Great Lakes, during heavy precipitation events.		response with respect to sulfide levels in wild rice habitat.	
GLNPO	<p>Increasing heavy precipitation events</p> <p>Increasing intensity of hurricanes</p> <p>Decreasing precipitation days and increasing drought intensity</p> <p>Increased water temperatures</p>	<p>Likely³</p> <p>Likely³</p> <p>Likely⁷</p> <p>Very Likely⁹</p>	<p>Restoring and protecting watersheds, aquatic ecosystems and wetlands</p> <p>GLRI, GLQWA</p>	<p>Increased number of sewer overflows and wastewater bypasses, as well increased pollutant loads in runoff, fouling streams and threatening public health.</p> <p>Challenges to coastal wetlands' ability to migrate.</p> <p>Reduced streamflow, altering the aquatic environments and increasing impairments.</p> <p>Higher nutrient loadings will likely lead to an increase in toxic algae blooms.</p> <p>Shifts in aquatic habitat will threaten the economic and cultural practices of tribal communities.</p>	High	<p>GLWQA nutrient loading and concentration targets will be harder to achieve if the Great Lakes experience increased runoff from more frequent and intense precipitation events.</p> <p>GLWQA and GLRI commitments to address risks to water quality from chemicals will be harder to address if increased runoff increases the amount of nonpoint source pollution such as chemicals, pesticides, oil and pharmaceuticals to the Great Lakes.</p> <p>GLRI-funded habitat restoration projects will be at risk from destruction or decreased performance due to increased erosion, scouring, wave action, etc. as a result of increased storm intensity. Additional costs and design considerations will result.</p> <p>Climate change effects on CSOs, NPS and other water pollution loadings will put current cleanup, remediation and restoration activities in Great Lakes Areas of Concern (AOCs) at risk from destruction or decreased performance.</p>	<p>Especially Lake Erie, Green Bay, Saginaw Bay</p> <p>31 US Areas of Concern spread throughout the GL Basin</p>

Appendix A: Region 5 Vulnerability Assessment Table

Office	Climate Change Impact ^a	Likelihood of Impact ^b	Focus of Associated EPA Program	Example of Risks if Program were Impacted	Likelihood EPA Program will be affected by Impact ^c	Regional Importance of Vulnerabilities	Variation in importance across the Region
GLNPO	Changes in temperature Increased water temperatures	Very Likely ³	GLRI, GLQWA	Shifting habitat ranges and migration patterns of Great Lakes species.	High	May force changes in goals for GLRI-funded restoration projects. Protection efforts for GLRI-critical species will require additional analysis and tools to address the increasingly out of sync migrations of some species with the appearance of their food sources.	Regionwide
GLNPO	Increasing heavy precipitation events	Likely ³	Restoring and protecting watersheds, aquatic ecosystems and wetlands	Increased pathogens on Great Lakes beaches	High	Fulfilling EPA’s commitments to remove “beach closings” as a beneficial use impairment from Great Lakes AOCs will be hindered if E. coli increasingly over-winters and faces ideal air and water conditions for growth.	Regionwide
GLNPO	Increasing heavy precipitation events Increasing intensity of hurricanes Increasing flood risk	Likely ³ Likely ³ Likely ⁷	Drinking water, wastewater and stormwater infrastructure GLQWA	Water infrastructure could be overwhelmed or damaged. Integrity of coastal water infrastructure systems could be put at increased risk. Drinking water and wastewater utilities will need an ‘all hazards’ approach to planning for emergencies and extreme weather events. Problems of safety as well as access to clean and safe water will be exacerbated for vulnerable and economically deprived communities.	High	A significant number of CSOs still exist in the Great Lakes Basin, so increased precipitation will continue to have a negative impact on EPA’s ability to meet its commitments under the GLWQA. The Upper Great Lakes basin has a significant and increasing number of mining operations, which will face new weather conditions that do not match engineering design assumptions, thereby increasing the vulnerability of Great Lakes waters to contamination. CWA Programs, NEPA, and GLRI programs may have an increased burden in dealing with these changes.	Lakes Superior, Huron and Michigan

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GLNPO	<p>Changes in temperature</p> <p>Increased water temperatures</p> <p>Increasing heavy precipitation events</p>	<p>Very Likely³</p> <p>Very Likely⁹</p> <p>Likely³</p>	GLRI, GLQWA	<p>Changing Seasonality of Great Lakes precipitation, evaporation, tributary flows</p> <p>Seasonal ice cover over the Great Lakes has been decreasing measurably, and will affect evapotranspiration, local weather, etc.</p>	High	<p>Depending upon changes in evaporation, lake levels, and seasonality of tributary flows, the concentration of some toxic chemicals may increase in some places. This will create negative conditions for management of toxic chemicals of concern to Great Lakes waters under the GLWQA and GLRI.</p> <p>These changes will complicate goal-setting, design and implementation phases of habitat/species restoration under GLRI and to fulfill GLWQA commitments, including projects associated with the AOCs.</p>	Regionwide
GLNPO	<p>Changes in temperature</p> <p>Increased water temperatures</p> <p>Increasing heavy precipitation events</p> <p>Decreasing precipitation days and increasing drought</p>	<p>Very likely³</p> <p>Very likely⁹</p> <p>Likely³</p> <p>Likely⁷</p>	GLRI, Other non- EPA programs including Great lakes Compact & IJC Water Regulation Authorities	<p>If GL water levels decrease significantly, costs to pollution abatement, habitat restoration and the economy could be significant.</p> <p>If GL levels increase, current GLRI remediation projects and activities (including those at AOCs) may be in jeopardy.</p>	High	Further modeling and monitoring of lake levels is needed, which will require the investment of GLNPO's federal, state and academic partners.	Throughout Great Lakes Basin
GLNPO	Increased water temperatures	Very likely ⁹	GLWQA	<p>Increased potential for aquatic invasives to enter the Great Lakes.</p> <p>Some invasives already present in Great Lakes can be</p>	High	The new GLWQA commits US and Canada to undertake an assessment of climate change impacts on AIS. EPA's contributions to AIS monitoring, prevention, control, and eradication programs may be affected, requiring shifts in priorities or added costs.	Regionwide

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				<p>triggered to become more invasive or increase their range.</p> <p>Some species may become less invasive in some places with new conditions.</p> <p>Longer shipping season increases the risk that a greater amount of ballast delivered might include a greater number of species not yet established in the Great Lakes.</p> <p>More flooding, due to greater numbers of severe precipitation events, means that species established (from pathways such as pet, water garden, bait, recreation, etc.) in isolated inland lakes and rivers near the Great Lakes will be more likely to be transported within watersheds and into the Great Lakes.</p>			
GLNPO	Increasing heavy precipitation events	Likely ³	Cleaning up Contaminated Sites and Waste Management	Increased risk of contaminate release from EPA Sites. May need to alter selected remedies to ensure protection.	Medium	<p>Increased volatility of weather and loss of predictability will complicate planning and implementation of AOC remediation projects.</p> <p>The GL Basin is vulnerable to resuspension</p>	Regionwide

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Office	Climate Change Impact ^a	Likelihood of Impact ^b	Focus of Associated EPA Program	Example of Risks if Program were Impacted	Likelihood EPA Program will be affected by Impact ^c	Regional Importance of Vulnerabilities	Variation in importance across the Region
				Erosion and flooding could increase the potential for chemical and hazardous substances contamination from Superfund and other sites within Great Lakes AOCs.		and volatilization of toxic chemicals from sediments due to the increased storm intensity. May render some remedies less effective in AOCs, may require changes in design.	
GLNPO	Increasing heavy precipitation events	Likely ³	Emergency Response	Increased need for emergency response. Possible limitations to response capability due to staff and financial resource constraints.	High	Increased storm intensity will increase the risk of toxic spills to the Great Lakes from shipping. ER must be coordinated with Coast Guard and the Canadians.	Regionwide
GLNPO	Increasing risk of floods Increasing intensity of hurricanes Increasing extreme temperatures	Likely ⁷ Likely ³ Very likely ³	Operations of Agency facilities, personnel safety, physical security, and emergency communications Emergency management mission support (protective gear and acquisition)	Facilities in coastal or flood-prone areas Personnel engaged in field work and vulnerable to extreme temperatures or events Security, lighting and communication systems without backup power Personnel and real property supporting emergency response and management	Medium	Increased storm intensity will increase the risk to EPA vessels and crews on the Great Lakes.	Regionwide
Homeland Security	Increasing risk of floods Decreasing	Likely ⁷ Likely ⁷	COOP Occupant Emergency Plan Activation of Homeland Security Frameworks	Increased occurrence and intensity of natural disasters increase the risks to Region 5 personnel and facilities	Medium	Impact to EPA Personnel and facilities; response to Natural Disasters; Emergency Communications; Activation of FEMA Support Functions	Regionwide

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	precipitation days and increasing drought intensity Increasing intensity of hurricanes	Likely ³					
IEO	Increasing heavy precipitation events Increasing risk of floods Changes in temperature	Likely ³ Likely ⁷ Very likely ³	General Assistance Program (GAP) capacity building program	Flooding, heat waves, droughts, etc. can interrupt essential services such as drinking water systems and wastewater treatment facilities. Subsistence resources may also be affected.	Medium	Increased requests for assistance from tribes that are experiencing climate-related hazards and impacts. Tribes will likely contact IEO to request assistance from EPA. IEO and the media Divisions will need to identify the types of assistance (technical, financial, personnel, etc.) that may be available from the Agency and if there are other federal agencies that should coordinate activities. May need to adjust how the Indian Environmental General Assistance Program (GAP) can be used by the tribes to plan for or respond to climate change impacts.	Tribal impacts would mostly be limited to MI, WI and MN
LCD	Increasing heavy precipitation events Increasing risk of floods Changes in temperature	Likely ³ Likely ⁷ Very likely ³	Cleaning up Contaminated Sites and Waste Management	Increased risk of contaminant release from EPA Sites. GW and subsurface contamination could be impacted by drought and flood conditions. Contaminants increase risk of migration from floods.	Low	May need to consider altering selected remedies to ensure protection; altering (hazardous/nonhazardous) landfill criteria and BMPs to ensure protection; conduct more frequent targeted inspections at hazardous waste disposal facilities; increase oversight of authorized states and/or provide increased technical assistance. Climate changes may trigger the following impacts at Corrective Action sites and the selected remedies will reflect these	Little variation in impact across Midwest; potentially increased risk in Great Lakes Basin and Ohio River Valley

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						<p>considerations:</p> <p>Increased flood and drought conditions will impact mobilization of contaminants at sites and may alter the time, cost, and effectiveness of cleanups.</p> <p>Vegetation considerations: Whatever plants are used may not be tolerant to heat or excessive water. May need to change plant species or do additional maintenance.</p> <p>Drier conditions might cause severe erosion issues on terrain and constructed landfills. Might have 500 year flood events. Drier conditions combined with larger rain events might contribute to additional erosion concerns.</p> <p>Could have water table fluctuations - wells might need to be screened in different zones. Contaminant plumes might change direction. Remedies might become ineffective due to fluctuating water tables which could increase smear zones and additional remedy options may need to be considered.</p> <p>Frequent Flooding – may need to design corrective action to ensure it is protective given possible increased flooding. High flood event might wash away constructed remedies and increase contamination to the environment. Standing water could bring contaminants to the surface and increase</p>	

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						<p>exposure potential.</p> <p>Colder weather and erratic weather - could change construction season. Investigations and remedies may take longer to construct.</p> <p>Ethanol shortage due to corn shortage-change policy of using ethanol; look for other options.</p> <p>Increased sedimentation and scouring due to larger rain events could impact sediment sites.</p>	
LCD	<p>Increasing intensity of hurricanes</p> <p>Increasing heavy precipitation events</p> <p>Increasing risk of floods</p> <p>Increasing extreme temperatures</p>	<p>Likely³</p> <p>Likely³</p> <p>Likely⁷</p> <p>Very likely³</p>	<p>Emergency Response</p> <p>Emergency Response Support</p> <p>Remedial Response</p> <p>Clean-Up & Corrective Action</p>	<p>Increased PBT chemical impacts to surface water</p>	<p>Low</p>	<p>Programs will need to consider updates to operating facility SPCC, contingency and other risk management and P2 plans for listed wastes, solid wastes and PBTs/Chemicals of Concern.</p> <p>Consideration/evaluation of appropriate work times for remedial/removal activities, and impacts to clean-up timelines.</p> <p>Consideration of facility and siting issues, as permitting occurs.</p>	<p>Regionwide, particularly for permitting and planning activities, where facilities may not have previously required an awareness for water releases, or risk management for water/flooding.</p>
LCD	<p>Increasing intensity of hurricanes</p> <p>Increasing heavy precipitation events</p> <p>Increasing risk of</p>	<p>Likely³</p> <p>Likely³</p> <p>Likely⁷</p>	<p>Emergency Response (debris management and recovery related to disaster response to storm events, flooding, etc.)</p> <p>Emergency Response Support</p>	<p>Increased need for emergency response and debris/waste management due to storms resulting in large-scale releases of chemicals and/or air emissions (e.g., asbestos,</p>	<p>High</p>	<p>Possible limitations to response capability due to staff and financial resource constraints.</p> <p>Possible increased need for emergency disposal permits.</p>	<p>Regionwide</p>

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	floods Increasing extreme temperatures	Very likely ³		PCBs, Hg, PBTs, SO ₂) from flooded/damaged and/or demolished buildings.			
LCD	Increasing extreme temperatures Increasing heavy precipitation events Increasing flood risk	Very likely ³ Likely ³ Likely ⁷	Protecting human health and ecosystems from chemical risks. EPCRA (TRI): o Maintaining inventory of chemical releases o Maintaining lists of facilities releasing chemicals TSCA: o Maintaining chemical database (inventories, dossiers and information) on chemicals within U.S. commerce (currently and previously, including allowances and prohibitions) o Maintaining lists of major chemical manufacturers, processors and formulators (MPFs) FIFRA: o Maintain Registration Review schedules/information o Maintaining establishment (facility) information	Increased need for emergency response and debris/waste management due to storms resulting in large-scale releases of chemicals from flooded/damaged and/or demolished buildings. Any regional risk assessments could be affected as weather and climate events could affect RCRA/TSCA and Superfund interpretations of risk at the facility level .	High	Risk Assessment Framework may need adjustments in order to: Assure that chemical exposure models reflect changes in the environment; Perform climate change assessments on chemicals/substances with a climate change impact; Address risk-shifting and new risk considerations where chemicals impact--or are impacted by--climate change (e.g., changes in chemical applications or uses). Will need to keep other media offices aware of chemical use trends that affect their programs. Facility awareness of these emerging chemical and risk issues and addressing them within their Operation and Emergency Management plans, as needed, but particularly where risk shifting or new risk considerations occur.	More relevant near sites with large densities of chemical Manufacturers, Processors and Formulators (MPFs), and RCRA and Superfund sites. Extremely relevant, particularly for permitting and planning activities, where facilities may not have previously required an awareness for water releases, or risk management for water/flooding.

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RMD	<p>Increased water temperatures</p> <p>Decreasing precipitation days and increasing drought intensity</p>	<p>Very likely⁹</p> <p>Likely⁷</p>	Water usage at EPA facilities	<p>Water temperatures impact research activities or cooling requirements.</p> <p>Facilities could be located in areas with water shortages</p>	Low	Use of water in facilities is of medium importance since GSA owns the majority of EPA buildings in the region. R5 has COOP and extensive flexiplace availability.	All field offices except the Lake Guardian
RMD	<p>Increasing risk of floods</p> <p>Increasing intensity of hurricanes</p> <p>Increasing extreme temperatures</p>	<p>Likely⁷</p> <p>Likely³</p> <p>Very likely³</p>	<p>Operations of Agency facilities, personnel safety, physical security, and emergency communications</p> <p>Emergency management mission support (protective gear and acquisition)</p>	<p>Facilities in flood-prone areas</p> <p>Personnel engaged in field work and vulnerable to extreme temperatures or events</p> <p>Security, lighting and communication systems without backup power</p> <p>Personnel and real property supporting emergency response and management</p>	Medium	<p>R5 office is located in an area with low probability for flooding, tornadoes, and earthquakes. There is a greater probability for blizzards.</p> <p>Severe Lake Weather is of high regional importance (affects GLNPO operations on Lake Guardian)</p> <p>R5 has COOP and extensive flexiplace availability. In addition, the Region has MOAs with R3 and R4 to assist in emergencies.</p>	Lake Guardian is a vessel that is affected by changes in the Great Lakes weather
SFD	<p>Increasing heavy precipitation events</p> <p>Increasing risk of floods</p> <p>Changes in temperature</p>	<p>Likely³</p> <p>Likely⁷</p> <p>Very likely³</p>	Cleaning up Contaminated Sites and Waste Management	<p>Increased risk of contaminant release from EPA Sites</p> <p>May need to alter selected remedies to ensure protection.</p>	Medium	<p>Increased flood and drought conditions will impact mobilization of contaminants at sites and may alter the time, cost, and effectiveness of cleanups.</p> <p>Vegetation considerations: Whatever plants are used may not be tolerant to heat or excessive water. May need to change plant species or do additional maintenance.</p>	Regionwide

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						<p>Drier conditions might cause severe erosion issues on terrain and constructed landfills. Might have 500 year flood events. Drier conditions combined with larger rain events might contribute to additional erosion concerns.</p> <p>Could have water table fluctuations - wells might need to be screened in different zones. Contaminant plumes might change direction. Remedies might become ineffective due to fluctuating water tables which could increase smear zones and additional remedy options may need to be considered.</p> <p>Frequent Flooding – may need to design corrective action to ensure it is protective given possible increased flooding. High flood event might wash away constructed remedies and increase contamination to the environment. Standing water could bring contaminants to the surface and increase exposure potential.</p> <p>Colder weather and erratic weather - could change construction season. Investigations and remedies may take longer to construct.</p> <p>Ethanol shortage due to corn shortage- change policy of using ethanol; look for other options.</p> <p>Increased sedimentation and scouring due to larger rain events could impact sediment</p>	

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						sites.	
SFD	<p>Increasing heavy precipitation events</p> <p>Increasing flood risk</p>	<p>Likely³</p> <p>Likely⁷</p>	Emergency Response	<p>Increased need for emergency response.</p> <p>Possible limitations to response capability due to staff and financial resource constraints.</p>	High	<p>Due to population densities along rivers in the Midwest, increased precipitation will lead to increased riverine flooding and to additional hazardous waste and domestic white goods (refrigerators, stoves) removal and cleanup as a result.</p> <p>Additionally, the frequency of events may stress availability of emergency response teams to react quickly.</p> <p>Hotter during days, and longer “summers” – health and safety considerations for the workers; Might need to take mid-day breaks and need more breaks - could change construction season; could take longer to conduct investigations and construct remedy; need to consider health and safety of workers.</p> <p>More severe weather- could take longer to conduct investigations and construct remedy; need to consider health and safety of workers</p> <p>May have a great proliferation of pests if we have no freeze and thaw to control them. This could then require additional safety concerns for workers.</p>	Hurricanes are not much of a risk in R5, but there may be an increased risk of extreme weather especially in the southern part of the Region (Illinois, Indiana, Ohio).
SFD	Increasing extreme temperatures	Very likely ³	Protecting human health and ecosystems from chemical risks	Changing in planting timing or location may affect the volume and timing of	Low	Assure that chemical exposure models reflect changes in the environment	Unknown (Chemical Preparedness & Prevention)

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	Increasing heavy precipitation events	Likely ³		agricultural chemical use which could impact the appropriate risk management decisions.			
WD	Increasing heavy precipitation events	Likely ³	Restoring and protecting watersheds, aquatic ecosystems and wetlands	Increased number of sewer overflows and wastewater bypasses, as well increased pollutant loads in runoff, fouling streams and threatening public health.	High	Increased demand for re-evaluation of controls and effluent limitations in NPDES permits; re-evaluation of development of WQBELs and TBELs to account for the pollutant loads. There could be increased requests for variances from water quality standards. Pretreatment programs may need to be assessed for local limit revisions and other controls on industries to ensure protection of a wastewater treatment plant and the receiving water body.	Regionwide
WD	Increasing heavy precipitation events	Likely ³	Restoring and protecting watersheds, aquatic ecosystems and wetlands	Increased number of sewer overflows and wastewater bypasses, as well increased pollutant loads in runoff, fouling streams and threatening public health.	High	Increased need for wet weather inspections (CSO/SSO communities, stormwater discharges), to assess compliance and confirm appropriate level of control; may lead to increased enforcement action, requests for revisions to consent decrees.	Majority of CSO communities are in IL, IN, OH, however SSO communities are spread across region.
WD	Decreasing precipitation days and increasing drought intensity	Likely ⁷	Restoring and protecting watersheds, aquatic ecosystems and wetlands	Reduced streamflow during summer months, altering the aquatic environments and increasing impairments.	Medium	Changes in watershed hydrology due to climate change will need to be reflected in changes to watershed assessment methodologies and models as well as TMDL development processes in order to predict the effects of pollutant loadings on water quality. These methodologies and models, which are critical in state and EPA development of TMDLs, will need to be revised to ensure TMDLs continue to be effective in attaining water quality standards.	Regionwide

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WD	Increasing heavy precipitation events	Likely ³	Restoring and protecting watersheds, aquatic ecosystems and wetlands	Challenges to coastal wetlands' ability to migrate.	High	Watershed planning and permitting would be impacted should waterbody boundaries move or are displaced.	Regionwide
WD	<p>Increasing heavy precipitation events</p> <p>Decreasing precipitation days and increasing drought intensity</p> <p>Increased water temperatures</p>	<p>Likely³</p> <p>Likely⁷</p> <p>Very likely⁹</p>	Restoring and protecting watersheds, aquatic ecosystems and wetlands	Changes in hydrology may alter aquatic habitat, ability of water bodies to support historic aquatic life communities may be compromised, prompting requests for use designation changes, revised water quality standards. CWA programs, such as assessments, 303(d) lists, TMDLs may not provide adequate protections without revisions. Current practices to control nonpoint sources and nutrient pollution may be less effective. Economic and cultural practices of tribal communities may be adversely affected.	Medium	<p>Watershed planning efforts will need to be modified to include projections related to climate change. The 319 program may not have adequate funds and the needed technical expertise to support states/tribes/local units of government in their efforts to continue to meet/maintain water quality standards. The research and models used to inform nonpoint source controls measures may need to be updated to reflect new runoff situations and effectiveness of practices at reducing pollution, particularly nutrient pollution from agricultural sources.</p> <p>Biennial listing process for TMDLs likely to be more challenging as hydrology changes. Hydrology strongly affects pollutant loadings, so changes in hydrology will affect the model and TMDL assumptions used to determine pollutant loading capacities. Impact on staff - more time on evaluating listings, more sophisticated training on models used in the program , more frequent reviews of TMDLs to determine if loadings are still sufficient to attain water quality standards. Impact to states/tribes: more time to evaluate the specific hydrodynamics of assessed waterbodies, possible changes in use designations, more frequent reviews of TMDLs to determine if loadings are still</p>	Regionwide; tribal impacts limited to MI, WI and MN

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						<p>sufficient to attain water quality standards</p> <p>For tribes, wild rice, occurring in both lakes and streams, conditions may be impacted by climate change, new methods of protecting that crop will be necessary.</p>	
WD	<p>Increasing heavy precipitation events</p> <p>Increasing risk of floods</p>	<p>Likely³</p> <p>Likely⁷</p>	<p>Drinking water, wastewater and stormwater infrastructure</p>	<p>Water and wastewater infrastructure could be overwhelmed or damaged, potentially resulting in noncompliance and causing human health and aquatic life risks.</p> <p>Existing emergency contingency plans may be insufficient for affected water and wastewater utilities.</p> <p>Problems of safety as well as access to clean and safe water may be exacerbated for vulnerable and economically deprived communities.</p>	High	<p>Particularly likely to affect direct implementation (DI) tribal program (provides oversight of and technical assistance to tribal public water systems), for example: tribes may need more assistance related to infrastructure impacts associated with climate change, putting demands on the region to be aware of changes occurring at the system level and educate systems about how best to adapt, (e.g., implement an "all hazards" approach to emergency planning); the DI program could be called on to prioritize an increasing number of projects for contractors and Indian Health Service (IHS) public health officials; we may see demands to assist in emergency response efforts.</p> <p>State and tribal technical assistance (promote awareness and information exchange)—the region may face increased demands to assist states and tribes with information sharing on available downscaled models and tools (climate ready water utilities (CRWU) and climate resilience evaluation and awareness tool (CREAT)), as well as lessons learned associated with climate change adaptation at</p>	<p>DI—significant (as of 10/4/12, there are 101 tribal water systems in Region 5)</p>

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						<p>states, tribes, and systems.</p> <p>State and tribal grant management and oversight may become more complicated.</p>	
WD	<p>Increased water temperatures</p> <p>Increasing heavy precipitation events</p> <p>Decreasing precipitation days and increasing drought intensity</p>	<p>Very likely⁹</p> <p>Likely³</p> <p>Likely⁷</p>	The quality and availability of safe drinking water	<p>High water temperatures and increased stormwater runoff may increase the need for drinking water treatment, raising costs, or compromise quality of drinking water.</p> <p>Water supplies may be affected, forcing communities to seek alternative sources.</p> <p>Water demand may shift to underground aquifers or prompt development of reservoirs or underground storage of treated water, requiring EPA to ensure safety.</p>	Medium	<p>DI tribal program—water quality changes may result in more Safe Drinking Water Act (SDWA) violations, which would increase the work of the regional compliance officers; State and tribal voluntary programs—the region could see demands to increase technical assistance, outreach, and education to further implementation of state and tribal:</p> <p>(1) source water protection programs, including encouraging systems to track water quality/quantity trends (particularly static water levels) and (2) WaterSense/water conservation/green infrastructure/water recycling and reuse programs.</p>	Regionwide; tribal impacts limited to MI, WI and MN
WD	Increased water temperatures	Very likely ⁹	Restoring and protecting watersheds, aquatic ecosystems and wetlands	Pollutant limitations in NPDES wastewater permits may no longer be protective of water quality standards.	Medium	Water quality standards and/or effluent limitations may be revised to continue to be protective of the water body. As water temperatures increase thermal loads in permits would need to be evaluated possibly restricting thermal limitations to lower levels in permits to continue to be protective of the aquatic life in the water body. Inability of permittees to meet revised limits may prompt	Regionwide

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Office	Climate Change Impact ^a	Likelihood of Impact ^b	Focus of Associated EPA Program	Example of Risks if Program were Impacted	Likelihood EPA Program will be affected by Impact ^c	Regional Importance of Vulnerabilities	Variation in importance across the Region
						permit challenges or lead to noncompliance, increasing administrative or enforcement workloads, respectively.	
WD	Increased water temperatures	Very likely ⁹	Restoring and protecting watersheds, aquatic ecosystems and wetlands	Ability of water bodies to support historic aquatic life communities may be compromised, prompting requests for use designation changes, revised water quality standards.	Medium	Requests for more WQS revisions/reviews, including revised uses, criteria, variances; more pressure from states, industry for flexibility, less stringent WQS; more stresses on listed species will mean more ESA BE work in conjunction with WQS changes; staff will spend more time working with states to develop climate change monitoring strategies.	Variable for two reasons: 1) climate maps appear to show some inter-regional variability in degree of change; and 2) cold water systems will be substantially affected, warm water systems less so.
WD	Increasing intensity of hurricanes Increasing heavy precipitation events	Likely ³ Likely ³	Drinking water, wastewater and stormwater infrastructure	Damage from intense storms may increase the demand for public infrastructure funding and may require re-prioritizing of infrastructure projects.	High	Increased demands on the clean water and drinking water State Revolving Fund. Investments in water infrastructure may be needed to manage both decreases in rainfall (e.g. reservoirs) and increased in rainfall (e.g. increases in pipe and storm water management facilities), straining water financing generally including the State Revolving Funds.	Regionwide
WD	Decreasing precipitation days and increasing drought intensity Increasing heavy precipitation events	Likely ⁷ Likely ³	The quality and availability of safe drinking water Restoring and protecting watersheds, aquatic ecosystems and wetlands	Increased number of applications, increased evaluation of more complex applications, and more assistance to primacy states	Medium	Increased use of lower quality aquifers could mean more drinking water treatment residuals that are sometimes disposed of down injection wells. Increased use of aquifer recharge wells. Some of these may be injecting water from waste water treatment plants.	Regionwide

Appendix A: Region 5 Vulnerability Assessment Table

Office	Climate Change Impact ^a	Likelihood of Impact ^b	Focus of Associated EPA Program	Example of Risks if Program were Impacted	Likelihood EPA Program will be affected by Impact ^c	Regional Importance of Vulnerabilities	Variation in importance across the Region
	Increased water temperatures	Very likely ⁹				<p>Increased use of aquifer storage and recovery wells to extend drinking water infrastructure.</p> <p>Competition for water use between agricultural, municipal/residential and energy uses. This may result in how the Agency evaluates aquifer exemptions. In some cases, aquifers could be so polluted that cleaning them up may be too expensive and they might then be granted exemption from protection under SDWA. However, if the cost of water sources rises due to droughts and dwindling resources, then the comparative cost of cleaning them up might be cheaper than exempting them.</p> <p>Increased number of storm water drainage and agricultural drainage wells</p> <p>Increased use of non-hazardous and hazardous injection wells to dispose of increased fluids that exceed the capacity of their systems (e.g., landfill leachate).</p> <p>Increased use of warm water for cooling (e.g., power plants) may result in more brackish water that will need to be disposed of instead of discharged via NPDES</p>	

^a Climate Change impacts are based upon peer-reviewed scientific literature.

^b In general, the sources cited in this section use Intergovernmental Panel on Climate Change (IPCC) likelihood of outcome terminology where the term ‘very likely’ means 90-100% probability and the term ‘likely’ means 66-100% probability. For some impacts in the table, additional discussion on the likelihood term is provided in the associated footnote.

^c High assumes the program will be affected by the impact; Medium assumes the program could be affected under some conditions by the impact; Low assumes that there is a potential for the program to be impacted or uncertainty currently exists as to the potential nature and extent of the impact. This assessment is based on best professional judgment within EPA at this time. Please note, this column does not reflect several important

Appendix A: Region 5 Vulnerability Assessment Table

considerations. For example it does not distinguish timeframes (current, near-term, long-term). It does not account for regional and local variations. And it does not reflect the priority of actions the agency may undertake now or in the future.

¹ Denman, K.L., et al. (2007). Couplings Between Changes in the Climate System and Biogeochemistry. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

² C.B. Field et al., “North America,” Chapter 14 in *Climate Change 2007: Impacts, Adaptation and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press, 2007).

³ IPCC, 2012: Summary for Policymakers. In: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 1-19.

⁴ World Meteorological Organization, *Scientific Assessment of Ozone Depletion: 2010, Global Ozone Research and Monitoring Project—Report No. 52* (Geneva, Switzerland, 2011). Note: the word “expected” is used in the report to characterize projected climate change impacts on the stratospheric ozone layer. For purposes of this table the word “likely” has been used as a proxy for “expected.”

⁵ Burns, D.A., Lynch, J.A., Cosby, B.J., Fenn, M.E., Baron, J.S., US EPA Clean Air Markets Div., 2011, *National Acid Precipitation Assessment Program Report to Congress 2011: An Integrated Assessment*, National Science and Technology Council, Washington, DC, p. 114.

⁶ IPCC, 2012: “It is very likely that mean sea level rise will contribute to upward trends in extreme coastal high water levels in the future.”

⁷ USGCRP, 2009: *Global Climate Change Impacts in the United States*. Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.

⁸ NRC, 2010: *National Research Council of the National Academies, America’s Climate Choices: Panel on Advancing the Science of Climate Change*, 2010. p 41. “One of the most certain outcomes from increasing CO₂ concentrations in the atmosphere is the acidification of the world’s oceans.” For purposes of this table, the term “certain” is used.

⁹ USGCRP, 2009: p. 46. [In the case of freshwater] “Increased air temperatures lead to higher water temperatures, which have already been detected in many streams, especially during low-flow periods.” For the purposes of this table “very likely” is used.

¹⁰ Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 2008: *Climate Change and Water*. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, p. 130