CITY DESCRIPTION

King County, and its largest city Seattle, Washington, along with its Emergency Preparedness Bureau, have been deemed major contributors to the discourse on climate change impacts and cities.

King County Executive Ron Sims stated before the Committee on Environment and Public Works of the United States Senate in support of the Climate Security Act of 2007:

My region is growing extremely fast, both in our economy and our population. And our global warming problem also is fast-growing. I know that I will not be in the Puget Sound region in 2050, but 2.5 million people will live there. And I think about how my decisions as an elected official today will shape what our region looks like then, and whether those people – including my children and grandchildren - will enjoy well being and prosperity….

2050 is the target year King County is using to develop its mitigation and adaptation plans based on the working relationship developed with the Climate Impacts Group (CIG), a part of the Center for Science in the Earth System at the University of Washington’s Joint Institute for the Study of the Atmosphere and Ocean. As a leader and active practitioner, Mr. Sims and his staff understand that action now on climate change impacts is really establishing and exercising good local government resource management practices to create and sustain resilient communities.

King County is implementing “no regrets” policies to deal with potential climate change impacts. The no-regrets policies are those that would make good sense to implement whether or not 2050 turns out to be as predicted. The strategies, plans, and activities are just good urban management.

The King County vision for its engagement in reducing global warming includes positive outcomes for not only the climate and Planet Earth but goals closer to home like positive environmental and social outcomes such as healthier air to breathe. Alternative fuels means less respiratory disease. More physical activity is incentive for pedestrian-scale development and active transportation infrastructure, such as bike paths. Greater economic stability for agriculture serves improved health with locally based...
food systems and sources. New market development results in new jobs using clean energy. And water conservation relieves pressure on the current water supply.\footnote{1}

**A. Population**

King County has a population of 1.835 million people and Seattle has 578,700 (2006 data). Ranked the 14th most populous U.S. county, King County’s population has grown by 22 percent since 1990 which reverses the downward trend of the 1990s when Seattle’s population declined to 516,259. King County is expected to grow by 12 percent (214,000 persons) to 2.049 million in 2022. Projected growth figures have been useful measures for planning through the State’s Growth Management Act. The King County population is 73 percent (non-Hispanic) white, 11 percent Asian or Pacific Islander, 5 percent African-American, 1 percent Native American, and 5.5 percent Latino.\footnote{2}

**B. Location**

King County is located on Puget Sound in Washington State and covers an area of 2,134 square miles. King County is twice as large as the average county in the United States. The geology of King County created its opportunities and now its vulnerabilities. Glaciers scraped the landscape thousands of years ago creating the north-south direction of its lakes and hills making east-west movement difficult and dependent upon bridges and tunnels.

Seattle is the largest urban center in King County and the major marine port of the Puget Sound Region. Its 193 miles of waterfront include 53 miles of tidal waters. Seattle is built on the strip of land between Lake Washington and Puget Sound with Elliott Bay carving out the center to form a narrow middle on which is located the central business district congested and vulnerable.\footnote{3}

**C. The Built Environment**

In 1992 the State passed the Growth Management Act as a measure to control urban sprawl. Urban sprawl increased the region’s vulnerability to climate change impacts. Seattle promoted greater density through its Towards a Sustainable Seattle with clustered urban villages that set growth targets and monitored their development. This merges with the King County “walkable” community vision. Each plan seeks to create a more concentrated urban growth pattern, making better use of limited urban development areas for housing, commerce, and industry, while at the same time protecting natural reserve areas.

The negotiated urban growth boundaries and populations are a State-level effort that has dramatically changed the settlement patterns of the cities of King County and the State of Washington. The urban growth boundary line is a mandated boundary that has been established to protect natural habitats and slow the conversion of land use in the state. It also supports new efficiencies to consolidate and make better use of existing infrastructure and creating walkable, healthier communities.

Historically, Seattle developed its communities over a complex terrain that, in times of emergency, could become isolated. Seattle developed on landfill, regrades, and cuts in the topography increasing its vulnerabilities to landslides, earthquakes, and floods. Seattle is a young city. Its development started in the 1890s and over half of its housing was built prior to the adoption of building codes and seismic standards in 1949. Hospitals are concentrated in an area called First Hill; the downtown is a concentration of government services known as the County Seat; and the West Seattle and Magnolia areas are dependent on three bridges to remain connected to the larger city. In fact, Seattle depends heavily on its bridges, as many settlements do in King County.
The geology produces a dependence on bridges. Within the city limits there are only six bridges connecting north Seattle with the rest of the city; three bridges lead into and out of West Seattle and two crossing Lake Washington. Each of these bridges is a bottleneck and in a disaster are a serious hazard. The same holds for networked infrastructure that must cross landslide prone hillsides and liquefaction zones.

D. Economic Base
The economy of King County and Seattle just recovering from severe setbacks. Following February 2001 earthquake, Boeing moved its headquarters to Chicago and with it 26,000 jobs. Boeing remains one of several major employers and jobs have returned as the economy has picked up in other sectors as well. Despite the dot-com bust during the region’s worst recession in 30 years, manufacturing industries, especially Microsoft and other computer and electronic product firms, continue to expand but remain below their 2001 levels. Educational and health services are growing as well, while retail, wholesale, information industries, and professional services continue to struggle.

The largest regional businesses (and related annual income) are:

- Boeing (US$51.32 billion)
- Cost Co (US$32.16 billion)
- Microsoft (US$23 billion)
- Weyerhouser (US$15.98 billion)
- Washington Mutual Bank (US$15.76 billion)
- Paccar (US$7.92 billion)

The King County median household income is US$53,157 (1999 data), higher than state and national medians; Seattle’s median household income is US$45,736 (2000 data).

Employment distribution by sector across King, Kitsap, Pierce and Snohomish counties include the following sectors:

- Services (30.4 percent)
- Wholesale/Retail (23.7 percent)

E. Governance Structure
The King County Executive Officer is elected to office and leads the county government. The Metropolitan King County Council is the elected legislative body of the county government. The Seattle Mayor is also an elected official.

King County provides regional services within its jurisdictions. The County responsibilities and services include public transportation and sewage disposal as well as courts and legal services, public health services, the county jail, records and elections, property tax appraisals, and the King County International Airport and other regional facilities and parks.

Following February 2001 earthquake, Boeing moved its headquarters to Chicago and with it 26,000 jobs.

Seattle has jurisdiction over emergency management for the city. The Emergency Management Section (EMS) is part of the Emergency Preparedness Bureau of the Seattle Police Department. The EMS has developed a knowledge base and mitigation and adaptation plans for the city. The principal documents that deal with mitigation of disasters and adaptation to changing conditions are the Seattle All-Hazard Mitigation Plan and the Hazard Identification and Vulnerability Analysis that reflect State Emergency Management Office policies and King County activities.

Seattle’s mitigation capacity has evolved into a program that features structural and non-structural mitigation as well as outreach and training at the community and
individual level. The Seattle Emergency Management Section maintains a website for detailed information on the programs it is carrying out. www.cityofseattle/emergency_mgt

The 2007 King County Climate Plan presents the authorities under which it operates as a starting point for effective plan development and implementation. The authorities include:

- Implementing a role in regional land use and transportation planning and growth management that encourages communities to become more walkable and offers an urban development model with homes and services in mixed-use configurations within walking distances of services encouraging people to drive less.
- The region’s largest transit fleet, several major wastewater treatment plants, and numerous buildings and facilities create opportunities to reduce operational GHG emissions, produce clean energy from waste gases, and develop a new civic ethic regarding the environment.
- Offering public transit services promoting travel options to carpool and travel on public transit with free passes for public employees to reduce GHG emissions from personal vehicle travel.
- Advocating for and shaping future federal legislation on mandatory nationwide reduction of GHG emissions.

II/ PRIORITY HAZARDS AND VULNERABILITIES

Scientists at the University of Washington predict that local temperatures will rise another 1.9 degrees by the 2020s and 2.9 degrees by 2040s. The implication for King County is that snowfall will decrease and rain will increase affecting the snow pack and spring melt. In some areas the snow pack has declined by as much as 60 percent a cause for concern for the region’s water supply. Water that would have slowly melted in later summer months will flow earlier and more rapidly into valleys and floodplains, testing levees designed for other conditions. Flooding events, such as the one in November 2007 that caused US$34 million in damages, will become more frequent. For Seattle, the priority hazards are earthquakes, landslides, and floods with earthquakes being the most destructive.

A. Climate Change Impacts

Based on the work of the scientists, climate change impacts were identified and presented in the 2007 King County Climate Change Plan and Seattle’s Hazard Identification and Vulnerability Analysis. The projections became the basis for the eventual plans. The impacts identified are as follows:

- Temperature. Average annual temperatures in the Pacific Northwest are projected to increase 2 degrees F by the 2020s and 3 degrees F by the 2040s across all seasons with the largest increases in the summer season.
- Precipitation. Increases in the amount of precipitation and changes in the type of precipitation from snow to rain and or a mixture of both are possible in the Pacific Northwest, causing potential water supply issues and drought when demand may become the highest.

Flooding events, such as the one in November 2007 that caused US$34 million in damages, will become more frequent. For Seattle, the priority hazards are earthquakes, landslides, and floods with earthquakes being the most destructive.
Extreme weather. Climate change effects on extreme weather still reflect higher levels of uncertainty that is now being investigated at this time, but potentially there could be conditions giving storms more strength leading to greater precipitation and wind storms.

Sea-level rise. Relative sea-level rise greatest in South Puget Sound, which could experience a 3.3 foot rise by 2100 and increase the rate and extent of coastal flooding, shoreline erosion, and near shore habitat loss. Sea-level rise can damage existing equipment and result in higher operating costs and greater capital investments to replace equipment and add capacity into the existing systems.

Snowpack loss and glacier melt. Snowpack and glaciers in the Pacific Northwest mountains will suffer further loss the most pronounced effect in the Cascade Mountains and the Snake River Valley. April snowpack could experience a 44 percent loss by 2040s and a 58 percent by the 2060s.

Streamflow. Higher winter and lower summer streamflows with warmer temperatures leading to increased loss of moisture from soil, vegetation, and water supply and storage.

Impacts per sectors are:

Public health and safety. The frequency, intensity, and type of natural hazards faced by the Pacific Northwest will increase, including more intense weather, flooding, landslides, drought, and forest fires. Also, hazards not historically experienced in the region will occur including extreme weather, heat, reduced snowpack, sea-level rise, shoreline erosion. The impact for these hazards will exacerbate existing threats and create new threats such as killer heat waves; respiratory ailments; pollen issues; diseases spread through animals; water-borne diseases; and adverse effects on the workforce, regional food systems, and health.

Land use, buildings, and transportation. Increased frequency of flood events; impacts on dam operations and flood control systems; urban flooding on streams; stream bank stability and erosion and silting; and flood duration will increase causing damage to infrastructure and economic loss; affect shoreline resources and infrastructure, parks, and recreational facilities; and threaten historic and cultural sites.

Water supply, management and quality. Increased frequency of drought events, decline in the region’s water supply reservoirs, and a greater demand for water in summer and fall make are made more difficult by reduced snowpack and wastewater operations. Flooding will tax existing infrastructure seasonally and cause backups and overflows leading to health problems associated with new infectious diseases and heat stroke.

Forests. Natural buffer zones and carbon sinks will be impacted negatively by insects and fire warmer temperatures.

Economic impacts. Affect the insurance industry with consequences for businesses, consumers, and industry. Agriculture may be affected by increased temperatures, precipitation, and type of crop, pests, and availability of water.6

B. Disaster History
The disaster history of King County and Seattle has shaped many of today’s vulnerabilities. Conversions of building codes after the great fire of 1889 militated for the exchange of wood for masonry construction and unreinforced construction in an unknown earthquake zone. Seattle growth patterns have created dependencies on bridge links in the transportation system that knits the city and county together and is only a reminder that the current strategy to use the best science available for planning and strategy decisions make sense.

Seattle has suffered 10 earthquakes of 4.9 magnitude and higher on the Richter scale. Seattle has also received eight Presidential Disaster Declarations between 1990 and 2002 only (seven for winter storms and one for the Nisqually earthquake).

C. Vulnerable Populations
While the number of well-to-do households (over US$100,000 annual income) increased, so did the poor households (under US$25,000). Ironically King County’s below-poverty population increased even as overall income increased. The 2000 census shows 142,500 people
or 8.4 percent of the population were below the poverty line. And this number has increased due to the recession to 9.4 percent. Seattle has a greater share of vulnerable populations than the rest of the county, and these groups are not evenly distributed across the city. Seattle’s vulnerable populations include the elderly, poor, disabled, and linguistically isolated.

Seattle’s special needs show that:

- The elderly declined (13.5 percent) from 78,402 in 1990 to 67,807 in 2000;
- Linguistically isolated increased by 39.24 percent from 21,503 in 1990 to 29,940 in 2000;
- Individuals in poverty increased by 11.37 percent from 57,526 in 1990 to 64,068 in 2000;
- Persons with disabilities in 2000 totaled 90,999; and
- Those living in group quarters (shelters) increased by 28.72 percent from 12,260 in 1990 to 15,781 in 2000.

E. Historical, Cultural and Natural Heritage
Seattle’s growth did not start until 1880. After the great fire of 1889, building codes changed to require brick construction introducing a new vulnerability to the then unrecognized risk of earthquakes. Seattle’s early development filled pockets of the broken topography with neighborhoods. Starting with Pioneer Square and the surrounding areas, older and vulnerable structures were built throughout the city. Surveys have identified an estimated 500 unreinforced masonry structures that today need retrofitting.

Historic urban areas, cultural artifacts, and natural heritage are already vulnerable assets of local governments. With the climate impacts intensifying, more heavy rains leading to floods, wind damage, and risk of fire bring concern of the risks to the cultural value and economic potential of Seattle’s heritage. Local governments are just now coming to recognize the importance of their built and cultural heritages and the need to be proactive in their care and maintenance. Actions to retrofit these vulnerable structures as well as bridges, levees, and other critical infrastructure are a priority. The definition of urban infrastructure takes on an expanded definition to include mitigation and adaptation capital investment structures.

III/ MITIGATION MEASURES
This section presents events initiated by King County and Seattle governments to address climate change impacts. The reconstructed steps start with the commitments each has made. Documenting the commitments creates a record of intent and a means of evaluating progress through benchmarks and accomplishments. The commitments, actions, and accomplishments are illustrative of what has been effective in Seattle and King County with potential in other cities.
A. Make Commitments

King County started its efforts by making clear its intent to engage in dealing with climate change impacts and making a difference. A bold goal for the region was established – climate stabilization or 80 percent reduction of GHG emissions below today’s levels by 2050. The County entered into commitments to deal with climate change and global warming that creates a record of intent and benchmarks for a roadmap to follow. The commitments include the following:

- King County is the charter partner for the Center for Clean Air Policy of the Urban Leaders Initiative on Infrastructure, Land Use, and Climate Change. The Initiative looks at projected climate change impacts in 2050 and “backcasts” to identify the necessary steps to reduce emissions and preempt vulnerabilities and to influence federal policies on infrastructure and emergency preparedness policies;
- The 2007 King County Climate Plan is the first response to the Executive orders on Global Warming Preparedness of March 2006 and King County Council Motion 12362 of October 2006, which provides an overview of how King County seeks to reduce GHG emissions and works to anticipate (mitigate) and adapt to projected climate change impacts, based on the best available science;
- A Climate Change Team was formed comprised of the Executive Office, Department of Development and Environmental services, the Department of Executive Services, the Department of Natural Resources and Parks, the Department of Public Health, and the Department of Transportation. Interestingly the Department of Emergency Management was not included in the Team because jurisdiction for emergency management falls to Seattle;
- Executive Order FES 9-3 AEP of 2001 directed departments to adopt green building practices and to form an internal Green Team responsible for developing countywide green policies;
- King County is a founding member of the Seattle Climate Partnership set up to implement the recommendations of Seattle’s Green Ribbon Commission;20 and

A bold goal for the region was established—climate stabilization or 80 percent reduction of GHG emissions below today’s levels by 2050.

- Seattle guides its citizens through example and direction with its Building Codes based on the Uniform Building Code set out by the International Conference of Building Officials.

B. Promote Learning

King County has made a serious effort to understand climate change impacts and hazard management issues that could potentially affect its well being. To that end, King County has entered into working agreements and arrangements with technical support groups that support it in developing its understanding of the potential impacts that may affect the county and translate those into actionable programs to mitigate and adapt to them.

Learning and a climate change knowledge base is a key to knowing how to proceed and to setting priorities for action. To that end working relationships have been established with the Climate Change Group of the University of Washington to be able to explain to its citizens and policy makers what climate is and what it means to the communities safety and development.

The Climate Change Conference organized by King County in October 2005, offered opportunity to learn about projected climate change impacts. The learning event covered the following topics:

- **Hydropower.** Changes in the annual pattern of electricity demand and changes in the annual pattern of electricity production. The Conference recommended strategies to (a) adjust reservoir operations for a changing climate; (b) conserve electricity to reduce overall demand; (c) use market
forces to reduce electricity demand during critical periods; (d) increase capacity, diversity, and interconnectivity of hydropower generation; and (e) shift electricity production toward renewables, nuclear, or thermal generation;

- **Municipal/industrial water supply.** Changes in the annual patterns of stream flow will affect water supply and make more difficult the supply of summertime demand as the stream flows alter their patterns;

- **Storm water and floods.** Changes to a warmer climate where precipitation falls as rain instead of snow and the increased loss of snowpack could increase winter flooding in transient river basins.

- **Forestry.** Changes in tree species that may migrate or have trouble adapting as well as an increased threat of fire and insect outbreaks;

- **Natural environment, especially fish and shell fish.** Changes in annual patterns of stream flow as detrimental to salmon rearing, migration, and spawning; increased water temperatures exceeding tolerable limits for coldwater fish populations, and future changes in coastal and marine habitat. Increased water stratification could decrease nutrient availability; and

- **Coasts.** Changes in sea level would increase coastal flooding and erosion, especially flat beaches and in areas of tectonic subsidence. Increased winter precipitation could increase the risk of landslides and coastal flooding. Changes in ocean circulation, which are important for coastal ecosystems, are uncertain.

King County decision-makers and planners receive regular climate updates. This puts King County in an excellent position to invest in capital projects that will make the region more resilient. Capital Projects include the Bright water reclaimed water project to address water shortages and improvements to roads, bridges, and seawalls to deal with sea-level rise and flooding.

Seattle bases its mitigation programs on studies that detail conditions and vulnerabilities in structural and non-structural activities. Seattle has prepared emergency management studies, especially seismic evaluations. The mitigation unit manages state and FEMA funds for mitigation projects and works with other city departments to learn about and integrate mitigation into post-disaster recovery initiatives. A program that has created awareness is the Seattle Project Impact, a proactive effort to make communities more resilient. Seattle Project Impact works with city stakeholders to take action before a disaster occurs for safer homes, schools, and businesses, and better mapping of earthquake and landslide hazards. Seattle also actively engages with the community through the Seattle Disaster Aid and Response Teams (SDART), a highly successful initiative to accomplish the goal of preparing people to be self-sufficient for three days following a serious disaster when assistance may not be available.

**C. Set Priorities**

King County has set priorities based on its learning and established goals for each of the priority impacts it will confront. From the King County Climate Plan and the information brochure on “Global Warming and King County” a summary of the priority areas and their goals follows:

- **Transportation choices.** King County’s biggest source of GHG emissions is the transportation sector.

Goals:

1. Achieve climate stabilization target in government operations by reducing GHG emissions 80 percent below current levels by 2050;
2. Reduce fossil fuel consumption, global warming emissions, and foreign energy dependence.
3. Encourage growth in the domestic clean-fuel industry; and
4. Strengthen infrastructure against the likely impacts of climate change.

**Buildings and land use**

Goals:
1. Protect the historic built environment, agricultural land, forestry, and open spaces as ecological buffers against global warming impacts. Seattle is actively working to protect historic urban areas through its Historic Preservation Program. The Program is responsible for the designation and protection of more than 230 historic structures sites, objects, and vessels as well as seven historic districts throughout Seattle; and
2. Ensure efficient land use and development by densifying designated urban growth areas to make communities more “walkable” and healthier, and ultimately encourage people to drive less.

**Environmental management**

Goals:
1. Protect health, safety, and landscape from global warming impacts and related natural resource supply emergencies and threats; and
2. Capture methane emissions from landfills and sequester carbon dioxide emissions in forests.

**Renewable energy**

Goals:
1. 50 percent of non-transit energy use form renewable resources by 2012;  
2. 50 percent of transit fuel by renewable resources by 2020;  
3. Be a market catalyst for increased use and availability of renewable energy resources; and  
4. Cut pollution, reduce dependence on foreign oil.

**D. Emergency Management and Disaster Risk Management**

The Seattle process established a vision statement, goals, and objectives through its Hazard Mitigation Work Group. Emergency management is the jurisdiction of Seattle and to that effect it has worked to inform itself and its citizens of what to expect and how to deal with emergency situations. The community is an active participant in the response strategies of the city as with the county.

The Department of Finance allocates existing and funds-applied-for through the Capital Improvement Program, a six-year program that is updated annually to rehabilitate, restore, improve, and add to the city’s capital facilities. The Capital Improvement Program is approved by the mayor and submitted to the City Council for adoption along with the proposed annual budget so that there is certainty in being able to implement the program’s activities. The Capital Improvement Program is consistent with the city’s Comprehensive Plan and presents information required by the State’s Growth Management Act.

Priorities of the Capital Improvement Program are:

- Rehabilitation or restoration of existing facilities to avoid deferred costs of maintenance and to meet regulatory requirements;
- Improvements of existing facilities to meet growing demand and to improve efficiency; and
- Development of new facilities.

**E. Taking Action**

The King County “no-regrets” policies are being applied to the vulnerable built environment, as well as other sectors that represent non-structural vulnerabilities such as health. No-regrets policies are also applied to promoting the use of reclaimed water as a drought-proof source of summer irrigation water. Another example was the shoring up the 199 miles of levees in King County, many dating from the 1930s and 1940s along the Green and Cedar Rivers. The Army Corps of Engineers shored up the levees in the ’60s. There has been more than US$7 billion in continued development in the floodplains. The
County Council increased property taxes by 10 cents per US$1,000 of assessed value to raise money for levee repairs and other flood-control projects.

For historic urban areas, and the cultural and natural heritage sites under threat recommended actions include mapping the most valuable places and the potential threats from climate change. Other actions include building relationships between the regional scientific community and local decisions-makers; raising awareness about sites in danger; seeking solutions to reduce global warming emissions in the context of conservation of the areas heritage assets, including as applicable green building principals; and retrofitting structures to resist earthquakes and wind damage toxicity of the air to control surface deterioration of historic buildings.

King County defines itself not in 2007 terms or 2009 terms but in 2050 terms.

IV/ OUTCOME/IMPACTS

King County defines itself not in 2007 terms or 2009 terms but in 2050 terms. King County leadership takes the position that local governments and their communities will be required to deal with the increasingly extreme conditions, floods shortages, and health concerns as well as guide responsibly the future growth for resilient cities. King County and Seattle look at accomplishments when planning for the future and setting objectives for building a more resilient county and city:

1. Transportation Choices
   - Building a green fleet of hybrid buses and cars;
   - Leading a regional consortium to purchase heavy-duty trucks;
   - Using 20 percent biodiesel, along with other clean fuels, to run Metro and other diesel-powered county vehicles;
   - Developing intelligent transportation systems that support climate-friendly community planning and transportation choices;
   - Expanding regional parks and trails systems; and
   - First mass transit system in the United States to join Chicago Climate Exchange, a voluntary market committed to reducing global warming emissions.

2. Buildings and Land Use
   - Protected 125,000 acres of open space, including 100,000 in the last 8 years, and slowed suburban sprawl;
   - Expanded and linked regional trail systems; and
   - Ordinances providing increased protection of sensitive shorelines, wetlands, lakes, and natural vegetation.

3. Environmental Management
   - Increased protection of shoreline, wetlands, lakes and natural vegetation;
   - Completed salmon recovery plans;
   - Nation’s leading flood hazard management plan; and
   - Safely using reclaim-med water.

4. Renewable Energy
   - Enacted major energy and resource conservation management programs;
   - Renton hydrogen fuel cell demonstration;
   - Converting waste to energy at the wastewater treatment facilities; and
   - As a large consumer of biodiesel, King County supports significant expansion of the market.

Notes
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