AECOM

COPY

Metropolitan Washington Council of Governments

Multi-Sector Approach to Reducing Greenhouse Gas Emissions in the Metropolitan Washington Region

Request for Proposals RFP No. 15-010

March 6, 2015

AECOM
3101 Wilson Boulevard
Suite 900
Arlington, VA 22201
www.aecom.com

703.682.4900 tel
703.682.4901 fax

March 6, 2015

George Hohmann
Contracts and Purchasing Manager
Metropolitan Washington Council of Governments
777 North Capital Street, NE, Suite 300
Washington, DC 20002

Proposal in response to RFP 15-010: Multi-Sector Approach to Reducing Greenhouse Gas Emissions in the Metropolitan Washington Region

Dear Mr. Hohmann:

AECOM is pleased to submit our qualifications in response to Metropolitan Washington Council of Governments RFQ 15-010 for Multi-Sector Approach to Reducing Greenhouse Gas Emissions in the Metropolitan Washington Region. This proposal is in response to your Request for Proposals dated February 13, 2015.

AECOM welcomes the opportunity to work with MWCOG to prepare the technical analysis and documents required to support the goals and targets for regional GHG emission reduction. We fully recognize the technical issues, policy sensitivities, and time constraints within which this project must achieve the goals and deliverables. AECOM is committed to helping MWCOG effectively manage the process while maintaining integrity and objectivity.

AECOM has received considerable national and international recognition for our work with cities and regions to develop strategic plans to reduce greenhouse gas emissions. Our project qualifications present the processes and tools we have developed to facilitate robust engagement and to identify effective policies, plans, and programs in cities across the US and globally. We are delighted to be joined by two subcontractors that provide both specialty services and local experience and resources.

- The **National Center for Smart Growth at the University of Maryland** adds substantial regional knowledge, data, and modeling capability to our team. With a national and international reputation as a source of rigorous and objective research, education, and technical assistance, the NCSG has conducted pioneering research on the measurement of urban form and transportation infrastructure and their effects on land markets, travel behavior, and human health, and on the efficacy of land use regulations and policy.
- **Nspiregreen, LLC** will contribute to the development and refinement of strategies as well as project coordination assignments. They bring notable experience working with stakeholders to communicate and work towards concensus. Nspiregreen is a certified DBE with the Metropolitan Washington Unified Certification Program, which includes the Metropolitan Washington Area Transit Authority and the District of Columbia Department of Transportation; is a certified DBE with the Maryland Department of Transportation and Virginia Department of Transportation; and is a certified MBE in Prince George's County, Maryland.

We recognize that effective project management is critical to the success of this effort. We have nominated **Claire Bonham-Carter, LEED AP,** Vice President and Director of Sustainable Development, to be the Principal in Charge and GHG Technical Leader, and **Brian Goldberg, AICP, LEED AP,** a Senior Environmental Planner in AECOM's Arlington, Virginia office, to be our project manager and team leader. Ms. Bonham-Carter is a national leader in climate change mitigation and has led a number of notable climate action plans and GHG emissions reductions plans. She is actively engaged in the Rockefeller Foundation's 100 Resilient Cities program and the Carbon Disclosure Project for the C40. Mr. Goldberg has extensive experience working on climate adaption plans and GHG emission reduction studies and has collaborated with Ms. Bonham-Carter on these projects, including the Climate Action Plan for Baltimore.

AECOM

Our proposal is organized under the four chapters as specified in the RFQ:

- Chapter 1: Qualifications of the Offeror and Personnel
- Chapter 2: Scope of Work
- Chapter 3: Services, Pricing and Schedule
- Chapter 4: References

These chapters are followed by the DBE Participation Plan and attachments.

AECOM has reviewed the standard terms and conditions outlined in the RFP and, with two exceptions, is prepared to execute a contract with these terms. The exceptions are that we request a modification of Indemnification such that our liability is tied to our negligence and request that the payment terms be reduced from 60 days to 45 days.

We sincerely appreciate the opportunity to submit this proposal and look forward to working with and supporting MWCOG in this important undertaking. If you have any questions or desire further information, please feel free to contact me at 703.682.4945 or ashely.o'connor@aecom.com or Brian Goldberg, Project Manager, at 703.682.5016 or brian.goldberg@aecom.com.

Very truly yours,

Ashley O'Connor, AICP
Vice President
AECOM

TABLE OF CONTENTS

1

QUALIFICATIONS OF OFFEROR + PERSONNEL

1 QUALIFICATIONS OF OFFEROR + PERSONNEL

1.1. Highly Qualified Team

AECOM is pleased to have the opportunity to introduce the qualifications of our firm and our partners for this important undertaking. We propose to engage two subcontractors to provide specialty services: Nspiregreen, LLC and the Transportation Research Policy Group, National Center for Smart Growth at the University of Maryland.

AECOM is a global professional services firm providing integrated design, planning, engineering, and program management services to a broad range of markets. Incorporated in 1970, AECOM has expanded to include some of the world's leading consulting practices, including EDAW, DMJM, ERA, and most recently, URS. AECOM's practice now spans over 150 countries with the skills of nearly 100,000 dedicated and specialized professionals.

With a truly global footprint and a longstanding presence in many of the world's largest cities, we recognize and understand the importance that cities and regional organizations play in dealing with 21st Century challenges of sustainability, as reflected in our portfolio of engineering and planning work. As climate change has come to the fore in recent years, AECOM has worked on a broad array of notable climate change projects. Our unique cross-disciplinary teams have a deep understanding of climate change impacts, mitigation and adaptation planning, and implementation in various geographies and contexts.

Our experience includes energy efficiency and renewable energy planning, climate action planning, sea level rise strategic programs, and vulnerability assessments for transportation and utility infrastructure. Our three-year partnership with the Carbon Disclosure Project Cities program in producing their 2012-2014 Global Reports highlights our commitment to working with cities in particular on their climate change agendas. Our access to and understanding of this data means that we are very familiar with current trends in GHG mitigation policies. We have recently started working with the 100 Resilient City program pioneered by the Rockefeller Foundation. Our experience is global – for both big and small cities, for small developments, and in some cases, for entire countries.

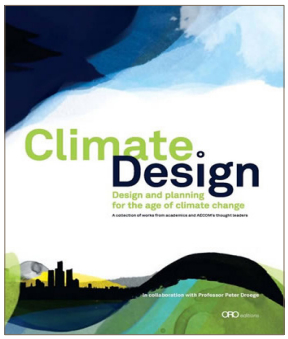
Due to the volume of Climate Action Plans that we were producing in California, and the need to explain benefits and trade-offs of different types of climate action policy, AECOM developed a Climate Action Plan toolkit. The Toolkit was designed to be user-friendly and facilitate the jurisdiction's capacity to develop and implement their selected measures. Our use of the Toolkit has enabled efficient and effective planning processes for clients across the US. The Toolkit:

- Organizes existing conditions, greenhouse gas (GHG) emissions inventory, and forecast data, and allows a jurisdiction to select measures and customize the measure assumptions to the community's specific context.

- Automatically quantifies GHG reductions, energy and water savings, waste diversion, and other sustainability co-benefits.
- Provides summary output tables and charts that can be directly imported into public outreach materials and plan documents.
- Assists in the implementation and monitoring of the resulting plans.

Other highlights of our recent climate change work include:

- GHG Emissions Reduction + Climate Change Management Program for NYC Department of the Environment
- 80x50 report for Office of Long Term Planning and Sustainability, New York City
- Long Term Plan to Reduce Energy Consumption and Greenhouse Gas Emissions of Municipal Buildings and Operations, for NYC EDC/DCAS
- Developing a 2050 carbon neutral route map for the City of Seattle building sector
- GHG Inventory development or peer review for various US municipalities, including Baltimore, Hempstead, West Hollywood, New York City, and San Diego
- Contribution to or completion of over 30 Climate Action Plans for cities across the US, including Baltimore, Seattle, New York, San Francisco, San Jose, West Hollywood, and Mountain View; and the Counties of San Diego, Santa Clara, Solano, Yolo, Alameda, Long Island, and Volusia
- 11 Climate Action Plans for municipalities in the Silicon Valley area (County of Santa Clara)
- Developing a Climate Action Plan toolkit to fine tune performance and participation assumptions
- Reporting on the regional economics of climate change in South Asia
- Extensive work with UK local authorities on innovative sustainability planning
- Publishing the book, *Climate Design: Design and Planning for the Age of Climate Change*



The National Center for Smart Growth (NCSG) at the University of Maryland will contribute substantial regional knowledge, data, and modeling capability. The NCSG, founded in 2000, has a national and international reputation as a source of rigorous and objective research, education, and technical assistance. NCSG scholars have conducted pioneering research on the measurement of urban form and transportation infrastructure and their effects on land markets, travel behavior, and human health, and on the efficacy of land use regulations and policy. The NCSG conducts and disseminates research and provides applied planning expertise with the intent to inform public policy, advance knowledge on topics related to smart growth, and contribute to this planning arena.

Areas of exceptional strength include transportation, land use, and economic modeling, especially in the mid-Atlantic region; as well as smart growth policy evaluation and affordable housing policy across the nation. Funding for work by the NCSG staff has been provided by US HUD, DOT, and EPA; the Maryland Departments of Planning, Transportation, Housing and Community Development, and Natural Resources; the Maryland-National Capital Park and Planning Commission; and many local and national foundations.

The NCSG works closely with, and serves as the administrative home for, the Planning and Design Center, the Transportation Policy Research Group, the Environmental Finance Center, and the Housing Strategies Group. The NCSG is currently a consortium member of regional planning efforts in Baltimore and Washington, DC, the former the recipient of a large HUD SCI grant.

The following representative projects demonstrate NCSG's range of capabilities and immersion in this region's issues and future:

- The Purple Line Corridor Coalition (PLCC), administered by the NCSG, brings a regional corridor approach to suburban Maryland's upcoming light rail project, the Purple Line. The PLCC engages organizations active in the planned light rail corridor, facilitates collaboration and integration, and conducts and disseminates research to

make sure that investments in the Purple Line achieve the maximum possible economic, social, and environmental benefits to its neighborhoods, residents, and businesses.

- The Plan for Regional Sustainability Tomorrow (PRESTO) is a new project to develop, disseminate, and promote the implementation of a sustainable development strategy for the Baltimore-Washington region, in conjunction with the Town Creek Foundation and other stakeholders in the region. The primary goal for the 2014-15 school year is to stimulate a science-based conversation about sustainability in this region and to develop one or more baseline scenarios. Stakeholders will stimulate the dialog by considering key driving forces that will shape the future of the region and by deploying a highly developed set of data and analytic tools to develop baseline scenarios.
- Funded by the NSF Institution SESYNC (National Socio-Environmental Synthesis Center), NCSG is building a large scale integrated model that includes the transportation model MSTM, the land-use model SILO, environmental impact models BEM and MEM developed previously at NCSG, the land-cover model CBLCM of the Chesapeake Bay Program, and ESSIC's climate change model. The goal of this project is to analyze policies that promote sustainable development, with a particular focus on environmental impacts, societal impacts, and the health of the Chesapeake Bay.
- The Washington Metropolitan Area Transit Authority (WMATA) had an urgent task to develop regression-based ridership models to predict a change in ridership with assumptions of land use and demographic changes around the Metro station areas. The NCSG worked to extend the current set of variables and statistical models, providing technical assistance particularly for the regression-based ridership models of the peak time periods.
- The Maryland Statewide Transportation Model (MSTM) is an advanced "four step," trip-based model sponsored by the Maryland State Highway Administration (SHA). With support from another consultant, the NCSG began the development of the MSTM in 2006. The model covers the state of Maryland and surrounding areas at a high level of fidelity, including local trips and long-distance trips by people and freight. The MSTM incorporates data from the MWCOG and BMC models and resolves data and boundary differences between them, improving transit travel simulation in particular. It has become a policy decision support tool that has been applied extensively for scenario analysis, corridor studies, project forecasts, and future transportation performance measurement by MDOT and MDE.

nspiregreen

Nspiregreen, LLC will contribute to the development and refinement of strategies as well as project coordination assignments.

Nspiregreen's partners, Veronica Davis, PE and Chancee Lundy, received the Small Businesswomen of the Year Great Streets Award from the Congress Heights Community Training & Development Corporation in 2014

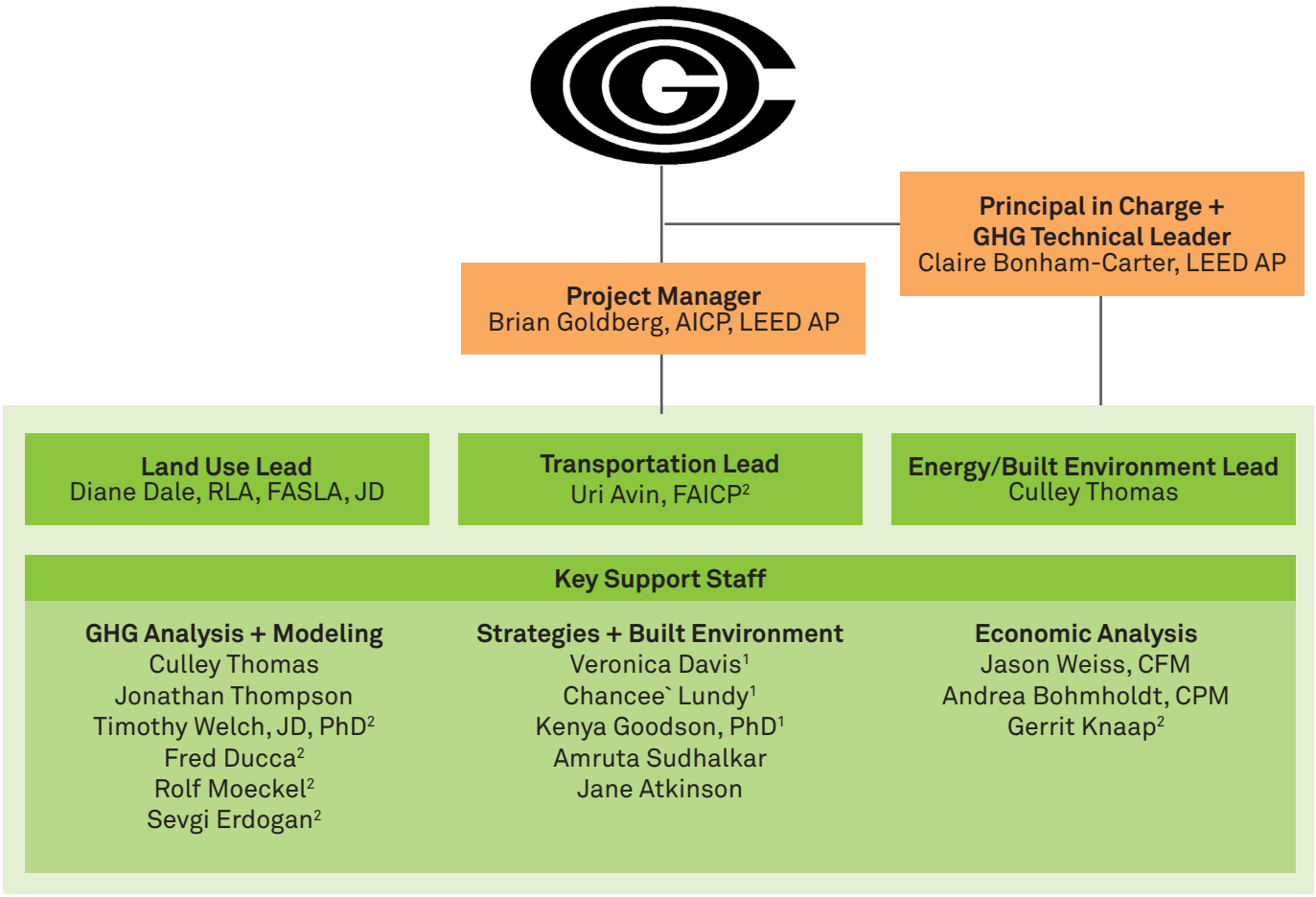
Nspiregreen is a small minority-woman owned environmental consulting firm based in Washington, DC. Founded in 2009, they have established themselves as an industry leader in the DC regional market. With nearly 25 years of combined experience, Nspiregreen has the unique ability to deliver both technical and community-driven solutions. They use their commitment to providing solutions that transform communities to guide delivery of their core service areas, which include urban and regional planning, environmental solutions, and public engagement.

Nspiregreen has the technical capabilities to support the "Multi-Sector Approach to Reducing Greenhouse Gas Emissions in the Metropolitan Washington Region." Their engineers and urban planners have extensive experience working on successful land use, transportation, energy, and environmental projects. They are currently working on four major planning efforts in the District, including the comprehensive energy plan, long-range multimodal plan (moveDC), alternatives analysis for the North-South Planning Study, and the consolidated total maximum daily load implementation plan. For these projects, they have conducted technical research and determined feasibility, conducted benefit-cost analysis, facilitated stakeholder engagement, provided technical support including GIS, technical research, and creation of a database for structural and non-structural BMPs and land use analysis.

Nspiregreen is a certified DBE with the Metropolitan Washington Unified Certification Program, which includes the Metropolitan Washington Area Transit Authority and the District of Columbia Department of Transportation; is a certified DBE with the Maryland Department of Transportation and Virginia Department of Transportation; and is a certified MBE in Prince George's County, Maryland.

1.2. Key Personnel Qualifications

We have assembled a team of technical leaders and specialists to engage in the work with MWCOG to develop the plan for GHG emission reductions to achieve the goals and targets for the region. They will be available to fill the roles identified in the organization chart below. Their project experience and qualifications to perform the tasks in the work plan are included in the resumes that follow.



All staff members are AECOM personnel unless otherwise noted:

[1] Nspiregreen (DBE)

[2] National Center for Smart Growth, University of Maryland

Brian Goldberg, AICP, LEED AP BD+C

Project Manager

Education
Master of Environmental Management (MEM), Yale University School of Forestry and Environmental Studies, 2003
Bachelor of Arts, Political Science; minor: Environmental Studies
Union College, 1999

Licenses/Registrations
American Institute of Certified Planners
LEED Accredited Professional, Building Design + Construction

Years of Experience
With AECOM: 8 years
Total: 13 years

Affiliations
Yale School of Forestry and Environmental Studies, Alumni Board, President
Harvard Graduate School of Design, Social Agency Lab, Fellow

Awards + Honors
National Recognition Award for Excellence in Engineering, ACEC, for Long Island Regional Sustainabilty Plan, 2014
Diamond Award for Excellence in Engineering, ACEC NY, for Long Island Regional Sustainabilty Plan, 2013
MD State Finalist for Excellence in Engineering, ACEC MD, for Baltimore Climate Action Plan, 2013
Merit Award, American Society of Landscape Architects, New Jersey Chapter, "Tuxedo Reserve Marbled Salamander Migration Study", 2008
Yale University-Hixon Center Fellowship for Urban Ecology
Yale Council on Southeast Asia Studies Research Fellowship
Yale University's Carpenter/Sperry/Mellon Ecology Research Prize
Thomas J. Watson Fellowship; National Finalist, Ecotourism Study
Union College International Relations Prize

Presentations and Publications
Annual Conference of MD Floodplain and Stormwater Managers, "City Risks and Adaptations to Climate Change", October 2013.
Harvard Graduate School of Design, "International and Environmental Challenges for Urban Planning" April 2013.
Northern Virginia Community College, "Individual Change Agents" Apr/Dec. 2013.
EcoDistricts Summit, Portland, OR, "Partnerships for Urban Ag" Oct 2011
American Society of Civil Engineers (ASCE). NYC Chapter, Conference, Keynote, "Principles of Sustainable Planning and Design", NY, NY, May 2010.
Yale University "Overview of Productive Urban Landscapes", Jan 12,. 2010.
"Metrics for Landscape Productivity", Jan. 21, 2010.
"Partnerships in Productive Landscapes" May 2010
"Sustainable Planning and Design", Oct. 14, 2009.
Design + Ecology In Practice: Presido Fort Scott Creek + Historic Garden. Presidio Trust and EDAW | AECOM, 2008.
Land and Natural Development (LAND) Code: Guidelines for Sustainable Development, Chapter "Saving Time and Money". Balmori and Benoit, 2007.
Public-Private Partnerships for Brownfields Re-development. Weston Solutions; Washington, District of Columbia. 2006.
Millennium Development Goals: Overcoming Barriers to Essential Services in Asia and the Pacific. UN ESCAP; Bangkok, July 2006.
5 year Environment Strategy for Poverty Reduction, United Nations Development Programme Cambodia; UNDP, March 2006.
Learning Communities: Community-Driven Development Initiative, UNDP Cambodia Country Office; UNDP Bangkok, December 2005.
New York City Open Space Plan. NYC Parks & Recreation, August 2003.
Successful Urban Spaces Beneath Elevated Expressway Infrastructure. United Nations and Yale University; Bangkok, Thailand, May 2003.

Brian Goldberg, an experienced sustainability and urban planner, is well-versed in working with public sector clients at a variety of community, local and regional scales for meeting sustainability goals. Brian's sustainability planning perspectives are drawn from an extensive array of projects in both urban and rural areas of the US, Asia, East Africa and North Africa.

Mr. Goldberg recently served as lead sustainability planner and project manager for the sustainability award-winning Long Island region's sustainability, climate mitigation, and adaptation plan. He has also served as sustainability planner and project manager for the City of Baltimore (MD) Climate Action Plan as well as a lead author of the Town of Hemspstead, New York's government operations Energy and Sustainability Master Plan.

Baltimore Climate Action Plan, Baltimore, MD. Project manager and sustainability planner for the city-wide plan to reduce greenhouse gas (GHG) emissions generated by energy consumption from buildings, transportation, land use, waste, water conveyance and wastewater sectors. AECOM reviewed the ICLEI GHG

Brian Goldberg, AICP, LEED AP BD+C Continued

inventory and recommended changes, carried out a gap analysis of current activities, and created a list of potential strategies through discussions wth the City's CAP Advisory Committee and City staff. AECOM used its Climate Action Toolkit to quantify the GHG emissions reductions from proposed strategies. The overall package of strategies are anticipated to exceed the City's 15% GHG reduction target. AECOM also drafted the CAP Report and recommendations which have been endorsed by the Mayor and adopted by the City Council. Additionally, AECOM secured pro bono funding to commission an animated video about climate-friendly actions for use as educational tools in Baltimore City schools.

Long Island Regional Sustainability Plan, Long Island, NY. Project manager and lead planner of a regional planning initiative funded by the New York State Energy and Research Authority's (NYSERDA) Cleaner Greener Communities program to help the Long Island region meet the State's goal of reducing GHG emissions 80% by 2050. AECOM led a diverse planning team of local governments, non-profits and other key stakeholders to prepare a quantifiable baseline assessment (GHG inventory, sustainability indicators, and gap analysis) and establish sustainability goals and performance targets for GHG reductions. The team developed a portfolio of economic development, energy, land use, transportation, water, waste and governance strategies to achieve the goals and targets. AECOM also outlined strategies for the municipalities to reference as they develop climate change adaptations for the low-lying and hurricane prone coastal area. The plan was endorsed by the LI Regional Economic Development Commission, helped leverage $1MM in implementation funds for the client in alternative energy technologies and received a Diamond Award for Engineering Excellence by the New York State ACEC.

PlaNYC GHG Mitigation Study and Economic Assessment, New York, NY. Environmental planner who provided precedent and case study research on transportation and waste management strategies to support Mayor Bloomberg's Office of Long Term Planning and Sustainability's GHG mitigation study. Looking beyond the goals and strategies of the current PlaNYC 2030 and the 30% greenhouse gas reduction by 2030, this long-term study aims to achieve an 80% reduction by 2050. The first task included analysis was to determine whether such a reduction goal is technically possible, if so at what societal cost, and what actions would need to be taken in the next 5 years to make sure the City sets the right course to achieve it.

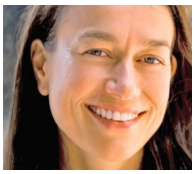
Energy and Sustainability Master Plan, Town of Hempstead, NY. Sustainability planner and lead author of the Energy and Sustainability Master Plan which identifies greenhouse gas reduction strategies and policy recommendations for helping guide the Town of Hempstead to achieve savings in costs, energy, water and waste. The plan included AECOM's baseline assessment of the Town facilities' energy usage and greenhouse gas inventory. In addition to climate change mitigation, the team identified municipal actions for promoting adaptation and resilience to increasing risks from coastal storms and flooding.

HUD Sustainability Communities Grant, Livable Roanoke Valley, Roanoke, VA. Planner for a strategic planning effort being conducted under a grant from HUD's Sustainable Communities program. Long-term regional planning issues for the four-country and two-city project area are being addressedthrough an innovative process of public engagement that draws on "scenario thinking," by working with the community to develop a vision, goals, and strategies to address project issues. AECOM advised the public engagement process, prepared case studies to inform the strategy development process and compiled the final summary report.

Sustainability Impact Analysis for Ft. Belvoir, VA. Co-author for Environmental Impact Statement chapter, "Sustainability Analysis of the Ft Belvoir Master Plan". The cross-sectoral sustainability analysis examined potential impacts of the proposed master plan on sustainability commitments; transportation; energy; water; materials; and, land. A baseline data set was generated capturing existing policy commitments, resource use and anticipated climate change considerations. Building from this baseline, the analysis forecasted future resource consumption patterns to determine degree of impacts under various build-out scenarios.

Claire Bonham-Carter, LEED AP BD+C

Principal in Charge + GHG Technical Leader



Education
MA, Natural Sciences, Cambridge University, UK
Advanced Certificate, Marketing, Guildhall, London, UK

License/Registration
LEED Accredited Professional, Building Design + Construction

Years of Experience
With AECOM: 8 years
Total: 20 years

Affiliations
Member, US Green Building Council, Northern CA Chapter
Member, Sustainability Committee, ULI San Francisco
Member, ULI National Sustainability Board
Member, Ecodistricts Advisory Committee

Awards + Honors
APA Northern California Chapter, Merit Award, Focused Issue Planning, Adapting to Rising Tides, 2012
AEP California Chapter, Merit Award, Environmental Resource Document, Adapting to Rising Tides, 2012
AEP California Chapter, Merit Award, Climate Change Document, 2012
Climate Change Business Journal, Project Merit Award, Adapting to Rising Tides – San Francisco Bay Area Transportation Vulnerability and Risk Assessment Pilot Project, 2012

Presentations
SCDP Global Cities 2014 launch event, keynote address, July 2014
Cities Preparing for Extreme Events, ICLEI Livable Cities Forum, Vancouver, April 2014
Identifying Climate Risk & Building Resilience, Climate Leadership Conference, San Diego, February 2014
NetZeroCities Conference: Hand Over the Keys: Urban Design in the Driver's Seat, Fort Collins, October 2013
CDP Global Cities 2013 launch event, keynote address, June 2013
Adapting to Rising Tides, Keynote address, American Railway Development Ass. Annual Conference, June 2013
Cities on the Edge: How coastal cities can prepare for and adapt to rising tides; Living Futures Conference, Seattle, May 2013
Integrating Climate Risk into Major Projects, training at National Adaptation Conference, Denver, April 2013
Adapting to Rising Tides, Greenbuild International Conference, November 2012

Claire Bonham-Carter is a principal with AECOM with over 17 years of experience working on climate change planning and low carbon sustainable design and construction/sustainability strategy projects for a range of public and private sector clients. Her experience spans policy planning for municipalities, as well as sustainability frameworks and feasibility studies for new and existing mixed use communities to minimize impact from an environmental, social and economic perspective. She has worked on climate mitigation plans for a number of US cities including Seattle, Baltimore and New York as well as many smaller California cities and counties, and sustainability design guidelines for masterplans ranging in scale from downtown areas in San Francisco, New Orleans and Sao Paulo, to large new communities in Mexico and China.

She also specializes in climate vulnerability and risk assessments and adaptation plans with projects completed or underway for Metropolitan Transportation Commission in the San Francisco Bay Area, for LA Metro, the Port of Long Beach, transportation agencies in New York, New Jersey and Connecticut and the Capital Regional District in British Columbia. Claire manages AECOM's partnership with the Carbon Disclosure Project's Global Cities program, and the Rockefeller Foundation 100 Resilient Cities program.

City of Baltimore Climate Action Plan, Baltimore, MD. Principal in charge for the development of a climate action and adaptation plan for the City of Baltimore. The project included quantifying the likely GHG reduction potential of the current sustainability plan, developing new strategies to reduce emissions in the transportation, land use, energy and water sectors as well as developing the first steps in a comprehensive adaptation strategy. AECOM worked with a large advisory committee made up of leaders of city departments and other local stakeholders to ensure a highly relevant, targeted and acceptable plan was developed.

Long Island Regional Sustainability Plan, Long Island, NY. AECOM worked with a consortium of Long Island, NY communities to prepare a regional sustainability plan under a grant from the New York State Energy

Claire Bonham-Carter, LEED AP BD+C Continued

Research and Development Authority's Cooler Greener Communities program. The plan establishes a framework to achieve NYS's goal of reducing GHG emissions 80% by 2050. Working groups addressed focus areas of climate adaptation, energy, land use and transportation, solid waste management, water management, and economic development and housing. AECOM provided direction, technical support to establish the baseline assessment, set targets for GHG emissions reductions, proposed implementations strategies to achieve the goals and targets, and synthesize and assemble the work in a comprehensive plan report.

CURB Tool – World Bank, Washington, DC. Project director. Working for the Social, Urban, Rural and Resilience division of the World Bank and for C40, AECOM is developing a climate action planning decision support tool that will allow city staff throughout the world identify and prioritize GHG emission abatement interventions in the transportation, building energy, water, and waste sectors. The CURB tool contains a city capacity assessment module that helps city staff select interventions suited to their community and an intervention development module that allows staff to customize intervention implementation assumptions. The tool provides estimates of GHG emission abatement potential, cost and savings, and community co-benefits for each selected intervention.

City of New York - PlaNYC GHG Mitigation Study and Economic Assessment, NY. Project manager for this project to look beyond the goals and strategies of PlaNYC 2030, and its goal of achieving a 30% greenhouse gas reduction by 2030, to an 80% reduction by 2050. AECOM reviewed whether such a reduction goal was technically possible, at what societal cost, and what actions would need to be taken in the next 5 years to make sure the City set the right course to achieve it. AECOM also conducted an economic impact analysis of GHG reducing policies within PlaNYC 2030, using REMI to analyze construction, operations and maintenance, and long-term productivity benefits accruing to the city's economy, particularly focused on policies leading to energy reduction in buildings. AECOM carried out an audit of the current City GHG inventory.

City of Seattle, Seattle Carbon Neutral Building Strategy, Seattle, WA. Principal in charge for policy development and analysis process for the City of Seattle's Office of Sustainability & Environment. The policies will help the City achieve the goal of carbon neutrality for all existing buildings and new construction by 2050. AECOM assisted the City in facilitating a technical advisory group and developed a methodology to analyze and compare proposed policy options' energy savings and greenhouse gas reductions. Policy areas covered include prescriptive and outcome-based energy code, benchmarking, disclosure, and ratings requirements, a wide variety of financing and direct assistance programs, district-level strategies including district heat, and climate benefit districts. The City plans to use the policy analysis to outline key policies that need to be adopted to meet their greenhouse gas reduction goals.

Carbon Disclosure Project Global Cities 2012-2014 Report and Partnership. As project director with AECOM, led and formed a multi-year partnership with the Carbon Disclosure Project (CDP) in January 2012 performing the data analysis and information design for the CDP Cities Global Reports. The report reflects city climate mitigation and adaptation activities, and establishes a benchmark for cities to report against on an annual basis. As well as handling the large data set, looking for relationships, crunching numbers, identifying trends and reviewing best practices by the sustainable economics team, AECOM's creative team designs the reports and creates info-graphics for the print reports and an interactive website to make the data accessible and interesting. The 2014 report is now available.

100 Resilient Cities Program, Rockefeller Foundation. As principal in charge, is the key client contact for AECOM's work on the 100 Resilient Cities program. AECOM is working with 7 cities globally, supporting their Chief Resilience Officer in developing a City Resiliency Strategy. Cities include San Francisco, Oakland, Berkeley in the US, Quito in Ecuador, Bangkok Thailand, Christchurch New Zealand and Melbourne Australia.

Diane Dale, RLA, FASLA, JD

Land Use Lead

Education
Juris Doctor, School of Law, University of Virginia, 1998
Fulbright Scholar, Universita' di Genova, Italia, 1980-81
Master of Landscape Architecture, University of Pennsylvania, 1980
Bachelor of Landscape Architecture, SUNY CES&F, 1978
Bachelor in Environmental Science, SUNY CES&F, 1977

License/Registration
Registered Landscape Architect: TN

Years of Experience
With AECOM: 9 years
Total: 32 years

Affiliations
American Society of Landscape Architects, Fellow
US Green Building Council

Awards + Honors
Diamond Award in Energy, ACEC NY Excellence in Engineering for Long Island Regional Sustainability Plan, 2014
Washington DC Water's Green Infrastructure Challenge, for 31st Bridge Replacement in Georgetown, 2014
National ASLA Planning Honor Awards for Park 20/20 Master Plan, Haarlemmermeer, NL, 2010,
National Design Award for Environment, The Smithsonian's Cooper-Hewitt, 2004 (firm-wide)
Business Week/Architectural Record "Good Design Is Good Business" Award; Excellence Award, Green Roofs for Healthy Cities; and NOVA Award, Construction Innovation Forum for Ford Rouge Center, 2004

Presentations and Activities
"Performance Based-Planning," UN Habitat World Urban Forum 7, Medellin, Colombia, 2014
Sustainability Advisor, ULI Advisory Services, Pasco County, FL, 2013
"Infrastructure and Resiliency," World Environment Center, 2013
Geo. Earle Memoria Lecture, SUNY College of ES&F, 2012 and 2007
Sustainability Advisor, Mayors' Institute on City Design, 2011
Ed. Sess., ASLA National Meetings, 2010, 2009, 2006, 2005, 2003
Panelist, "Strengthening Sustainability in Urban Communities," Royal Dutch Embassy, Washington DC, 2010
Panelist, "Recovering Green," Urban Land Institute & American Institute of Architects Forum, Washington DC, January 2010
Keynote, "Cradle to Cradle Design," Conference on Roads & Regional Development, Romania, 2009
Author, "Hali'imaile," ULI Urban Land "Green" Issue, Spring 2009.
Presentation, Symposium Rijkswaterstaat Duurzaam: Cradle to Cradle, Utrecht, Netherlands, 2009
Exhibitor, "Green Communities," National Building Museum, Washington, DC, Oct. 2008 – 2009
Guest Lecture, Peking University, Beijing, P.R. China, 2007
Education Sessions, USGBC GreenBuild 2006 and 2005
Keynote, Virginia's Sustainable Futures Summit, 2005
Lecturer, Chinese Mayors Training Program in Sustainable Planning, American Planning Association, 2004, 2005
Presentation on Sustainable Land Planning, Leadership Conference on Conservation & Development, Kunming, P.R. China, 1999
Author, "The Boundary Dilemma at Shenandoah National Park," Virginia Environmental Law Journal, 1997

Diane Dale joined AECOM in September 2011 after more than 14 years at the sustainable design thought-leadership practice of William McDonough + Partners. As director of community design, she translated the McDonough's Cradle to Cradle design philosophy and the innovations in green buildings to the scale of community planning. Trained as both a designer and a lawyer, Diane brings unique skills in analysis, strategic thinking, and communication that are highly effective in addressing the challenges of sustainable planning. She was established as a skilled project manager early in her career and has served as project director for large and multi-disciplinary projects. She is highly regarded for project and client management and as a thought leader in sustainability and strategic planning. She approaches sustainable planning through an integrated systems-based conceptualization process in which energy, water, waste, transportation, and other site systems are early and key informants of planning.

With more 30 years of experience on six continents, her portfolio represents a continuum of advancements and innovation that are models of sustainable planning and development. Her innovative work for Hali'imaile, an affordable and sustainable community on Maui, was included in the 2010 Green Community exhibit at the US National Building Museum, Washington DC.

Urban Plan Update, City of Santa Marta, Colombia for UN-Habitat. Project director of update of the Urban Master Plan employing AECOM's bespoke Sustainable Systems Integration Model (SSIM) to provide a rigorous

Diane Dale, RLA, FASLA, JD Continued

and quantified comparative analysis of master plan concept alternatives to provide performance-based planning and decision support tools. Performance indicators calibrated for the city will address goals that include tourism-based economic development to optimize the city's historic and environmental assets, strategies for climate adaptation and environmental resiliency, and improved accessibility to public services for the displaced victims of recent internal conflict. Included an extensive public engagement process and workshops with city stakeholders to establish the planning context and to identify the preferred urban plan concept for further development under the Planes de Ordenamiento Territorial (POT) process.

Promoting Green Urban Development in Africa: Enhancing the Relationship between Urbanization, Environmental Assets and Ecosystem Services, Cities of Durban, South Africa, Dar es Salaam, Tanzania, and Kampala, Uganda. Project director for innovative study funded by the World Bank integrating environmental economics and urban planning to develop strategies to address the degradation of the natural environment in Africa's cities caused by the impacts of rapid urbanization. An urban environmental assessment identified key environmental assets and ecosystem services to be valued. A toolkit of policy, planning, and management strategies will developed that can be adapted and utilized by city and national governments in other African cities.

Long Island Regional Sustainability Plan, Long Island, NY. Project director for regional planning initiative funded by the New York State Energy and Research Authority's (NYSERDA) Cleaner Greener Communities program to develop programs to meet the State's goal of reducing GHG emissions while promoting economic development. AECOM led a planning team of local governments, NGO, and stakeholders to prepare the baseline assessment (GHG inventory, sustainability indicators, and gap analysis) and establish sustainability goals and performance targets for GHG reductions. Developed a portfolio of economic development, energy, land use, transportation, water, waste and governance strategies to achieve the goals and targets. The plan received the Diamond Award for Excellence in Engineering from ACEC NY in 2014.

Livable Roanoke Valley Strategic Master Plan, Roanoke, VA. Project director and administrative lead of a strategic planning effort being conducted under a grant from US Dept of Housing & Urban Development's Sustainable Communities program for a multi-jurisdictional area in southwest Virginia. Provided oversight and direction for the planning team. Worked with a steering committee to develop a vision, goals, and strategies to address housing, transportation, land use, energy, environment, economics and workforce development, and health and education. Led the development of statement of Livability Principles, including background on community values captured and intention and lead editor of case studies report and project summary report.

IJburg Sustainability Dashboard & Principles, Project Management Bureau IJburg, City of Amsterdam, NL. Project director for evaluation of the sustainable design performance achieved at IJburg I, the highly acclaimed man-made urban island community south of the historic city core. The sustainability dashboard was developed to establish a qualitative planning framework, mapping the environmental achievements of targeted criteria against standards of measure that reflect the community's values and objectives. Highlighting interconnectedness of strategies, the dashboard reveals opportunities for optimization of strategies. The dashboard was viewed as so highly successful that the PMB began to use the tools and principles to guide other agency projects.

Cradle to Cradle Community Framework, Hali'imaile, Maui, HI. Project director to develop a site planning guidance from a new perspective, integrating sustainable design and new urban design principles with a focus on the interface and integration of spatial planning, site infrastructure systems and urban form. The project was included in the Greener Communities exhibit at the US National Building Museum, Washington DC in 2008-2009.

Culley Thomas

Energy/Built Environment Lead
GHG Analysis + Modeling

Education
Master of City and Regional Planning (concentration in Land Use/Environmental Planning), University of California, Berkeley, 2005
Master of Science, International Development, (concentration in Municipal Environmental Programs), University of California, Davis, 2003
Bachelor of Arts, Anthropology/Human Ecology, Colorado College, Colorado Springs, 1996

Years of Experience
With AECOM: 8 years
Total: 11 years

Affiliations
American Planning Association,
Member, Representative at UN Habitat Climate Action Planning
Guidelines Committee

Presentations
Effectiveness of Municipal Climate Change Strategies, Sustainable Communities Conference, Burlington, VT, 2004

Science and Data into Local Decision Making Processes, CalFed Science Conference, Sacramento, CA, 2004

Municipal Applications of LEED for Neighborhood Development, GreenBuild Conference, Boston, MA, 2008

Toward a Low-Carbon Future, California AEP Conference, San Franciso, CA, 2009

Community Climate Action Planning, California APA Conference, Tahoe City, CA, 2009

Effective Climate Action Plans, National APA Conference, New Orleans, LA, 2010

Culley Thomas develops greenhouse gas emissions mitigation strategies for local governments within the United States and other countries. Mr. Thomas has eleven years of experience in the fields of emissions mitigation, climate action planning, and municipal sustainability policy. Culley's clients include local governments in California, New York, Washington, Florida, Missouri, Arizona, Massachusetts, and Vermont, the Canadian national government, and international organizations (e.g., World Bank, C40). Mr. Thomas has been project manager, primary author, and/or technical analyst on more than 35 communnity climate action planning projects and four climate adaptation projects. As part of these and other projects, he has gained extensive experience working with governments and stakeholders to develop policies and implementation programs with feasible, measurable, well defined action steps.

In addition to his policy work, Culley has developed of a variety of computer-based decision support tools for community-sacle greenhouse gas mitigation and climate vulnerability planning. He is currently in the final phases of developing a greenhouse gas emissions mitigation planning tool for the World Bank and C40 that will be used by cities throughout the developing world. The tool will help city staff identify and prioritize greenhouse gas emission mitigation strategies, policies, and programs and identify costs and co-benefits associated with implementation.

Prior to working at AECOM, Culley's graduate research examined the effectiveness of climate action plans and related policies throughout the United States, Canada, the United Kingdom, and Australia. During this research, he gained insight into the success of different types of policies and programs in addressing climate change.

CURB Tool – World Bank, Washington DC. Lead Developer and Project Manager, working for the Social, Urban, Rural and Resilience division of the World Bank and for C40. AECOM is developing a climate action planning decision support tool that will allow city staff throughout the world identify and prioritize GHG emission abatement interventions in the transportation, building energy, water, and waste sectors. The CURB tool contains a city capacity assessment module that helps city staff select interventions suited to their community and an intervention development module that allows staff to customize intervention implementation assumptions. The tool provides estimates of GHG emission abatement potential, cost and savings, and community co-benefits for each selected intervention.

PlaNYC 2030 – 80X50 Plan, New York City, NY. Technical Lead. Working for the Mayor's Office, AECOM researched global best management practices and developed and analyzed pathways and key actions

Culley Thomas Continued

that will help the City reduce emissions by 80 percent below 1990-levels by 2050. AECOM also conducted an analysis of state-of-the-art monitoring practices that will allow the City to better track GHG emissions generating activities within the community.

Seattle Carbon Neutral Building Strategy, Seattle, WA. Project Manager. Policy development and analysis process for the Office of Sustainability & Environment to put City on path to carbon neutrality for all existing buildings and new construction by 2050. AECOM assisted the City in facilitating a technical advisory group and developed a methodology to analyze and compare proposed policy options' energy savings and greenhouse gas reductions.

Greenhouse Gas Reduction Plan, Mountain View, CA. Project Manager/ Technical Lead. AECOM prepared a GGRP to prioritize greenhouse gas reduction measures, identify economic costs/benefits for each, and identify how each proposed measure contributes toward meeting the City's established GHG reduction targets. The plan included an analysis of GHG emissions generated in five sub-districts within the City. The sub-district analysis was used to analyze the impact of different development patterns in high growth areas.

Union City Climate Action Plan (CAP), CA Technical Lead. The Union City Climate Action Plan and associated environmental clearance document were developed to help the City achieve its goal of a 20% greenhouse gas emission reduction below 2005 levels by the year 2020. AECOM developed a greenhouse gas emissions inventory; analyzed emission reduction benefits of existing programs and projects; developed reduction and adaptation strategies; and analyzed the performance of new measures in terms of emission reductions, job generation, and cost benefit.

Shasta Regional Climate Action Plan (RCAP), Shasta County, CA. Project Manager. The Shasta RCAP is a multi-jurisdictional climate action planning process that involves a large number of agency and key industry stakeholders. The goal of the RCAP is to develop a coordinated climate protection effort that fits the Region's unique context and needs. Within the city jurisdictions, primary emphasis is placed on the development of cost-effective energy efficiency programs. Close coordination with relevant energy utilities has helped identify feasible efficiency programs. The potential of Smart Grid–related technologies has emerged as an important source of efficiency improvements. Within the rural unincorporated areas, alternative transportation modes (i.e., expanded carpooling and express transit service), carbon sequestration in timberlands, and industrial process efficiency improvements will play a significant role in achieving the Region's climate protection goals.

Silicon Valley 2.0 - Climate Change Vulnerability Assessment and Adaptation Plan, Santa Clara County, CA. Lead Tool Developer. Developing a suite of decision support processes and tools that will help Silicon Valley jurisdictions identify vulnerabilities and increase resiliency to the effects of climate change. The project will also develop a regional climate adaptation plan that identifies strategies to adapt to sea level rise, flooding, extreme heat events, wildfire, and climate change-related public health issues.

Jonathan Thompson

GHG Analysis + Modeling

Education
Master of Engineering, Sustainable Energy, Columbia University, 2010
Master of Environmental Planning, The Pratt Institute, 2006
Bachelor of Science, Environmental Geoscience, Stony Brook University, 2003

Years of Experience
With AECOM: 11 years
Total: 14 years

Publications
"Infrastructure from the Bottom Up - an overview and assessment of the millennium village project energy and infrastructure sector after five years:. The Earth Institute – Columbia University. 2011. (with V. Modi, E. Adkins, K. K. Freeman, H. Fouad, L. F. Konstanty, S. Sherpa, J. Aviles, and R. Cosmaciuc.)

"Spatial Distribution of Urban Building Energy Consumption by End Use. *Energy and Buildings*". 2011. (with B. Howard, L. Parshall, S. Hammer, J. Dickinson, and V. Modi)

Mr. Thompson is a member of the Energy Efficiency Group within AECOM Energy. His background includes energy analysis and optimization, primary pollutant and Greenhouse Gas emissions analysis and inventorying, wastewater treatment process design, air emissions and odor control design, environmental impact analysis, regulatory compliance determinations, and data analysis utilizing GIS. He has been a member of the AECOM team of over 10 years. He brings research experience from academia as a former research coordinator for the Earth Institute at Columbia University in the lab of Vijay Modi, specializing in spatial energy modeling of urban areas.

Long Island Regional Sustainability Plan, Long Island Region, NY. As GHG Analyst, performed GHG baseline inventory and mitigation strategies impact calculations. AECOM developed mitigation strategies that support New York State's goal of reducing GHG emissions 80% by 2050. AECOM led a planning team to prepare the baseline assessment and establish sustainability goals and performance targets for GHG reductions. AECOM also outlined strategies for climate change adaptations to better withstand climate change in the low-lying, hurricane-prone coastal areas and urban centers.

PlaNYC 80 x 50 Master Plan, New York, NY. Project Manager for the PlaNYC 80 x 50 project, an ambitious sustainability master plan project that aimed to reduce New York City's GHG emissions levels 80% of the 2005 levels by 2050. Responsible for the Task 3 GHG inventory expansion involving an audit of the current NYC GHG inventory, a review of emerging community-based inventorying protocols, and an expansion of the inventory to model data to the neighborhood level for the targeting of specific policies and mitigation strategies where their effectiveness would become evident with this more granular data.

World Bank CURB- Energy Efficiency Toolkit for Developing Cities. As part of a team developing an energy master-planning tool for cities in developing nations to reduce energy consumption and GHG emissions, Mr. Thompson provided energy modeling and cost estimation for the building sector of the tool.

Hartsfield Jackson Atlanta International Airport Climate Action Plan, Atlanta, GA. The Hartsfield Jackson Atlanta International Airport (HJAIA) asked AECOM to further develop the sustainability initiatives identified in their Sustainable Master Plan (SMP) by creating a strategy for reaching their emissions reduction goals with a Climate Action Plan (CAP). As lead analyst for the HJAIA CAP, Mr. Thompson was responsible for preparing the comprehensive GHG emissions inventory and the evaluation of emissions reduction measures for their reduction potential and cost effectiveness.

Hartsfield Jackson Atlanta International Airport ISO 50001 Certification, Atlanta, GA. HJAIA asked AECOM to bring their Energy Management System (EnMS) into accordance with the certification requirements of ISO 50001. As lead analyst, was responsible for evaluation of energy consumption data collection against requirements of ISO 50001.

Multiple Climate Action Plans, Santa Clara County, CA. These Multiple Climate Action Plans developed for several municipalities in the Silicon Valley region provided a framework of initiatives to guide the local governments in reaching ambitious Greenhouse Gas emissions reduction goals. Provided analysis of the energy conservation measures including emissions

Jonathan Thompson Continued

reduction potential and capital costs, delivering the clients a matrix that prioritized the initiatives in their effectiveness and investment requirements.

United States Air Force Sustainable Infrastructure Audits Multiple Bases. The United States Air Force hired AECOM to provide an assessment of a number of bases both in the U.S. and international. Responsible for the on-site energy assessment of these facilities and the generation of energy conservation measures to provide energy efficiency and cost savings with the development of the assessment report provided to the client.

Town of Hempstead Energy & Greenhouse Gas Inventory, Hempstead, NY. Project engineer responsible for analyzing energy usage data and providing a report on GHG emissions and mitigation techniques that fed into the Town's over Energy and Sustainability Master Plan.

NYCDEP Greenhouse Gas Inventorying Task Order Contract, New York, NY. Project engineer responsible for data analysis, energy conservation measure development, and report production. Provided the NYCDEP with validation of inventories included in the New York City Mayor's Office PlaNYC 2030 inventory and delineated capital and operational improvements for NYCDEP to meet required reductions in GHG emissions by the 2017 city facility deadline.

NYCDOT Tappan Zee Corridor Improvements, New York, NY. Project engineer responsible for modeling traffic flow and also criteria pollutant and greenhouse gas emissions from the corridor for pre and post construction scenarios.

NYCDEP Owls Head WPCP Greenhouse Gas Reduction Feasibility Study, New York, NY. Lead analyst responsible for optimizing the energy inputs and usage at the Owls Head facility. The project was initiated in response to the NYC Mayor's plan to reduce city wide GHG emissions by 30% by the year 2017. The report provided a baseline inventory of GHG emissions and projections for GHG emissions after project implementation showing 72% reduction in non-biogenic emissions and 42% reduction in total emissions.

Jamaica Water Pollution Control Plant (WPCP) Odor Control System, New York, NY. Lead engineer for the design of the Jamaica WPCP Odor Control System, providing design calculations, process and sizing specifications.

Jamaica WPCP Biofilter Pilot, New York, NY. As the task leader for the Jamaica WPCP Biofilter Pilot project, had the lead role in facilitating project success from the initial design considerations to operating conditions of this project. The Biofilter project was a year-long pilot; the goal was to contain and treat effluent air from the primary clarifier section of the Jamaica WPCP. This successful pilot project proved the feasibility of Biofilter technology within the NYCDEP wastewater treatment system.

Croton Water Treatment Plant Final Environmental Impact Statement, New York, NY. Assisted in the production of the Croton Water Treatment Plant Final Environmental Impact Statement, July 2004, for the New York City Department of Environmental Protection. Responsible for researching and authoring several sections of the report and also providing site investigation and data analysis that established the statements findings. Also provided GIS imaging of natural resources affected within the construction area.

Earth Institute, Columbia University, Millennium Development Project, Infrastructure Development, Uganda, Kenya, Rwanda. As water research coordinator for the Millennium Development Project's piped water projects, represented the Earth Institute and acted as Technical Advisor to Millennium Promises to help facilitate design and construction of water systems in sub-Sahara Africa. Provided construction management of Uganda, Kenya, and Rwanda sites.

Uri Avin, FAICP, MCP

Transportation Lead

Education
Master of City Planning
Master of Architecture (Urban Design)
Master of Architecture
Bachelor of Architecture

License/Registration
Fellow of the American Institute of Certified Planners

Years of Experience
Total: 42 years

Publications
Avin, Uri, FAICP et al, Equity in Scenario Planning: HUD Guidance Paper,2014, HUD Capacity–Building Series for national Sustainable Communities Initiative program
Avin, Uri, Tools for Building Scenarios: Sorting out what to use when, Planning Magazine, December 2012
Avin, Uri; and Rodriguez, Daniel, The Role of Employment Subcenters in Residential Location Decisions, Discussion by Uri Avin and Daniel Rodriguez, Journal of Transport and Land Use, Vol 3, No 1, 2010
Avin, Uri; Cervero, Rober; and Moore, Terry, Forecasting Indirect Land Use Effects of Transportation Projects, NCHRP 25-25, Report Project 22, , December, 2007

Uri Avin is a Research Professor and Director of the Planning and Design Center (PDC) at the National Center for Smart Growth at the University of Maryland. PDC projects include land use planning, urban design, integrated land use/transportation planning, economic analysis, agricultural preservation, housing and environmental issues. Uri's 42 years of experience span both the public and private sectors. Prior to his appointment at UMD, Uri was the Practice Leader for Regional Growth Management with the large international infrastructure consulting firm of Parsons Brinckerhoff. Before joining Parsons Brinckerhoff, Uri was a Vice President with HNTB, a large, national planning, architecture and engineering firm and prior to its acquisition by HNTB, Uri was a principal with LDR International, a planning/urban design and landscape architecture firm with a national portfolio and reputation. During the decade of the 80s he served as a planning director or deputy director in Howard, Baltimore and Harford Counties where his innovative Smart Growth plans earned him national recognition. Uri's work has received 9 national and 21 state awards. His articles and papers are widely cited, he is a regularly featured speaker at national conferences and has also keynoted numerous conferences on Smart Growth and the land use/transportation connection. He served on the Board of the Center for Watershed Protection and on the Maryland's Climate Change Commission, Greenhouse Gas and Carbon Mitigation Work Group. He is also a member of the TRB's Committee on Transportation and Land Development and served on the Technical Committee of AMPO.

Climate Change Mitigation Analysis, Maryland Department of the Environment, MD. As project manager, supervised and participated in review of Statewide Climate Change Plan and developed options for additional land use/transportation mitigation measures and impact assessments on emissions.

Lake Tahoe GHG Scenario Analysis, NV. As project advisor for the MPO, oversaw the development of a alternative future scenario and the analysis of related GHG emissions from land use and transportation actions and policies using CarbonFIT and CommunityVIz.

MARC Scenarios and GHG Impact Analysis, Kansas City, KS. As project advisor for the MPO, oversaw the analysis of GHG emissions for two regional scenarios using CarbonFIT and CommunityViz.

CarbonFIT GHG Tool. As special advisor, contributed to development and beta-testing of new sketch planning tool to build development scenarios and evaluate their GHG impacts from buildings and transportation; uses CommunityViz as platform and provides default values or user determined options.

Scenario/Sketch Planning Tools for Regional Sustainability, NCHRP Project 8-36, Task 117. As principal investigator, applied research to enhance planners' understanding of software tools for regional scenario planning. Involves interviews with practitioners, case studies of applied projects and recommendations for guidance in practice.

Maryland Scenario Project, National Center for Smart Growth, University of Maryland. As special advisor, assisted Center staff and Advisory Committee in structuring a scenario-building process for an

Uri Avin, FAICP, MCP Continued

unprecedented Statewide planning effort allied with a statewide transportation modeling effort.

Statewide Fiscal Impact Analysis, NCSG. As project manager, helped develop analytical framework and execution of statewide infrastructure costs for Maryland's Roads, Schools and Wastewater Treatment to assess their sensitivity to alternative land use patterns.

Plan Update for Tysons Corner Edge City, Fairfax County, VA. As alternatives development lead, helped develop alternative concepts for the redesign of one of the largest and most mature Edge Cities in the country, suffering from an obsolete auto-dominant design and about to receive four transit stops in an extension of the Washington, DC Metro system. Work included the application of CarbonFIT, a sketch model developed by PB to assess the GHG impacts of alternative building and transportation plans.

Transportation/Land Use Policies, Montgomery County, MD. As project director, developed an approach for County to revise its land use/transportation policies and plans and assisted in scenario building and fine-tuning of growth-management tools in this sophisticated, growth-management environment.

Disney Impact Study, Prince William County, VA. As principal-in-charge, directed impact study and managed citizen task force effort under intense media scrutiny; mission to develop the appropriate county response to the proposed mega-theme park rezoning.

Sustain Southern Maine, Greater Portland Council of Governments, ME. As special advisor, assisted the MPO and Partners on this HUD Sustainable Communities grant to effect changes in housing affordability, transportation and energy cost reductions primarily through demonstration planning efforts.

Common Ground Regional Framework Plan, Northern Illinois Planning Commission, CH. As special advisor, helped agency develop an ambitious outreach program to the 240 municipalities in a six county, eight million person region. Assisted with application of the INDEX scenario-building tool and development of a regional Framework Plan.

Regional Development Plan 2040, Implementation Strategy Assistance, ARC, Atlanta, GA. Land use strategies lead for research-based project, drawing on peer MPO actions, to recommend implementation programs of action, legal under Georgia Law but perhaps underutilized, to local municipalities that can help implement the 2040 Plan.

Gateway 1 Corridor Action Plan, ME. Lead planning advisor for a multi-year planning study for the 120-mile US 1 corridor along Maine's coastline which bisects over 20 municipalities. Plan received EPA national Smart growth Award for 2010 and also cited as a national model in AASHTO's Corridor Approaches to Integrating Transportation and Land Use, 2009 and in the FHWA Livability in Transportation Guidebook, 2010.

Timothy Welch, JD, PhD

GHG Analysis + Modeling

Education
PhD, Urban and Regional Planning
Master of City and Regional Planning
Juris Doctorate
Bachelor of Laws
Bachelor of Finance & Business Administration

Years of Experience
Total: 8 years

Publications
Welch, T., Mishra, S. (2014) Envisioning an Emission Diet: Application of Travel Demand Mechanisms to Facilitate Policy Decision Making, *Transportation*. 41 (3), 611-631

Mishra, S., Welch, T. (2012). A Joint Travel Demand and Environmental Model to Incorporate Emission Pricing For Large Transportation Networks. Transportation Research Record: *Journal of the Transportation Research Board* 2302 (December 1): 29–41. doi:10.3141/2302-04.

Welch, T. F., & Mishra, S. (2014). A Framework for Determining Road Pricing Revenue Use and Its Welfare Effects. *Research in Transportation Economics*. 44, 61-70

Welch, T. F. (2013). Equity in transport: The distribution of transit access and connectivity among affordable housing units. *Transport Policy*, 30, 283-293. http://dx.doi.org/10.1016/j.tranpol.2013.09.020

Welch, T. F., & Mishra, S. (2013). A measure of equity for public transit connectivity. *Journal of Transport Geography*, 33, 29-41. http://dx.doi.org/ 10.1016/j.jtrangeo.2013.09.007

Erdogan, S., Welch, T., Knaap, G & Ducca, F. (2013). What to Expect In 2030: The Impacts of Fuel Prices and Fuel Efficiency on Land Use and Transportation. Transportation Research Record: *Journal of the Transportation Research Board*, 2397(1), 89-98.

Mishra, S., Welch, T., & Jha, M. K. (2012). Performance Indicators for Public Transit Connectivity in Multi-Modal Transportation Networks. *Transportation Research Part A: Policy and Practice*, 46(7), 1066–1085. doi:10.1016/j.tra.2012.04.006

Welch, T., (2014, November). Climate Action Plans – Fact or Fiction? Evidence from Maryland. 61st Annual North American Meetings of the Regional Science Association International, Washington, DC (National)

Tim Welch is an Assistant Professor of City and Regional Planning and Assistant Director of the Center for Quality Growth and Regional Development at Georgia Tech and an Affiliate at the National Center for Smart Growth at the University of Maryland. Tim is an expert in transportation, freight and emissions modeling with an extensive background in transportation related research. Dr. Welch provided research assistance on numerous projects as a Faculty Research Associate at the National Center for Smart Growth including ongoing development and management of the Maryland Statewide Transportation Model and many other projects sponsored by the Maryland DOT, Department of Environment, Department of Planning and Federal Highway Administration. Dr. Welch's current research focuses on transportation systems analysis, with extensive work in developing travel demand and emissions forecasting models and finding new and innovative ways to apply models to urban problems. Dr. Welch is the author of over forty-five articles in refereed journals, book chapters, and conference proceedings. He serves as a member of the Transportation Research Board's Transportation and Air Quality (ADC20) and Freight Economics and Regulation (AT010) committees.

Climate Action Plans – Fact or Fiction? Evidence from Maryland. Author; while plans have proliferated across the nation, little has been done to examine closely the ability of the policies to achieve climate change mitigation goals through enumerated strategies. This thesis fills part of the research void by examining all of the built environment emissions reduction strategies specified in the Maryland CAP. The analysis proceeds by developing multiple models calibrated with local empirical data. The results of this analysis show that Maryland, even with a successful implementation of its CAP will not meet its carbon mitigation targets. To address climate change adequately, Maryland should take a three-prong approach. First, strengthen the mitigation strategies that show the greatest potential to reduce CO2 while abandoning strategies that do not. Second, extend the current set of strategies to include the low hanging and quickly implementable mitigation 'fruit'. Third, in the face of serious and inevitable climate change, begin to adapt the built environment for better resiliency to more extreme conditions.

Timothy Welch, JD, PhD Continued

A Data Driven Approach to State Transportation Investment Decisions: a Transportation Project Investment and Evaluation Resource (T-Pier). The primary objective of this research was to provide a data-driven resource that planners and engineers, policymakers, service providers and researchers can use to determine how investments should be made in the future by balancing available recourses to maximize ROI. The project developed a comprehensive decision support system in one (T-PIER) equipped to examine the performance of multiple transportation system performance objectives in small and medium scale transportation networks with multiple interacting modes. The tool will assist transportation planners and engineers determine the optimal allocation of projects to maximize a bundle of benefits when resources are limited and scarce.

Freight Impacts on Small Urban and Rural Areas. This study focuses on the impacts of freight activity on rural and small urban areas, using hyper-local data to analyze current and forecasts of future truck movements along rural corridors. The study improves upon existing research by integrating the use of real-time (GPS) truck activity data, growth in major economic sectors, detailed route information and growth in port activity to analyze the flow of freight and its impact on smaller geographic areas.

National MAP-21 Implementation and Monitoring. This project examines the efforts that states and MPOs have undertaken to adopt a performance-based planning process, by contextualizing the relevance of adopted measures and comparing to other important indicators. Based on this work, and supplemented by information collected from DOTs and MPOs, a national database to benchmark performance progress was developed. The database development process identified desired transportation system performance characteristics and performance measures and evaluates them within the context of specific performance targets.

Frederick Ducca, PhD

GHG Analysis + Modeling

Education
PhD, City Planning
Masters, Business Administration
Bachelor of Science, Mathematics

Years of Experience
Total: 35 years

Publications
Ma, T., Ducca, F., Welch, T., Yoder, SL., Moeckel, R. Megaregions-the Economic Ties: a Case Study of the Chesapeake Megaregion. Transportation Research Board (Presented at the 93rd TRB Annual Meeting, January 2014)

Ducca, F., Weidner, T., Moeckel, R., Mishra, S. Exercising the Mega-region Analysis Framework in the Chesapeake Bay Area; Compendium of Papers at the 92nd Annual Meeting of the Transportation Research Board, Washington D.C., January 2013 http://amonline.trb.org/

Erdogan, S., Ducca, F., Zhou, J.,Mollanejad, M., Patnam, K. Large Scale Dynamic Traffic Routing for Statewide Transportation Planning: Application of TRANSIMS in Maryland Conference on Agent-Based Modeling in Transportation Planning and Operations October, 2013

Ducca, F, Moeckel, R., Mishra, S., and Weidner, T. (2012). A mega-region approach to planning for a High Energy Price Future. Transportation Research Board, (Presented at 91st TRB Annual Meeting,).

Ducca, F., Moeckel, R., Mishra, S., Weidner, T. A Megaregion Framework for Analyzing a High Energy Price Future; Compendium of Papers at the 91st Annual Meeting of the Transportation Research Board, Washington, D.C. January, 2012 http://amonline.trb.org/

Liu, C. , Ducca, F., "Exploring the Influences of Urban Form on Travel and Energy Consumption Using Structural Equation Modeling (SEM)" Using National Household Travel Survey Data for Decision making : A Workshop Transportation Research Board, Washington, D.C. June, 2011

Weidner, T., Moeckel;, R., Ducca, F., Yoder, S. A Framework for Mega-regional Analysis, Computers in Urban Planning and Urban Management, Annual Meeting, Lake Louise, Alberta, Canada. July 5-8 2011

C. Liu, and F. Ducca. 2011. Exploring the Influence of Urban Form on Travel and Energy Consumption: A Tour-based or a Trip-based Analysis? (Presented at 91st TRB Annual Meeting,).

Mishra, S., Ye, X., Ducca, F., and Knaap, G. (2011). A Functional Integrated Land Use-Transportation Model for Analyzing Transportation Impacts in the Maryland-Washington D.C. Region, in Journal of Sustainability Science Policy and Practice, vol.7(2), pp. 1-10.

Mishra, S., Ducca, F., Mahaparta, S., and Ye, X. (2011). Socio-economic Data Reconciliation Procedure in Maryland Statewide Transportation Model: Challenges, Current Solutions, and Future Steps. Scheduled for Presentation at TRB 2011 Using Census Data for Transportation Applications Conference, Irvine, CA, October, 2011.

C. Liu, F. Ducca, and Q. Shen, "Role of the Built Environment on Travel Behavior and Energy Consumption: Additional Evidence on the Influence of Urban Form on Travel". Presented at the 52nd Association of Collegiate Schools of Planning (ACSP) Conference, Salt Lake City, UT. 2011 October.

Fred Ducca directs the Transportation Policy Research Group at the National Center for Smart Growth Research and Education. His three main interests are (1) Improving analytic procedures: For the Maryland State Highway Administration Fred has managed the development of the Maryland Statewide Transportation Model (MSTM) for the last five years. This model has been continually improved since its inception with addition of auto ownership models, destination choice as a replacement for trip distribution and the development of an integrated land use/transportation component. Fred currently manages the development of a statewide analytic DTA for the MSTM package, enabling users to have a much better understanding of travel by time of day (2) Illustrating the results of analytic procedures: While model results are usually very understandable to modelers, they are often not presented in a way which provides easy understanding to other users or the general public. GIS and other visualization tools, combined with model output, can greatly assist in presenting results to a non-technical audience. (3) Transportation impacts on Emissions: New highway projects play a role in both Greenhouse gas and criteria pollutant emissions. Travel modeling

Frederick Ducca, PhD Continued

and emissions models can help to understand how transportation projects will affect emissions. Models of this type can also be used to estimate the impacts of zero emission vehicles on emission.

Prior to the NCSG Fred was with the Federal Highway Administration for 30 years. For the FHWA he managed the Travel Model Improvement Program (TMIP). The TMIP improved both the state of the art and state of the practice in travel forecasting and provided training on new methods. Fred also provided direct 'hands on' technical assistance to State governments and MPOs on travel forecasting issues around the US.

Maryland Statewide Transportation Model, MD. Managed the development of the MSTM since arriving at the NCSG. The MSTM team consists of graduate students and professional staff at the NCSG as well as support from Parsons Brinckerhoff. The MSTM is a multi-layer, state-of-the-practice travel demand model that has been developed for the State of Maryland. The model includes a national layer to cover long-distance travel and a statewide layer to cover shorter trips. Freight flows and person trips are distinguished, and modeled travel demand has been reconciled with two urban models.

Statewide Analytic DTA. To understand the time of day of travel, an analytic DTA is being implemented within the MSTM. This will operate at a lower level of detail than urban area DTAs and will enable a much better understanding of travel by time of day. It will enable long distance trips, which currently may take more than five hours to cross the state, to reflect the amount of time taken to cross the state and at what time periods their travel occurs.

Development of place types and accessibility, Maryland Department of Transportation, MD. Manages the development of accessibility maps. These maps enable users to view how accessible individual areas are to opportunities are within Maryland. Four types of accessibilities are illustrated, walk, bike, transit and auto.

Transportation and Emissions Modeling, Maryland Department of the Environment, MD. Manages a program to support local governments in estimating the impact of proposed highway projects on greenhouse gases and criteria pollutants. In addition, the NCSG is testing the effect of introducing zero emission vehicles, either electric vehicles or other types, on overall air quality.

Rolf Moeckel, Dr.-Ing.

GHG Analysis + Modeling

Education
Doctorate of Engineering, Spatial Planning (equivalent to PhD)
Diploma in Engineering, Spatial Planning (equivalent to Masters degree)
Pre-diploma in Engineering, Spatial Planning (equivalent to Bachelor degree)

Years of Experience
Total: 12 years

Publications
Moeckel, R., Donnelly, R. (forthcoming) Gradual rasterization: Redefining spatial resolution in transport modelling. In: *Environment & Planning B*. Accepted for publication, awaiting proofs.

Moeckel, R., Mishra, S., Ducca, F., Weidner, T. (forthcoming) Modeling complex Megaregion systems: Horizontal and vertical integration for a Megaregion Model. Submitted for publication to the International Journal of Transportation.

Moeckel, R. (2015) Modeling constraints versus modeling utility maximization: Improving policy sensitivity for integrated land-use/transportation models. In: *Proceedings of the 94th Annual Meeting of the Transportation Research Board (TRB)*. Washington, D.C. January 11-15, 2015.

Moeckel, R., Fussel, R., Donnelly, R. (2015) Mode choice modeling for long-distance travel. In: *Transportation Letters. The International Journal of Transportation Research*, vol. 7(1), Pages 35-46.

Mishraa, Sabyasachee, Iseki, Hiroyuki, Moeckel, Rolf (2014) Multi entity perspective freight demand modeling technique: Varying objectives and outcomes. In: Transport Policy, Volume 35, September 2014, Pages 176–185.

Moeckel, R. (2013) Firm location choice vs. employment location choice in microscopic simulation models. In: Pagliara, F., de Bok, M., Simmonds, D. and Wilson, A. (Eds.): Employment location in cities and regions: models and applications. Advances in Spatial Science Series. Springer Verlag. 223-242.

Mishra, S., Welch, T., Moeckel, R., Mahapatra, R., Tadayon, M. (2013) Development of Maryland Statewide Transportation Model and Its Application in Scenario Planning. In: *Proceedings of the 92nd Annual Meeting of the Transportation Research Board (TRB)*. Washington, D.C. January 13-17, 2013.

Moeckel, Rolf, Donnelly, Rick (2011) Nationwide Estimate of Long-Distance Travel. Generating External Trips for Local Travel Demand Models. In: Proceedings of the 52nd Annual Meeting of the Transportation Research Forum (TRF). Long Beach CA

Donnelly, Rick, Erhardt, Gregory D., Moeckel, Rolf, Davidson, William A. (2010): Advanced Practices in Travel Forecasting. A synthesis of Highway Practice. NCHRP Report 406.

Moeckel, Rolf (2009): Simulation of firms as a planning support system to limit urban sprawl of jobs. In: Environment and Planning B: Planning and Design vol. 36. 883-905.

Rolf Moeckel is a faculty research assistant at the National Center for Smart Growth Research and Education. His main interest is to understand how computer modeling may support urban and regional planning. Rolf primarily focuses on three areas of modeling:

1. Integrated land-use/transportation: Since accessibilities affect location decision of households and businesses and since locations of households and business establishments define travel demand, the land-use and transportation systems are tightly integrated. This so-called land-use/transportation feedback cycle can be represented in integrated land-use/transportation models. Rolf has developed and implemented three land-use models and continues researching how to integrate such models with travel demand models.

2. Statewide modeling: To support regional and statewide planning, statewide or even megaregional travel demand models help decision makers prioritizing projects and policies. Rolf has worked on eight statewide models across the country and is one of the key architects of the Maryland Statewide Transportation Model. Within these models, Rolf has designed and implemented long-distance travel demand models for both person travel and freight travel.

3. Spatial resolution: A continuous challenge in modeling is finding the appropriate level of resolution in attributes, geography and time. Rolf has extensively compared microscopic with aggregate models and continues analyzing the impact of spatial resolution on modeling performance.

Rolf Moeckel, Dr.-Ing. Continued

Prior to joining the National Center for Smart Growth, Rolf worked with the consulting firm Parsons Brinckerhoff, where he developed a wide range of models, including activity-based, mode choice, land use and freight models.

Maryland Statewide Transportation Model (MSTM), MD. The MSTM is a multi-layer, state-of-practice travel demand model that is under development for the State of Maryland. The model includes a national layer to cover long-distance travel and a statewide layer to cover shorter trips. Freight flows and person trips are distinguished, and modeled travel demand has been reconciled with two urban models.

Simple Integrated Land Use Orchestrator SILO, MD. To better understand the integration between land use and the transportation, the land use model SILO (Simple Integrated Land Use Orchestrator, www.silo.zone) has been enhanced and implemented for the State of Maryland. Special attention is given to the representation of constraints in location choice, such as budget restrictions or travel time limitations.

Development of a multi-level freight model for Chicago, IL. To represent long-distance flows, a commodity flow forecast was converted into truck flows, while routing selected flows through distribution centers and warehouses, marine ports, rail yards or airports. A methodology was developed to model short-distance trucks based on available count data, employment data and density estimates. The model system was fully integrated with a person travel demand model and used to analyze infrastructure expansions.

Modeling frameworks for person and freight travel for the Province of Ontario. Funded by the Ministry of Transportation, frameworks were developed to model person travel and freight travel. The framework covered both short-distance and long-distance travel, including external travel to/from other provinces and the United States.

Sevgi Erdogan, PhD

GHG Analysis + Modeling

Education
PhD, Civil Engineering
MS, Operations Research
MS, Civil Engineering
BS, Surveying Engineering

Years of Experience
Total: 18 years

Publications
Ting Ma, Chao Liu and Sevgi Erdogan. Bicycle Sharing and Transit: Does Capital Bikeshare Affect Metrorail Ridership in Washington, D.C.? (Accepted for presentation and publication), 94th Annual Meeting of the Transportation Research Board, Washington, D.C., January 12-16, 2015.
Sevgi Erdogan, Cinzia Cirillo and Jean-Michel Tremblay. Ridesharing as a Green Commute Alternative: A Case Study at the University of Maryland Campus. International Journal of Sustainable Transportation, 9 (5), 377-388, 2015.
Sevgi Erdogan, Timothy Welch, Gerrit J. Knaap, G. and Fredrick W. Ducca. What to Expect in 2030: The Impacts of Fuel Prices and Fuel Efficiency on Land Use and Transportation. Transportation Research Record, Volume 2397(Planning), 89-98, 2013.
Sevgi Erdogan and Elise Miller-Hooks. A Green Vehicle Routing Problem.
Transportation Research Part E: Logistics and Transportation Review, 48(1), 100-114, 2012.

Sevgi Erdogan is faculty research associate at the National Center for Smart Growth Research and Education (NCSG) at the University of Maryland. Dr. Erdogan's research fields and applied work span a wide range including transportation planning and operations, dynamic network modeling and optimization, dynamic traffic assignment and its applications, advanced travel demand modeling, travel demand management with emphasis on congestion pricing and energy efficient modes, travel behavior analysis, land use-transportation policy and smart growth, emissions mitigation and adaptation to climate change. At the NCSG, Dr. Erdogan conducts research as PI, Co-PI or senior researcher for various projects such as development of a dynamic statewide transportation model for the state of Maryland, developing local methods for modeling, economic evaluation, justification and use of the value of travel time reliability in transportation decision making, and the Maryland Scenarios Project.

She is member of the Statewide Multimodal Transportation Planning subcommittee (ADA10) of the Transportation Research Board and friend of the following committees: Network Modeling (ADB 30), Transportation Demand Forecasting Committee (ADB40), and Environmental Analysis in Transportation (ADC10). Her research has been presented at several conferences and published in peer-reviewed journals. She serves on the editorial advisory board of the journal Transportation Research Part E: Logistics and Transportation Review and serves as reviewer for nine academic journals.

Inclusion of time dependent networks in statewide travel demand models, Federal Highway Administration, MD. Principle investigator for project to advance statewide transportation modeling practice by demonstrating improvements offered by using time-dependent, person-based analyses. Such a prototype is being developed using the Maryland Statewide Transportation Model (MSTM). The project demonstrated the effectiveness of this approach in representing temporal and spatial changes in traffic flow. The project contributes to improving existing dynamic network modeling capabilities by demonstrating application to large scale networks.

Modeling Support on GHG Impacts of Transportation Projects, Maryland Department of Environment, MD. Co-principal investigator for project that aims to assist the MDE with transportation modeling for the local jurisdictions in the Baltimore and Washington metropolitan areas. Modeled emissions that result from locally selected individual or packaged transportation projects provide local decision makers with valuable information in selecting transportation projects that help Maryland meet its clean air and greenhouse gas reduction goals.

Maryland Scenarios Project, Maryland Department of Transportation, MD. Research associate for the Maryland Scenarios project that is a multi-year effort led by the NCSG to explore alternative futures for the State of Maryland and to identify policy interventions that would lead to more desirable outcomes. The project involves testing combinations of land use and transportation alternatives to determine their impact

Sevgi Erdogan, PhD Continued

on travel and congestion and other impacts, including GHG emissions, through scenario analysis. Five land use and three groups of transportation scenarios and their combinations have been analyzed so far.

Transportation system redundancy analysis, Baltimore Metropolitan Council, MD. Lead researcher for this project that aimed to support regional homeland security planning activities for the Greater Baltimore Region funded by Baltimore Metropolitan Council (BMC). The study examined the ability of the transportation network and services to withstand shocks and disruptions resulting from natural or man-made hazards and events, and develop contingency measures and strategies to cope with the resulting travel demand patterns under constrained supply conditions. Modeled Baltimore metropolitan and subarea networks, estimated dynamic OD demand and conducted scenario analysis.

Integrated Corridor Management, Federal Highway Administration, DC Metro Area. As researcher, led this project for FHWA to analyze the potential benefits of Integrated Corridor Management (ICM). Also executed the work on demonstrating the potential impacts of various demand management strategies (HOV/HOT lanes and value pricing) on the Baltimore-Washington DC I-95 corridor. Designed and conducted sensitivity analysis to illustrate the short and long term effects of value pricing strategies.

A Dynamic Subarea OD Trip Demand Estimation Method (Southern California Association of Governments and FHWA), CA. Lead researcher for this project that developed a procedure for subarea network extraction and origin-destination (OD) demand estimation for Intelligent Transportation Systems (ITS) applications. Developed a two-stage subarea OD demand estimation procedure to construct and update important time-dependent OD demand input for subarea analysis in an effort to overcome the computational limits of DTA methodologies. This procedure was later applied to estimate OD demand for several networks: e.g. Los Angeles, Beijing, and Baltimore.

Veronica Davis, PE

Strategies + Built Environment

Education
Master of Regional and Urban Planning, Land Use and Environmental Planning, Cornell University, 2003
Master of Engineering, Civil Engineering, Cornell University, 2003
BS, Civil and Environmental Engineering, University of Maryland College Park, 2001

License/Registration
Professional Engineer: DC, MD, VA, NC, GA

Years of Experience
Total: 14 years

Affiliations
American Planning Association
American Society of Civil Engineers
National Society of Black Engineers

Awards & Recognition
White House Champion of Change, Transportation Innovator, 2012
Urbanful, 20 People Making DC

Publications + Presentations
Davis, Veronica O. and Chancee' Lundy. *Preventing the Sustainability Divide: Engineers as Leaders in Community Outreach*, Annual Conference, National Society of Black Engineers, Toronto, Canada, April 1, 2010

Corning, Bruce, Steve Nesbitt, and Veronica O. Davis. *A Sustainable City*, 94th Annual Conference, International City/County Managers Association, Richmond, VA, September 21-24, 2008

Pallansch, Karen, Stephen Hayashi, Bruce Corning, and Veronica O. Davis, *Implementation of Sustainability is a Grassroots Effort*, Proceedings, Water Environment Federation Sustainability Conference, June 2008

Davis, Veronica O., *Impact of Transit Stations on Land Use and Development: Shady Grove Metro Station Case Study in the Washington, DC Metropolitan Area*, Proceedings, Transportation, Land Use Planning, and Air Quality Conference, TRB and ASCE, Orlando FL, July 9-11, 2007

Veronica Davis is an experienced civil engineer and urban planner. She has twelve years of experience in project management, planning, and public engagement. Ms. Davis manages transportation planning, economic analysis, market analysis, planned development, policy development, and long-range planning; provides technical analyses on land use, transportation, development suitability, zoning, and urban design; and conducts sustainability analysis and facilitates sustainability training for municipal clients. She has worked on a variety of topics, including corridor planning, developing master plans, and transit oriented development analysis. Prior to founding Nspiregreen, she worked as an urban planner for the City of Alexandria, Virginia and as a highway planning engineer for the Federal Highway Administration.

North-South Corridor Planning Study, District Department of Transportation, Washington, DC. Task manager for public engagement for the study to develop and evaluate improved surface transit alternatives in a nine-mile corridor between Takoma/Silver Spring and Southwest in DC. She was directly responsible for developing the outreach strategy, executing a public involvement plan to engage stakeholders, overseeing the development presentation materials for the public meetings, attending established community meetings on behalf of the project team, and insuring all outreach initiatives comply with Title VI. She supported the planning tasks, which included the development of Tier I and Tier II evaluation matrices, refinement of alignments, and selection of alternatives advanced for detailed analysis in a Phase 2: environmental study.

EnergySmartDC – Comprehensive Energy Plan, District Department of the Environment, Washington, DC. Serves on the technical team for the development of the District's energy profile. Responsible for collecting an analyzing data for the transportation sector, which includes fuel consumption of motor vehicles and electricity consumption of rail/metro and rail/metro stations. Provides quality control on the development of the comprehensive energy plan.

moveDC, Long Range Multimodal Transportation Plan, District Department of Transportation, Washington, DC. Nspiregreen was a part of the consultant team responsible for developing the 2040 multimodal transportation plan. Directly responsible for planning and executing a community strategy with the goal of engaging over 10,000 unique people. The communication strategy included bus shelter

Veronica Davis, PE Continued

ads, large community meetings around the District, interagency and community advisory groups, pop-up meetings, online surveys, webinars, and social media. Nspiregreen was responsible for outreach to Title VI groups and other underrepresented populations such as youth and seniors. In addition to outreach for the public meetings, Nspiregreen managed all the social media accounts, which included Twitter, Facebook and Flickr.

Project-level Transportation Conformity Determination for Fine Particulate Matter (PM2.5) for the Inter-County Connector, Federal Highway Administration, MD. The Inter-County Connector was the first highway project in the country required to undergo a PM2.5 hot spot analysis as part of the National Environmental Protection Act. Veronica was one of the lead authors of the conformity determination, which included a qualitative analysis and coordination between Federal Highway Administration, US Environmental Protection Agency, and Maryland State Highway Administration. The conformity determination and associated response to over 300 air quality comments were included in the Record of Decision.

Alexandria Waterfront Small Area Plan, Department of Planning and Zoning, Alexandria, VA. As project manager, oversaw the master planning process for the Alexandria Waterfront. Directly responsible for analyzing existing conditions to determine project constraints, challenges and opportunities, including analysis of current and projected demographics, zoning restrictions based on Federal settlement agreements, historic properties, property ownership, parking utilization rates, existing transportation and circulation, and economic development potential. During this time, developed principles to guide the conceptual plan, such as using art for place-making, adaptive reuse of historic buildings, and flood mitigation as urban design. Planned and executed extensive community outreach and engagement plan, which included two walking tours along the waterfront, boat tour, full-day community visioning workshop/charrette, field trip to New York City, and community informational meetings.

Eisenhower West Industrial Use Study, Department of Planning and Zoning: Alexandria, VA. As the project manager, was responsible for the study to determine the feasibility of converting land used by medium to heavy industrial facilities and freight rail near the Van-Dorn Metrorail Station into transit-oriented development. Determined potential land use scenarios for each property based on site conditions, zoning, environmental regulations, neighborhood character, trip generation, and transit ridership potential. The study including an analysis of impacts on infrastructure, cost of environmental remediation, and return on public investment.

Braddock Metro Neighborhood Community Funds, Department of Planning and Zoning, City of Alexandria, VA. As project manager, worked with the Deputy City Manager and the Director of Development to develop funding formulas for developer contributions to fund over $9 million of community amenities and open space in the neighborhood near the Braddock Road Metrorail Station. The formulas were tiered based on projects in the development pipeline and density allowed by zoning and the small area plan. This included developing costs estimates for land acquisition and development costs to create a one-acre neighborhood park. She co-authored the funding policy approved by the Planning Commission and City Council.

Chanceé Lundy

Strategies + Built Environment

Education
Master of Science, Civil Engineering (Environmental), Florida State University, 2006
Bachelor of Science, Environmental Science, Alabama Agricultural and Mechanical University, 2002

Years of Experience
Total: 13 years

Affiliations
Water Environment Federation
National Society of Black Engineers
Women's Transportation Seminar

Publications
Davis, Veronica O. and Chanceé Lundy. *Preventing the Sustainability Divide: Engineers as Leaders in Community Outreach*, Annual Conference, National Society of Black Engineers, Toronto, Canada, April 1, 2010

Chanceé Lundy is a community-conscious engineer. She uses her passion for the transformation of blighted communities as fuel to provide technical competence and adept communication on civil infrastructure projects. She has extensive experience in environmental engineering and facilitating community trainings and workshops. Ms. Lundy has worked on a variety of environmental and infrastructure topics including: air permitting, solid and hazardous waste management, greenhouse gas emissions reductions, storm water management, regulatory compliance and federal reporting, energy, transportation, and low impact development. She previously served as an environmental specialist at Texas Instruments.

GHG Emissions Reduction, Texas Instruments. Led the GHG emissions reduction team tasked with developing reduction strategies that would be implemented globally in Texas Instruments manufacturing facilities. Lead team and managed projects to reduce PFC Emissions by 2010 to 10% of the 1995 baseline. The team began with a broad list of best practices and measured practicality based on ease of implementation and cost benefit without disruption to continuous manufacturing operations. Ms. Lundy and the team narrowed the broad list to three primary recommendations for presentation to executive management. These recommendations included the introduction of green chemistry, technology/process changes and equipment change outs. Future emissions were forecasted based on each scenario. Further, each of these were evaluated for their ability to meet aggressive PFC reduction goals overall impact to operations from a cost/benefit perspective and maintenance issues, in addition to company interest. Chancee supported the feasibility analysis and developed the plan, which prioritized and detailed implementation strategies.

EnergySmartDC – Comprehensive Energy Plan, District Department of the Environment Washington, DC. Ms. Lundy serves as the local project manager for the development DDOE's Comprehensive Energy Plan (CEP). As a part of the project team, she is directly responsible for project management including performance and delivery as well as planning and executing stakeholder engagement and public information sessions about the CEP. In addition, Ms. Lundy was the technical lead for the energy and environment section determining the impact of the District's energy supply choices on the environment.

Consolidated Total Maximum Daily Load Implementation Plan and Revised Monitoring Program, District Department of the Environment, Washington, DC. To satisfy requirements contained in the Municipal Separated Storm Sewer System MS4, DDOE is developing a Consolidated TMDL implementation plan and Revised Monitoring Framework to submit to the US Environmental Protection Agency by May 2015. Ms. Lundy is the project manager for Nspiregreen's portion of the project which includes modeling to deliver the Baseline Analysis, GIS mapping, conducting a Gap Analysis, development/ redevelopment forecasting, website development and stakeholder outreach.

North-South Corridor Planning Study, District Department of Transportation, Washington, DC. As part of the DC Streetcar Program, the purpose of the North-South study is to evaluate improved surface transit alternatives in a nine-mile corridor between Takoma (DC)/Silver Spring (MD) and Southwest (DC). Over 90,000 diverse stakeholders live, work, and/or play in the corridor. Chanceé is directly responsible for

Chanceé Lundy Continued

engaging stakeholders, such as Howard University and Howard University Hospital.

Solid Waste Management Study, Department of Public Works, Washington, DC. Nspiregreen was a part of a team tasked with identifying three to five solid waste management scenarios for reduction, collection, disposition and diversion of the District's solid waste. This study analyzed the environmental media used in each stage of the waste collection and disposition process and would go further to analyze the scenarios for their economic and social value.

DC Circulator Transit Development Plan, 2014 Update, District Department of Transportation, Washington, DC. The District Department of Transportation is updating the Transit Development Plan for the DC Circulator Bus. Nspiregreen is responsible for planning and executing six Pop-Up Meetings around the city to solicit feedback from current and future riders on the DC Circulator bus system. This includes writing a press release, developing a social media schedule, creating a format to engage residents at the pop-up meetings.

moveDC, Long Range Multimodal Transportation Plan, District Department of Transportation, Washington, DC. Nspiregreen is a part of the multimodal long-range plan consultant team, responsible for outreach and mobilization of the community through organizing and social media management. Nspiregreen is directly responsible for planning and executing large community meetings around the city, managing social media accounts related to the project, planning and facilitating social media meet-ups, and participation in advisory group meetings. Nspiregreen is also responsible for outreach to Title VI groups and other underrepresented populations, which includes planning a meeting for non-profits to connect transportation with the services they provide and getting their commitment to outreach to their clients and members. Going above and beyond the call of duty, made phone calls to invite members of the community that do not have access to the Internet.

Kenya Goodson, PhD

Strategies + Built Environment

Education
PhD, Civil and Environmental Engineering, University of Alabama, 2013
Master of Science, Environmental Management, Samford University, 1999
Bachelor of Science, Chemistry, Stillman College, 1999

Years of Experience
Total: 16 years

Affiliations
American Society of Civil Engineers
Association of Women in Science
National Society of Black Engineers

Publications
Identification and Treatment of Emerging Contaminants in Wet Weather Flows – Final EPA Report, US EPA, 2013

Dr. Goodson is an environmental consultant currently working on Nspiregreen's environmental projects for the District of Columbia's Metro area, including stormwater implementation and solid waste. She has extensive quantitative research experience that will be beneficial for retrieving information that will assist with guidelines for the GHG emission reduction goals. Dr. Goodson has an interdisciplinary background in chemistry, public health, and environmental engineering. She provided technical support with the District Department of Environment's Consolidated Implementation Plan. She also provided research on data on land use-based event mean concentrations, pollution removal efficiencies on structural best management practices, and non-structural best management practices. Previously, Dr. Goodson was a researcher for a collaborative research project with EPA on the impact of emerging contaminants on US waterways through stormwater runoff and wastewater effluent impacted by stormwater infiltration.

Brookland Livability Study, Washington, DC. Working on the summarization of existing studies for the Brookland and Edgewood area to assist with understanding the needs and proposed transportation and environmental measures for the study area. She will assist with site evaluations in the study area to provide an existing environmental assessment and recommendations.

Consolidated TMDL Implementation Plan, Washington, DC. Responsible for conducting research and statistical analysis on event mean concentrations (EMCs) and stormwater best management practices (BMPs) for the Modeling Tool for the Consolidated TMDL Implementation Plan. She has extensive research skills that assisted the Team in collecting data for the TMDL IP Modeling Tool that was used for estimating pollutant loads for DC's MS4 area. Dr. Goodson collected data from literature research on event mean concentrations specific to land use and land cover, pollutant efficiencies for structural best management practices (BMPs) from pollutant TMDLs specific to the District of Columbia, non-structural BMP implementation (qualitative and quantitative), and bacterial source tracking (BST) implementation. For the IP Development Forecast, Dr. Goodson assisted in classifying ownership and sub ownerships for the GIS maps used for the Forecast Tool and calculating percentage areas for ownership and sub ownerships. She also assisted in preparing important memorandums included in the Implementation Plan.

US EPA's Identification of Emerging Contaminants in Wet Weather-Tuscaloosa, AL. Conducted research on an EPA project identifying emerging contaminants, a relatively new category of pollutants, in wastewater systems. She provided literature on various types of emerging contaminants and their treatability in combined sewers and separate sanitary sewers. She used her research in a comparison analysis in treatability in unit processes of the sewer system during dry weather conditions and wet weather conditions.

Site Assessment and Inspections for private On-site Sewage Disposal Systems, Tuscaloosa, AL. Performed site assessments for individual properties for approving onsite sewage disposal systems. She reviewed the area for drainage areas, potable water systems, rivers, streams, and parcel boundaries, which OSDS have to maintain a certain distance from. She also assessed soil conditions and water percolation to ensure suitability for the installation of OSDS. She issued permits for new and existing (repair) installations and ensured the Alabama state regulations for onsite disposal systems were correctly implemented.

Andrea Bohmholdt, CPM

Economic Analysis

Education
MS, Applied Economics, Utah State University, 2007
BS, Economics, University of Utah, 2001

License/Registration
Certified Project Manager

Years of Experience
With AECOM: 4 years
Total: 14 years

Affiliations
E3, Economists for Equity and the Environment
Sustainable Remediation Forum (SURF)

Publications
Bohmholdt, Andrea, (2014) "Evaluating the Triple Bottom Line Using Sustainable Return on Investment." Remediation Journal, Volume 24, Issue 4, pp. 53-64, Autumn 2014.
Bohmholdt, Andrea, (2010) 101 Ways to Reduce Your Carbon Footprint, Silverleaf Press.
Bohmholdt, Andrea, Commissioner Lawrence Brenner and Michael Lee (2010) Renewable Energy Portfolio Standard Report of 2010, Maryland Public Service Commission (PSC).
Bohmholdt, Andrea (2010) Annual Report on the Status of Wind-Powered Generating Stations in the State of Maryland, Maryland Public Service Commission.
Bohmholdt, Andrea, Michael Lee, et al. (2010) Ten Year Plan (2009 – 2018) of Electric Companies in Maryland, Maryland Public Service Commission.
Burtis, Bill, Iain Watt, Arjun Bhoopal and Andrea Bohmholdt (2008) "Getting to Zero: Defining Corporate Carbon Neutrality." Published by Clean Air-Cool Planet and Forum for the Future.
Bohmholdt, Andrea (2007) "Benefit Cost Analysis of a Wind Turbine for Utah State University." Master's Thesis, Utah State University.
Bohmholdt, Andrea, Kevin Brady, Paul Jakus and Sandra Reategui (2007) "An Empirical Study of the Demand for Electricity by Residents of Logan, Utah." Working paper, Utah State University

Andrea Bohmholdt has a Master's Degree in Applied Economics, specializing in Natural Resource and Environmental Economics and has been successfully performing economic analyses for government agencies, private and non-profit organizations. Her capabilities include statistics, benefit-cost analyses, economic impact assessments, linear programming, econometric modeling, life-cycle cost analyses, cost effectiveness and incremental cost analyses, forecasting, recreation assessments, and risk and uncertainty analyses. Prior to working for URS, she managed the Renewable Energy Portfolio Standard for the State of Maryland and was also the Maryland Technical Representative for the Regional Greenhouse Gas Initiative. In 2010, Ms. Bohmholdt authored the book, 101 Ways to Reduce Your Carbon Footprint. She was a spotlight speaker at the 2008 USU Climate Conference and also chosen to represent the conference with an interview on a local radio talk show. Recently she spoke at the Ninth International Battelle Conference on Remediation of Chlorinated and Recalcitrant Compounds in Monterey, CA and the 2014 International Workshop on Environment and Alternative Energy hosted by NASA at the Kennedy Space Center. She will be speaking at the upcoming Air & Waste Management Associations 2015 Annual Conference.

State of Maryland 2011 Greenhouse Gas Emissions Reduction Act (GGRA) Climate Action Plan, MD. In 2009, enacted the GGRA which requires the State to develop and implement a Plan to reduce GHG emissions 25 percent from a 2006 baseline by 2020. The Plan must create jobs and contribute to the recovery of Maryland's economy. Development of the Plan, which spanned over 3 years, was led by the Maryland Department of the Environment (MDE) and involved the collaboration of 9 other state agencies, universities, and many stakeholders. As technical lead for Category 2, was responsible for estimating economic impacts of Plan implementation, quantifying the GHG emission reductions expected from implementing the strategies of the Plan, developing the GHG emission inventory, leading stakeholder meetings, and writing sections of the report while employed at MDE. The Plan is comprised of 65 strategies which are expected to meet the 2020 target while also contributing to the restoration of the Chesapeake Bay, improved air quality and visibility, and reductions in mercury emissions. The Plan includes a comprehensive baseline GHG emission inventory of the entire State from 2006 and "business-as-usual" projections for 5, 10, and 15 year time horizons. The inventory is divided into 8 major source categories including: electricity supply; residential, commercial, and industrial fossil fuel combustion; transportation; industrial processes; fossil fuel industry; waste management; agriculture; and forestry and land use. Once the Plan

Andrea Bohmholdt, CPM Continued

is fully implemented, annual benefits of $6.1 billion are expected and approximately 36,000 jobs will be created.

Sustainable Network (SUSNET), Sustainable Return on Investment (sROI) Analysis. As task manager, developed a model to use in conjunction with SimaPro, a software designed to perform life cycle analysis for remediation projects. The model monetizes the economic, social and environmental benefits for future remediation projects using the results of the life-cycle analysis of the project.

City of San Jose, Economic Analysis for Biomass and Biosolids Gasification Feasibility Study for the Environmental Services Department, San Jose, CA. As technical specialist, prepared economic and financial pro forma analysis for a demonstration and commercial-scale gasification facility that will produce synthetic natural gas from construction and demolition waste and biosolids from treated wastewater sludge. At commercial scale, the project may provide compressed natural gas (CNG) as an alternative transportation fuel. This project is assisting the City of San Jose with strategic planning to develop, implement, and document organic conversion technology projects in order to achieve the goals of the City's Zero Waste Strategic Plan. The conversion facility will increase landfill diversion, generate renewable energy, and reduce greenhouse gas emissions.

DuPont, Sustainable Return on Investment (sROI) Analysis for Brevard Remediation Project, Brevard, NC. Task manager for project to repurpose a retired manufacturing site for parks and public space, the on-site landfills required remediation. The landfills contained approximately 40 million pounds of polyethylene terephthalate (PET). An sROI analysis was used to determine whether recycling the PET materials would be beneficial financially, socially, and/or create a more environmentally sound project compared to the traditional remedy of disposing the materials off-site.

DuPont, Sustainable Return on Investment (sROI) Analysis for Deepwater Remediation Project, Deepwater, NJ. Task manager for benefit-cost and financial analysis evaluating the economic, social and environmental value of 6 remediation strategies for the sustainable remediation of a potential plume at the Chamber Works facility.

US Department of the Air Force, Shaw Air Force Base Annual Air Emissions Inventory, Sumter, SC. As technical specialist, assisted with the annual air emissions inventory, including actual annual and potential emissions of criteria pollutants, hazardous air pollutants, and toxic air pollutants for each stationary source category on the base.

Washington County, Forty West Landfill Annual Air Emissions Inventory, Hagerstown, MD. As technical specialist, assisted with the annual air emissions inventory, including actual annual and potential emissions of criteria pollutants, hazardous air pollutants, and toxic air pollutants from landfill operations.

Charles County Department of Public Facilities, Charles County Landfill No 2 Annual Air Emissions Inventory, Waldorf, MD. As technical specialist, assisted with the annual air emissions inventory, including actual annual and potential emissions of criteria pollutants, hazardous air pollutants, and toxic air pollutants from landfill operations.

USACE, Sustainable Return on Investment (sROI) Analysis for Design/Build of Intelligence Community Campus, Bethesda, MD. Task manager for an existing government campus on 46 acres that is being redeveloped as an Intelligence Community Campus for 3,000 workers. To be sure that the Federal government invests in justified sustainability initiatives while also meeting Federal mandates and executive orders, a sROI analysis was conducted. Financial analysis evaluating the economic, social and environmental value of sustainable investment strategies for two new buildings and three existing buildings. Sustainability strategies addressed air quality, stormwater and wastewater management, renewable energy, energy efficiency, and LEED Silver certification. The campus will be designed with the intention of net zero stormwater run-off and net zero energy consumption.

Jason Weiss, CFM

Economic Analysis

Education
Master of Science, Resource Economics and Policy, University of Maine, 1999
Bachelor of Industrial Engineering, University of Minnesota, Duluth, 1993

License/Registration
Certified Floodplain Manager, Association of State Floodplain Managers

Years of Experience
With AECOM: 14 years
Total: 20 years

Affiliation
Association of State Floodplain Managers

Training and Certification
Deepdraft Navigation for Planners and Economists, USACE

Mr. Weiss has 20 years of professional experience as a researcher and consultant in the fields of economics, planning, engineering, and community development. Mr. Weiss specializes in applied economic and socioeconomic analyses, including benefit-cost analysis, economic impact assessment, incremental cost analysis, commodities forecasting, regional input-output modeling, forecasting, recreational assessments, and socioeconomic impact analysis. He has performed flood damage reduction, navigation, environmental restoration, and recreation projects. Mr. Weiss has successfully completed economic analyses and managed projects for federal (including USACE, FEMA, NRCS, SBA, FAA and NOAA), state, municipal, and private clients.

Federal Highway Administration, Smart Roadside Initiative Macro Benefit Analysis. As project manager and economist, developed a benefit-cost analysis tool to evaluate technologies associates with the smart roadside initiative. The tool estimates the economic, social, and environmental benefits and costs of the technologies. The tool was developed for use by state-level planners and economists.

USACE Baltimore District, Sustainable Return on Investment (sROI), Bethesda, MD. Conducted a benefit-cost analysis that evaluated the triple bottom line, the economic, social and environmental value of investment strategies for two new buildings and three existing buildings at a Government campus. Strategies addressed air quality, stormwater management, renewable energy, energy efficiency, and LEED Silver certification.

Johns Hopkins University, Sustainable Return on Investment, Baltimore, MD. Evaluated the financial and sustainable return on investment for various energy efficiency measures for two laboratory buildings on the campus of Johns Hopkins University.

San Antonio River Authority, Sustainable Return on Investment (sROI) East Salitrillo Restoration Project, TX. Integrated triple bottom line and sROI concepts to provide a broad understanding of the impacts associated with a streambank restoration project. The study conducted research and developed a model that monetized economic, social, and environmental factors. The results were presented and refined during a workshop with staff and stakeholders to demonstrate the sROI process and assessment.

Massachusetts Department of Transportation, Solar Demonstration Project, Boston, MA. Responsible for creating business models and financing options that were considered to determine the most beneficial option for MassDOT to pursue for a solar PV system. Economic analysis evaluated each option based on technical and legal feasibility, life-cycle costs and benefits to MassDOT, and the time required for project implementation.

NOAA, Economic Analysis of Critical Habitat Designation under the Endangered Species Act. In the role of project manager and economist, analyzed economic efficiency and distributional effects, including direct, indirect, and induced economy wide impacts, of proposed critical habitat designation for the smalltooth sawfish located in southern Florida. A comprehensive approach based on economic, ecological, and biological analyses was undertaken to provide an overall analysis capable of withstanding the scrutiny of the Federal court system.

Department of the Army, Environmental Cost Standardization. Developed methodology and produced the Environmental Cost Standardization (ECS) model to estimate the Army environmental requirement costs for conservation and compliance. The cost variables

Jason Weiss, CFM Continued

were determined based on historical execution data, published standards, and expert opinion. Regressions analyses were performed to determine significant variables and correlations between variables. The model includes installations for active Army Active, Army Reserve, and National Guard. Performed technical review on the previous version of ECS model and methodology.

USTDA, Aquaculture Ecosystem Restoration, Pak Phanang, Thailand. Performed an economic analysis on ecosystem restoration alternatives for the USTDA Coastal Restoration and Feasibility Study in the Pak Phanang River Basin, Thailand. The study involved the definition of the implementation approach, budget requirements and economic, financial, environmental, and social benefits of the identified alternatives.

USACE Buffalo District Blanchard River Watershed, General Investigation Feasibility Study, OH. Conducted plan formulation and economic analysis for the Blanchard AFB portion of the General Feasibility Investigation for Findlay and Ottawa study areas. Complex analysis incorporated multiple tributaries and season conditions.

City of Charles Town, Fiscal Impact Analysis and Development of Capital Improvement Plans, Charles Town, WV. As project manager and economist, conducted economic assessments of the potential benefits and costs associated with proposed residential and commercial developments in the City of Charles Town, West Virginia. Project included the development of a fiscal impact model, a capital improvement plan, and triennial reviews. These assessments provide the clients with information regarding the current state of their finances, projected fiscal impacts, and appropriate financial and economic tools for minimizing or enhancing these impacts.

USACE Buffalo District, Section 206 Ecosystem Restoration Study, Little Cuyahoga River, OH. Assessed the ecosystem restoration benefits of 32 measures over seven river segments. Conducted cost effectiveness and incremental cost analyses to identify the National Ecosystem Restoration plan which maximizes the environmental benefits.

USACE St. Paul District, RED, OSE, and Transportation Analysis, Fargo, North Dakota & Moorhead, MN. As project manager and economist, developed the regional economic development (RED), other social effects (OSE), and transportation analysis portions of the Fargo-Moorhead Flood Risk Management Feasibility Study. Analyses were developed based on interviews conducted in the study area, historical data, trade industry data, and extensive literature review. The comprehensive analyses were completed while meeting a very tight schedule.

North Carolina Department of Transportation, TIGER Grant Application. Prepared the economic analysis for two TIGER grant applications. The goal of one project was to reduce congestion by increasing roadway capacity and improving interchanges in a rapidly growing area. The goal of the other was to improve port operations by expanding a terminal and revising the infrastructure. The economic analyses accounted for a wide range of impacts and estimated the benefits and cost of each project.

NRCS Arkansas, Big Slough Watershed Flood Damage Reduction Study, Piggot, AR. Performed economic analysis of flood damage reduction alternatives for Big Slough Watershed near Piggot, AR. Alternatives include the construction of up to seven dams located throughout the watershed. The economic analysis measured the full impacts of the alternatives, including damage to residential and commercial structures, impacts to transportation, agricultural damages, damages to infrastructure, and environmental concerns. Evaluation tools included HEC-FDA, agricultural damage model developed in-house, and Marshall & Swift.

USACE Galveston District, Mississippi River-Gulf Outlet (MRGO) Deep-Draft De-Authorization Study, New Orleans, LA. As project manager and economist, led a multi-disciplinary study involved economic analysis, website design, public involvement, engineering analysis, environmental analysis, and cultural resource analysis. Produced draft report and performed incremental economic analysis on the impacts of the de-authorization of deep-draft navigation on MRGO. The economic analysis involved estimating the transportation inefficiencies from vessels not being able to use the MRGO, the impact to businesses from not having a deep-draft channel and the real estate relocation expenses for firms with facilities on the MRGO.

Jane Atkinson

Strategies + Built Environment

Education
ME, Chemical Engineering, Cooper Union, 1997
BE, Chemical Engineering, Cooper Union, 1996

License/Registration
Professional Engineer: New York

Years of Experience
With AECOM: 16 years
Total: 18 years

Publications
"NYCDEP Steps to GHG Reduction" Conference Proceedings, 2011 New York Water Environment Association Annual Conference (with others)
"Pilot Study for the Applicability of Biofilter Odor Control Technology for Use at New York City Water Pollution Control Plants," 2008 Water Environment Federation Specialty Conference on Odor and Air Emissions (with others).
"Estimation of Air Emissions Resulting from Implementation of Supplemental Carbon to Enhance Denitrification for the NYC Stepfeed BNR WPCPs," Water Environment Federation WEFTEC 2007 Conference (with others).
"Determination of Methanol and Ethanol Biodegradation Rates for the New York City Step-Feed Biological Nutrient Removal Water Pollution Control Plants," Proceedings of the 2007 Water Environment Federation Specialty Conference on Nutrients (with others).

Jane Atkinson leads AECOM Water's Environmental Group in New York City. She is a project manager with extensive experience in wastewater treatment, environmental analysis for regulatory compliance, greenhouse gas mitigation and energy reduction. Her expertise includes assessment of environmental impacts using water and air quality modeling, development of mitigation strategies, wastewater treatment process design, regulatory compliance determinations, and emission reduction credit procurement.

She brings significant experience in air quality assessment, greenhouse gas inventorying, and developing regulatory compliance strategies. Her work integrating sustainability and climate change adaptation strategies into the operation of the NYCDEP's facilities is just one example of how she brings innovation and quality to projects. Her planning efforts will potentially reduce greenhouse gas emissions by up to 50% from forecasted emissions levels in 2017.

Long Island Regional Sustainability Plan, Long Island, NY. Served as technical lead for water management in this ACEC Diamond Award winning project. Work entailed conducting working group meetings with various municipalities, agencies, universities, and environmental groups to determine which measures could be taken to reduce GHG emissions, promote economic development, reduce climate change impacts, and improve water quality Island-wide. The final report was issued to NYSERDA in April 2013 and will prompt a second phase of funding for selected measures.

World Bank Carbon Abatement Planning Tool (CURB). Served as technical lead for water and wastewater sector in the development of a carbon abatement planning tool to be used by various municipalities and countries in the developing world. The tool will facilitate a step-by-step community carbon abatement planning process that allows the user to understand their community's carbon emissions and the contributing source activities, identify and prioritize emission abatement opportunities, develop locally appropriate interventions, set emission targets, and begin implementation. Developed GHG emissions calculations in accordance with GPC and IPCC for wastewater treatment types ranging from direct discharge of untreated wastes to decentralized latrines and septic systems to centralized lagoon systems and activated sludge plants with and without nitrogen removal. Quantified the capital costs, operating costs, and energy requirements to upgrade wastewater treatment processes to higher levels of treatment and implement various optimization activities.

PlaNYC GHG Mitigation Study and Economic Assessment, New York, NY. Served as technical lead for water management and addressed crossover and synergies with waste management sector. Made recommendations for potential levers to reduce GHG emissions City-wide by 80% by 2050. Worked with the Mayor's Office of Long Term Planning and Sustainability, various agencies (including DEP), and environmental groups to further develop ideas to achieve this amibitious goal.

Jane Atkinson Continued

Greenhouse Gas Emissions Reduction and Climate Change Management Program, New York City Department of Environmental Protection, New York, NY. Served as project manager of New York City Department of Environmental Protection's (NYCDEP's) planning project to reduce GHG emissions in compliance with PlaNYC goals. The project developed a strategic plan for NYCDEP to reduce GHG emissions by 30% below to FY2006 baseline by FY2017, despite numerous new mandated energy-intensive facilities and processes coming on-line in the years leading up to FY2017. The project scope includes preparing annual GHG emissions inventories for over 500 NYCDEP facilities in accordance with LGOP v1.1, forecasting a business-as-usual GHG emissions inventory for FY2017 using information from NYCDEP's $20 billion capital plan from which proposed modifications can be assessed, performing a desktop analysis using five years of process data of over 30 operating facilities to identify methods with the greatest impact to reducing GHG emissions, conducting on-site facility audits at seven facilities to identify both operational modifications and financially viable capital projects, and develop a contracting mechanism to encourage GHG reduction and energy efficiency in all future projects.

Energy Planning for DEP Wastewater Treatment Plants, New York, NY. Served as project manager of a comprehensive energy reduction initiative for NYCDEP. Work entailed conducting detailed facility audits of eight WWTPs to identify operational and capital modifications to improve energy efficiency and reduce GHG emissions. Audits were conducted in accordance with ASHRAE Level II and Local Law 87. At the conclusion of the audit and analysis, a comprehensive Energy Master Plan was developed for each facility, including a detailed end use analysis, benchmarking against similar facilities, numerous energy conservation measures (ECMs) covering both process and building-side improvements, a detailed GHG emissions profile for each measure, and life cycle cost analyses for all viable measures.

Owls Head Water Pollution Control Plant Study, Design, and Construction, New York City Department of Environmental Protection, New York, NY. Served as project engineer on the conceptual design of improvements to the digester gas system at Owls Head WWTP. The improvements will increase the Plant's utilization of digester gas and reduce its dependence on diesel fuel. As a result, emissions of greenhouse gases and criteria pollutants will be greatly reduced.

City of San Jose Greenhouse Gas Reduction Strategy, San Jose, CA. Served as technical lead for wastewater treatment. Work entailed review of the process of the San Jose WWTP, review of 10-year capital invenstment plan, quantification of potential GHG emissions increases/decreases based on project description (in compliance with LGOP v1.1), and recommendations for additional GHG reduction and energy efficiency measures for the City to consider.

Rockaway Water Pollution Control Plant Facilities Plan and Design, New York City Department of Environmental Protection, New York, NY. Environmental task leader for the Phase 1 upgrade of the Rockaway water pollution control plant for the New York City Department of Environmental Protection. During conceptual design, consulted with the client on ways to integrate sustainability and climate change adaptation strategies into the design. Assessed the vulnerability of the main sewage pump motors to storm surges and helped develop ways to mitigate this risk.

Biological Nutrient Removal Research Program, New York City Department of Environmental Protection, New York, NY. Project engineer for the citywide advanced wastewater treatment programmatic assistance project. Provided design guidance for biological nutrient removal processes and associated systems. Updated the citywide programmatic environmental assessment statement to include the analysis of environmental impacts resulting from supplemental carbon addition, sludge trans-shipment, and the SHARON process. Developed chemical handling and air emissions modeling (TOXCHEM) guidance documents.

Amruta Sudhalkar

Strategies + Built Environment

Education
MCP, Environmental Planning & Policy, Massachusetts Institute of Technology, 2010
ME, Environmental & Water Quality, Massachusetts Institute of Technology, 2010
BS, Environmental Management and Technology, Rochester Institute of Technology, 2007

Years of Experience
With AECOM: 2 years
Total: 4 years

Amruta has experience in providing technical and policy-based guidance on climate change mitigation and adaptation planning to public sector clients. Prior to joining AECOM, Amruta worked at ICLEI-Local Governments for Sustainability, an association of local governments, where she designed a training curriculum and delivered trainings to local governments on various topics related to climate change mitigation planning, such as conducting greenhouse gas (GHG) inventories, setting a GHG reduction target, developing and implementing a climate action plan, and measuring/monitoring progress towards GHG reduction targets.

World Bank Abatement Tool, Washington, DC. Project analyst in the development of an excel-based tool which can help local governments complete each stage of the climate change mitigation planning process, such as conducting a greenhouse gas (GHG) emissions inventory and forecast, setting a GHG reduction target, and developing strategies to reduce GHG emissions. Amruta's responsibilities in this project include the development of GHG inventory and forecast calculators for sectors such as energy and solid waste, GHG abatement calculators for sectors such as solid waste, and GHG abatement cost calculators for sectors such as solid waste and transportation.

LA Metro Energy and Resource Report Project, Los Angeles, CA. Project analyst in the development of an annual energy and resource report, which indicates LA Metro's sustainability performance in various areas such as energy/water consumption, waste generation, and greenhouse gas (GHG) emissions. Responsibilities in this project included a GHG emissions analysis of Metro's operations, and the development of a GHG emissions calculation template for future reports.

City of Beaumont, Beaumont Climate Action Plan, Beaumont, CA. Deputy project manager for developing a Climate Action Plan (CAP) for the City of Beaumont. The CAP was funded by grants to the City from Southern California Edison and the Southern California Gas Company. The project included development of a greenhouse gas (GHG) inventory; GHG projections; advising the City on setting a GHG reduction target; identification of additional local policies and programs that would contribute to achievement of the target; and recommendations of which policies and programs to pursue based on an economic assessment of each of the policies and programs. Led tasks on completing the GHG inventory, GHG projections, target-setting, and developing GHG reduction policies and programs for inclusion in the CAP.

County of Santa Clara, Silicon Valley 2.0, Santa Clara County, CA. Project analyst in the development of municipal climate action plans for multiple cities in Santa Clara County. Responsibilities in this project included conducting forecasts of emissions in the transportation sector, and checking and verification of GHG reduction calculators in the transportation sector.

Cape Cod Commission, Triple Bottom Line Decision-Making Tool, Barnstable County, MA. Project analyst for the development of a climate change impact calculator for the Triple Bottom Line (TBL) tool to assist the Commission in the selection of wastewater treatment alternatives to reduce nutrient loading in marine water bodies, with the aim of optimizing economic, social and environmental outcomes. The impact of treatment alternatives on climate change was one of the environmental outcomes considered in the project.

Pacific Gas and Electric Company (PG&E) Green Communities Training Program, San Francisco, CA. As program trainer, designed a training curriculum, and provided training, technical support, and ad hoc auditing services for the completion of either municipal or community-wide inventories for over 100 local governments in California via the use of tools developed by ICLEI-Local Governments for Sustainability.

Amruta Sudhalkar Continued

Department of the Environment Greenhouse Gas Inventory, Washington, DC. As project analyst, provided training, technical support, and ad hoc auditing services for the Washington DC Department of the Environment on their district-scale and community-scale GHG inventory.

US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Nationwide. For PG&E, Oregon Department of Environmental Quality, and University of Colorado, served as a note-taker and facilitator for the protocol steering committee and various technical advisory committees responsible for the development of protocol content. Also compiled and incorporated public comments into various sections of the protocol, and proof-read sections prior to the release of the final protocol version.

Gerrit Knaap, PhD

Economic Analysis

Education
PhD, Economics,
Master of Science, Economics
Bachelor of Science, Economics

Years of Experience
Total: 31 years

Affiliations
Smart Growth Subcabinet, State of Maryland
Maryland Sustainable Growth Commission
Zoning Advisory Panel, Maryland-National Capital Park and Planning Commission (former member)
Editorial Board, Journal of Urbanism
Science and Technical Advisory Committee, Chesapeake Bay Commission (former member)

Publications
Knaap, Gerrit-Jan and Rebecca Lewis, 2012, Institutional Foundations for Sustainability Planning: Lessons from State Development Plans, *State and Local Government Review*; 44, 1: 33-44

Chakraborty, Arnab, Nikhil Kaza, Gerrit-Jan Knaap, and Brian Deal, 2012, Robust and Contingent Plans: Scenario Planning for an Uncertain World, *Journal of the American Planning Association*; 77,3: 251-266.

Mishra, Sabyasachee, Xin Ye, Fred Ducca, and Gerrit-Jan Knaap, 2011, A functional integrated land use-transportation model for analyzing transportation impacts in the Maryland – Washington, DC region. *Sustainability: Science, Practice, and Policy*; 7,2: 60- 69.

Sohn, Junyul and Gerrit-Jan Knaap, 2010, Maryland's Priority Funding Area and the Spatial Pattern of the New Housing Development, *Scottish Geographical Journal*, 126: 2, 76-100.

Gerrit-Jan Knaap, Kieran Donaghy and Nancy Brooks eds, The Oxford Handbook of Urban Economics and Planning, *Oxford Handbooks*, Hardcover – 2011

Knaap, Gerrit-Jan, Huib Haccou, Kelly Clifton, and John Frece, eds, Incentives, Regulations, and Plans: The Role of States and Nation-states in Land Use Planning, London, UK: Edgar Alger, 2006.

Knaap, Gerrit J., ed., Land Market Monitoring for Smart Urban Growth, Cambridge, MA: Lincoln Institute of Land Policy, 2001.

Juntunen, Lorelei, Gerrit-Jan Knaap, and Terry Moore, 2012, Fiscal Impact Analysis and the Costs of Alternative Development Patterns, in Brooks, Nancy, Kieran Donaghy, and Gerrit-Jan Knaap, Ed.s, *Oxford University Press Handbook on Planning and Economics*, Oxford, UL: Oxford University Press.

Knaap, Gerrit-Jan and Rebecca Lewis, 2009, Growth Patterns and Trends. In G. K. Ingram, A. Carbonell, Y-H. Hong, & A. Flint (Eds.) Smart Growth Policies: An Evaluation of Programs and Outcomes. Cambridge, MA: Lincoln Institute of Land Policy.

Bult-Speiring, Mirjan and Gerrit-Jan Knaap, 2006, Examples of Joint Venture Projects in the USA, in Mirjam Bult-Spiering, Geert Dewulf, Strategic Issues in Public-Private Partnerships: An International Perspective, Oxford, UK: Blackwell Publishers, LTD.

Knaap, Gerrit-Jan, 2004, Comment, in Anthony Downs, ed, Growth Management and Affordable Housing, Washington, DC: Brookings Institution.

Since 2002 Gerrit Knaap has been the Professor of Urban Studies and Planning, School of Architecture, Planning, and Preservation, and also the Executive Director, National Center for Smart Growth Research and Education (NCSG), both at the University of Maryland, College Park. He has executed numerous projects for public sector clients on economic and growth management issues and has a longstanding relationship with MWCOG and the region's Counties planning staffs and leadership. He has published over 100 peer refereed journal articles, authored, coauthored, or coedited eight books, and more than 30 book chapters. Several of these papers are highly cited and were judged worthy of awards. Under his leadership the NCSG has grown to a staff of approximately 30 scholars and academic professionals and an annual budget of approximately three million dollars. As Center Director he also serves on Maryland's Sustainable Growth Commission and Smart Growth Subcabinet. His areas of focus include Scenario development, Smart Growth Policy, Housing Markets and Policy, Urban Economics and Planning, Economic and Community Development, Transportation and Environmental Policy. He oversees numerous projects at the NCSG, many of which involve transportation and land use polices at the regional and statewide scale.

PRESTO (Plan for Regional Sustainability Tomorrow). Grant-funded scenario based planning to explore policies that will increase the environmental, social and economic sustainability of the Baltimore/Washington

Gerrit Knaap, PhD Continued

region. Effort deploys and couples several leading edge models (e.g. transportation, land use, water and air quality) to test impacts of alternative land use/ transportation patterns and policy assumptions.

Reality Check and Reality Check PLUS. High profile outreach efforts statewide to solicit public opinion about growth location preferences as input into a large scale Visioning effort by numerous stakeholders including the NCSG.

Opportunity Mapping for Maryland. An emerging tool to assess locational access to multiple kinds of opportunities has changed the nature of planning for equity. The NCSG completed such an effort for the Opportunity Collaborative, Baltimore's Sustainable Communities Initiative, and has now applied it to the State of Maryland to benefit local planning processes. The new interactive online mapping tool for the State of Maryland – OppMapp – is a leading edge example of this democratizing analytical tool.

Purple Line Corridor Coalition. Initiative to create a corridor –wide forum to address numerous impacts that will result from the new light rail project that spans 16 miles across two counties through very diverse neighborhoods. Extensive analysis and mapping executed to lay the groundwork for coming to grip with issues of displacement and gentrification that often accompany such major capital investments. Coordinating consensus-building around County compacts with Hispanic stakeholder group.

1.3. Similar Project Experience

The AECOM team, including the key personnel shown on our org chart, has extensive experience successfully completing similar projects. We have provided detailed project descriptions on the following pages as well as client references for each in Chapter 4.

PlaNYC GHG Mitigation Study + Economic Assessment

New York, NY

Firm
AECOM

Completion
2013

Client
New York City Department of Environmental Protection

Key staff
Brian Goldberg, Claire Bonham-Carter, Culley Thomas, Jonathan Thompson, Jane Atkinson

AECOM was tasked by Mayor Bloomberg's Office of Long Term Planning and Sustainability to look beyond the goals and strategies of the current PlaNYC 2030, and its goal of achieving a 30% greenhouse gas reduction by 2030, to an 80% reduction by 2050. PlaNYC 2030 has made great progress for the City, including achieving a 16% reduction in emissions to date (2012/2013) from 2005 levels and now wishes to consider how it might achieve the New York State goal of 80x50. The project, funded by NYSERDA's Greener Greater Communities Fund, had three main components.

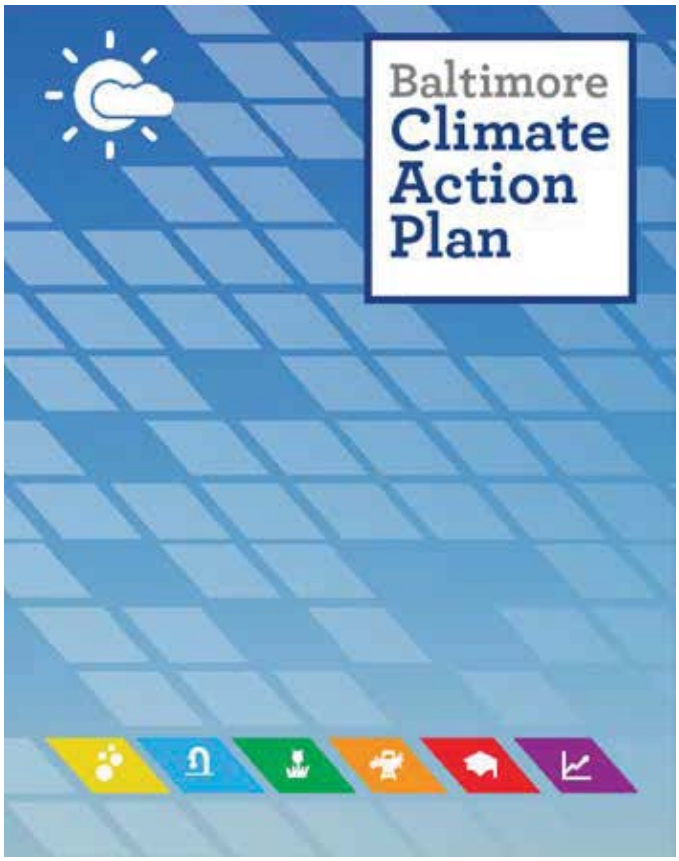
The first task included analysis to work out whether such a reduction goal is technically possible, at what societal cost, and to determine which actions would need to be taken in the next five years to make sure the City sets the right course to achieve it.

The second task included an economic and fiscal impact analysis of key GHG reducing policies within PlaNYC 2030 as well as proposed action for the 80x50 plan. This analysis utilized a customized REMI model to evaluate construction, operations and maintenance, and long-term productivity benefits accruing to the city's economy, with particular emphasis on policies leading to energy reduction in buildings.

Finally, the City wanted to develop a deeper understanding of their greenhouse gas emissions—what activities are causing these emissions where, and how this information can be used to pinpoint where specific emissions reduction measures should be implemented. The third task included an audit of the current City GHG inventory, a review of emerging GHG inventorying protocols that the City might elect to adhere to for future iterations of the inventory and an analysis of data necessary for attributing GHG emissions more discretely throughout the city.

Baltimore Climate Action Plan

Baltimore, MD



Firm
AECOM

Completion
2012

Client
City of Baltimore Offi ce of Sustainability

Key staff
Brian Goldberg, Claire Bonham-Carter, Culley Thomas

AECOM was retained by the City of Baltimore to develop a Climate Action Plan (CAP) that would help the City achieve its goal of a 15 percent reduction in GHG emissions by 2020. AECOM guided the Baltimore Office of Sustainability and an Advisory Committee comprised of approximately 30 representatives of City Departments, State Agencies, Utilities, the Sustainability Commission, NGOs, and citizen representatives through the creation of the CAP.

The final plan established targets and developed strategies for the city's 621,000 residents, that in addition to achieving a 17 percent reduction in GHG emissions by 2020, would also save energy and water, reduce waste, modernize buildings, and improve the public realm. The CAP also builds upon the City's 2009 Sustainability Plan and contributes to Maryland's Greenhouse Gas (GHG) Emissions Reduction Act, requiring the state to implement a plan that achieves GHG emissions reductions by 2020.

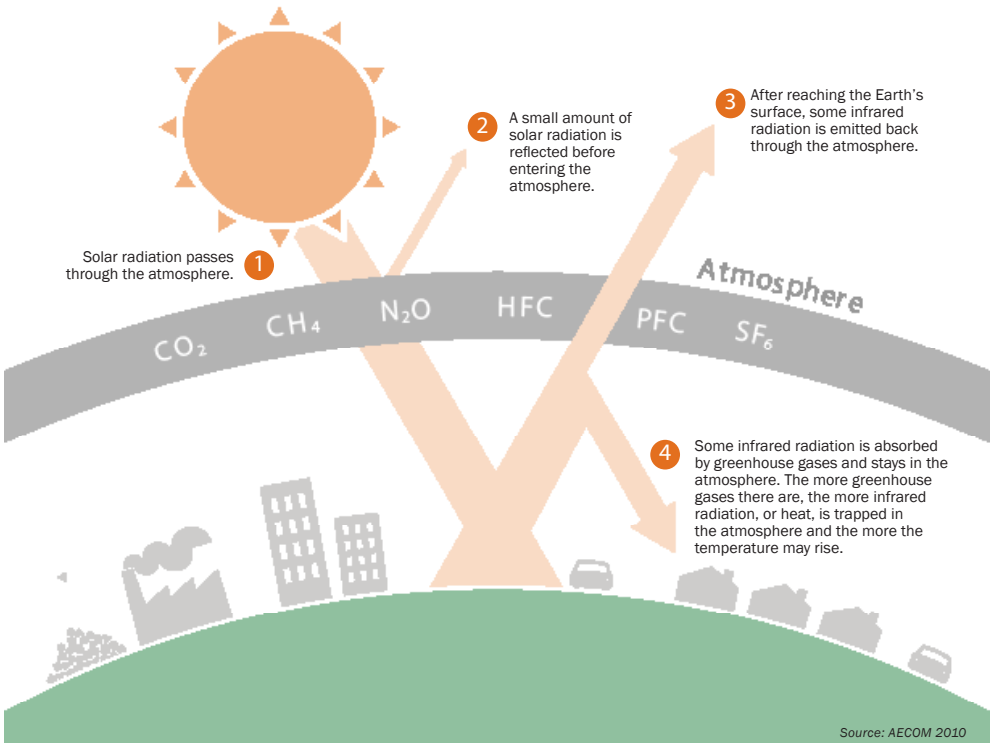
Specifically, AECOM reviewed the 2010 ICLEI-protocol GHG inventory and reductions anticipated from current mitigation activities, projected the level of GHG emission reductions required by 2020, conducted a gap analysis of current activities, and identified potential mitigation strategies, for discussion with the advisory committee and city staff drawing from previous AECOM work and other best practices from the US and internationally.

Once a short list of feasible measures was agreed upon, AECOM used its proprietary CAP Toolkit to demonstrate potential GHG reductions of certain measures. This

quantitative output empowered city leaders to make decisions about the political, technical, and economic feasibility of strategies that achieve reduction targets. This process generated a final list of quantified emissions reduction strategies and an overall GHG reduction target for the city.

AECOM also commissioned an animation that demonstrates tangible steps residents can take to meet the CAP's goals. Endorsed by the City's Sustainability Commission and Baltimore's Mayor, and then approved by City Council in 2012, the CAP is now being used to guide effective decision-making and the strategic allocation of the City's resources as Baltimore takes its next steps to reduce GHG emissions.

Figure 2 The Greenhouse Effect and Greenhouse Gases



Source: AECOM 2010

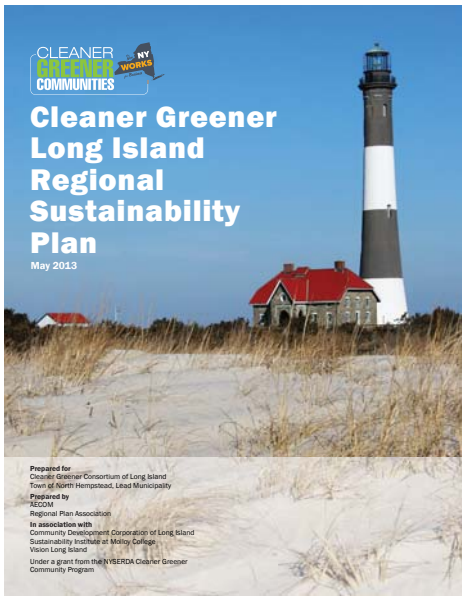
Although there are dozens of GHGs, the Intergovernmental Panel on Climate Change (IPCC) identifies six primary GHG compounds (shown in Figure 2), including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) as the predominant GHGs found in non-industrial processes. Each type of GHG has a different capacity for trapping heat and, therefore, GHG emissions are "equalized" by their global warming potential (GWP) and are reported in this CAP in "Metric Tons of CO_2 equivalents" (MT CO_2e). For example, 1 ton of CH_4 has the same contribution to the greenhouse effect as approximately 21 tons of CO_2 on a 100-year timescale and would, therefore, have a CO_2e of 21 tons. Listed in Table 1 are the primary GHGs, along with their symbols, GWP, and common human-generated sources.

Table 1 Primary Greenhouse Gases

Symbol	Name	GWP (MT CO_2e)	Human-generated Sources
CO_2	Carbon Dioxide	1	Fossil fuel combustion, forest clearing, cement production
CH_4	Methane	21	Fossil fuel combustion, landfills, livestock, cultivation
N_2O	Nitrous Oxide	310	Fossil fuel combustion, nylon production
HFC	Hydrofluorocarbons	140–14,800	Refrigeration gases, semiconductor manufacturing
PFC	Perfluorocarbons	6,500–12,200	Aluminum production, semiconductor manufacturing
SF_6	Sulfur Hexafluoride	23,900	Electrical transmissions and distribution system, circuit breakers

Long Island Regional Sustainability Plan

Long Island Region, NY



Firm
AECOM

Completion
2013

Client
Town of North Hempstead, lead community of the Cleaner Green Community Consortium

Key staff
Diane Dale, Brian Goldberg, Claire Bonham-Carter, Culley Thomas, Jonathan Thompson, Jane Atkinson

AECOM was lead consultant to the Cleaner Greener Consortium of communities across Long Island, New York, to prepare the Long Island Regional Sustainability Plan under a grant from the New York State (NYS) Energy Research and Development Authority (NYSERDA). The Plan establishes a growth framework for a region of more than 3 million people, covering 1,400 sq mi with 700 different governmental jurisdictions and entities. The plan is intended to inform land use policies, guide public and private investment in infrastructure and promote energy, sustainability, and climate adaptation policies and practices. The plan provides a toolkit of specific actions communities can implement that support NYS's goal of reducing GHG emissions 80 percent by 2050, while promoting green jobs and economic development.

AECOM received a Diamond Award for Excellence in Engineering from ACEC NY and National Recognition Award for Excellence in Engineering from ACEC National

The plan was developed by AECOM's staff in association with subject-area working groups comprised of consortium representatives, NGOs, and other community and regional stakeholders. AECOM provided project direction and management for the following professional services:

- development of the business-as-usual GHG emissions projections to establish as the baseline of measure
- selection of sustainability indicators to structure the system of measure
- development of sustainability goals for the key subject areas of energy, land use, and transportation, solid waste management, water management, economic development, and housing, and establishment of targets for GHG emissions reductions for each
- development of implementation strategies to achieve the goals and targets

- quantification of the potential GHG emissions reductions of key strategies, using our bespoke Climate Action Plan (CAP) Toolkit
- development and production of the comprehensive plan report

AECOM's CAP Toolkit, a computer modeling tool that quantifies energy performance, was used to test the potential GHG emissions reduction of individual key strategies that were developed through the working group process. It also demonstrated the cumulative reduction in GHG emissions that could be achieved by implementing the plan. The total potential impact of recommended strategies was quantified using assumptions of performance and participation levels, projected to 2020 and against the 2020 BAU scenario, expanding the public's understanding of GHG emission and energy use issues in relation to community actions. The process advanced public understanding of energy and GHG impacts and created the data for evidenced-based decision-making.

The plan addresses the relationship of transportation and land use planning and their collective impact on the region's GHG emissions and the projected impacts of climate change. Goals and strategies emphasize the value of transit oriented development in achieving project objectives. Key sustainability performance indicators include:

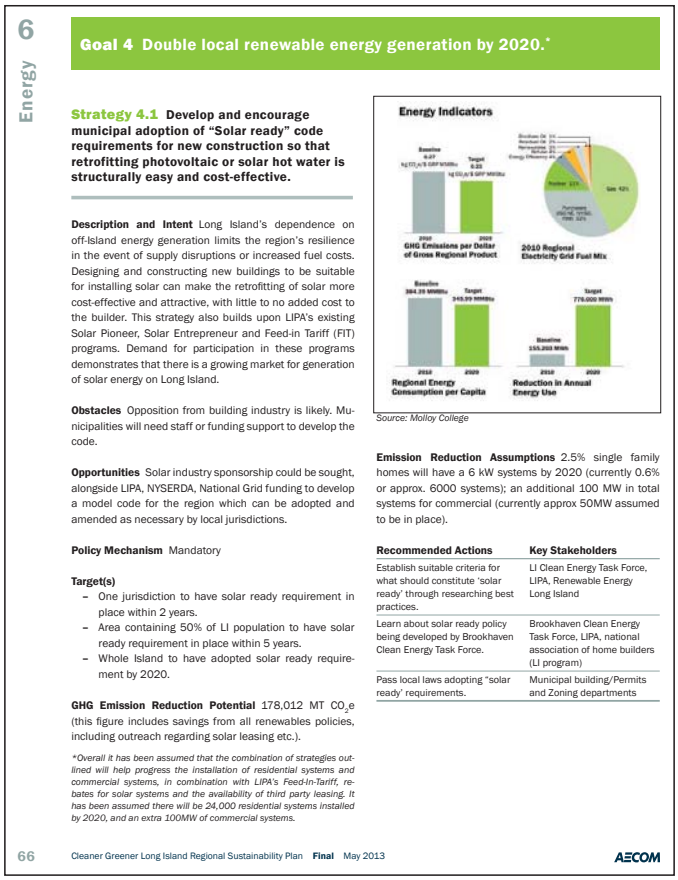
- Land consumption per capita
- Percentage of redevelopment of vacant buildings and sites
- Number of building permits issues in downtown areas
- Vehicle miles traveled per capita
- Walkability score of downtown areas

The plan goal to increase the number of communities with reduced auto dependence and increased livability on Long Island is addressed through strategies to increase mixed-use development in downtowns and near Long Island Railroad stations.

Extreme weather patterns—including the unprecedented level of destruction caused by Superstorm Sandy as the project got underway—brought heightened focus to this undertaking. This project served to heighten public awareness of the relationship of climate-effecting carbon emissions to regional sustainability-based planning and advance public interests in developing strategies to adapt to the unavoidable effects of climate change. AECOM provided technical leadership to assist the Long Island community as the client team overcame numerous obstacles to develop a plan that has received high praise from local, regional, and state levels.

The plan is a model in the ongoing transformation of public planning from the qualitative to a quantifiable and performance-based process. It provides objective and measurable data on the performance and value of policies and practices under consideration. The plan incorporates the impact of energy use and GHG emissions at the front-end of regional planning, considering direct and indirect drivers of energy demand across a comprehensive planning spectrum, including transportation.

The plan was endorsed by the Long Island Regional Economic Development Council (REDC) and was approved by NYSERDA. The project directly contributed to the region securing a $1-million grant from the REDC and NYSERDA to implement a combined natural gas and electric vehicle charging facility. AECOM received a Diamond Award for Excellence in Engineering from ACEC NY and National Recognition Award for Excellence in Engineering from ACEC National.



6 Energy

Goal 4 Double local renewable energy generation by 2020.*

Strategy 4.1 Develop and encourage municipal adoption of "Solar ready" code requirements for new construction so that retrofitting photovoltaic or solar hot water is structurally easy and cost-effective.

Description and Intent Long Island's dependence on off-Island energy generation limits the region's resilience in the event of supply disruptions or increased fuel costs. Designing and constructing new buildings to be suitable for installing solar can make the retrofitting of solar more cost-effective and attractive, with little to no added cost to the builder. This strategy also builds upon LIPA's existing Solar Pioneer, Solar Entrepreneur and Feed-in Tariff (FIT) programs. Demand for participation in these programs demonstrates that there is a growing market for generation of solar energy on Long Island.

Obstacles Opposition from building industry is likely. Municipalities will need staff or funding support to develop the code.

Opportunities Solar industry sponsorship could be sought, alongside LIPA, NYSERDA, National Grid funding to develop a model code for the region which can be adopted and amended as necessary by local jurisdictions.

Policy Mechanism Mandatory

Target(s)
- One jurisdiction to have solar ready requirement in place within 2 years.
- Area containing 50% of LI population to have solar ready requirement in place within 5 years.
- Whole Island to have adopted solar ready requirement by 2020.

GHG Emission Reduction Potential 178,012 MT CO_2e (this figure includes savings from all renewables policies, including outreach regarding solar leasing etc.).

**Overall it has been assumed that the combination of strategies outlined will help progress the installation of residential systems and commercial systems, in combination with LIPA's Feed-in-Tariff, rebates for solar systems and the availability of third party leasing. It has been assumed there will be 24,000 residential systems installed by 2020, and an extra 100MW of commercial systems.*

Source: Molloy College

Emission Reduction Assumptions 2.5% single family homes will have a 6 kW systems by 2020 (currently 0.6% or approx. 6000 systems); an additional 100 MW in total systems for commercial (currently approx 50MW assumed to be in place).

Recommended Actions	Key Stakeholders
Establish suitable criteria for what should constitute 'solar ready' through researching best practices.	LI Clean Energy Task Force, LIPA, Renewable Energy Long Island
Learn about solar ready policy being developed by Brookhaven Clean Energy Task Force.	Brookhaven Clean Energy Task Force, LIPA, national association of home builders (LI program)
Pass local laws adopting "solar ready' requirements.	Municipal building/Permits and Zoning departments

66 Cleaner Greener Long Island Regional Sustainability Plan **Final** May 2013 AECOM

Seattle Climate Action Plan - Buildings + Energy Sector

Seattle, WA

Firm
AECOM

Completion
2012

Client
City of Seattle

Key staff
Claire Bonham-Carter, Culley Thomas

AECOM worked alongside a Building Energy Technical Advisory Group (TAG) comprised of 19 experts in building development, management, and energy who were challenged to recommend a suite of strategies to help achieve Seattle's goal of a carbon neutral city (defined as net zero emissions) by 2050.

The project intended to develop a road map specifying a course of action in the near-term, mid-term, and long- term to meet this goal including identifying critical near-term pilots that can set City policy on the right path. AECOM provided a gap analysis of current activities and created a list of potential strategies, both incentive and mandate based, for new construction; strategies for existing buildings; pricing and financing strategies; and district-scale infrastructure strategies for low-carbon fuels, considering two key ways to reduce emissions. Seattle has already made considerable progress in this area, and is piloting an outcome-based code for existing buildings. The State has a fairly advanced energy code and several significant energy efficient grant programs, with pilot district energy projects in progress.

The proposed strategies and their estimated greenhouse gas emission reductions were presented by AECOM to the TAG at monthly person meetings for discussion and debate. Through iterative discussions with the TAG and the City a roadmap was developed, made up of an interconnected suite of policies that cover energy price structuring, innovative financing options, outcome based incentives, benchmarking and disclosure, mandatory upgrades, retro-commissioning, tax energy efficiency tax exemption, energy code improvements, incentive zoning, fee bates, waste heat recovery. These included working at different scales, including lobbying the State for changes to the Building Code, and working with the utility to consider energy price structuring.

World Bank Carbon Abatement Planning Tool - CURB

Washington, DC

Firm
AECOM

Completion
Ongoing

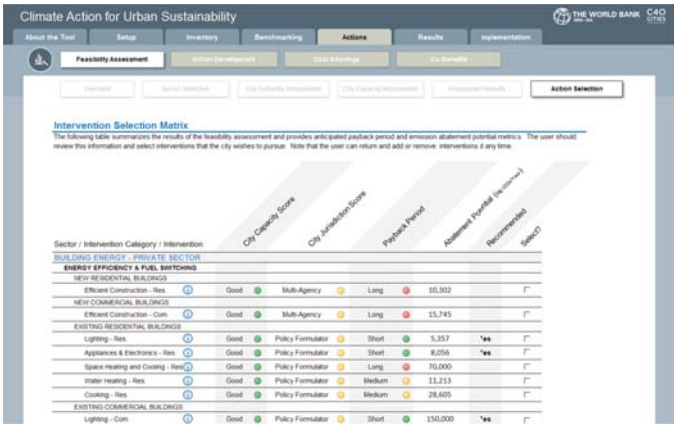
Client
The World Bank Group - Social, Urban, Rural and Resilience Unit & C40

Key staff
Claire Bonham-Carter, Culley Thomas, Jonathan Thompson, Jane Atkinson

AECOM is developing a Carbon Abatement Planning Tool (Tool) for the World Bank and C40 that will be used by cities in developing nations to identify and prioritize greenhouse gas emission abatement interventions. The Tool allows the user to assess the city's capacity to implement different interventions and customize the intervention assumptions to the community's context. With relatively simple data inputs, the tool will provide emission abatement and cost/cost savings estimates, identify key co-benefits (quantitative and qualitative), and suggest implementation actions for each selected intervention.

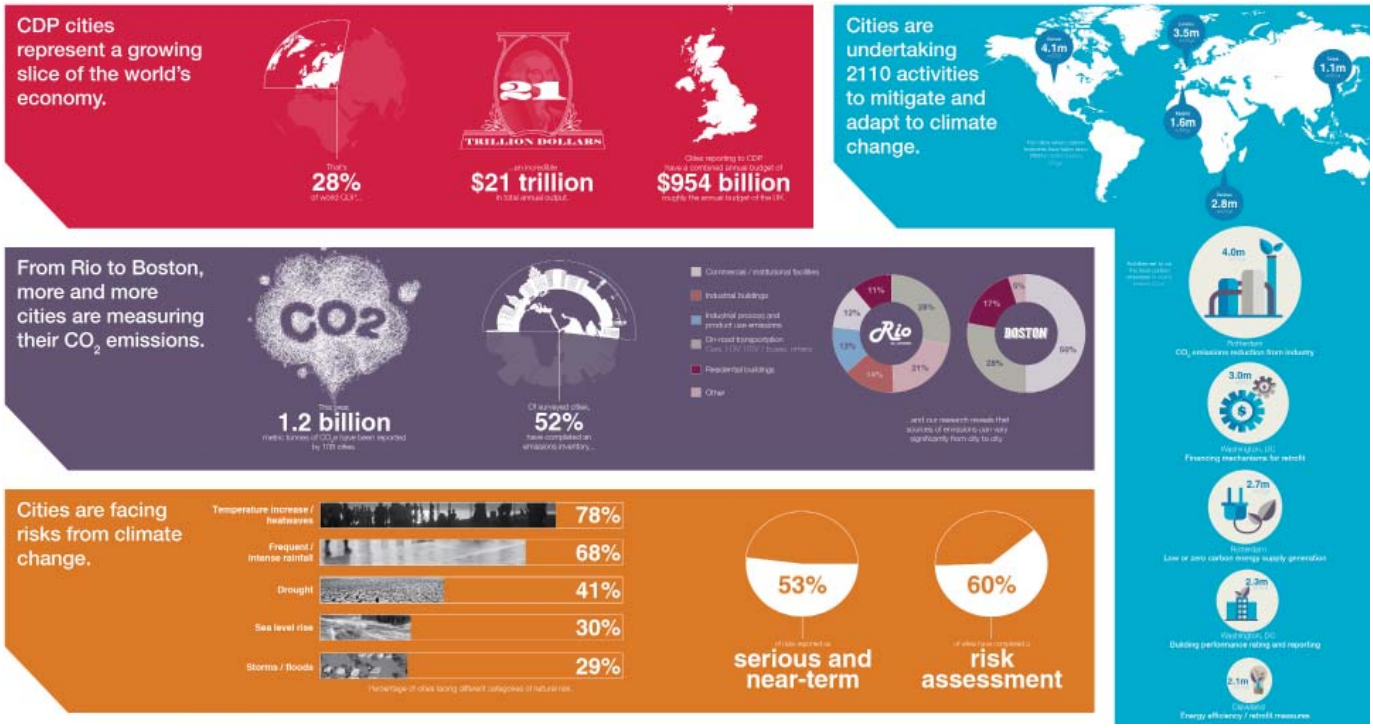
Phase 1 of Tool development focuses on building and facility energy (private and public sector), energy generation, solid waste and wastewater sector interventions. Phase 2 will add transportation and industrial energy sector interventions.

The energy model within the tool includes detailed building energy use assumptions that reflect climatic, economic, and cultural factors. The energy model was developed through a collaboration effort between leading governmental, non-governmental, and private sector contributors. All assumptions within the tool are transparent and customizable by advanced users.



Carbon Disclosure Project 2014 Global Cities Report

International



Firm
AECOM

Completion
2014

Client
Carbon Disclosure Project (CDP)

Key staff
Claire Bonham-Carter

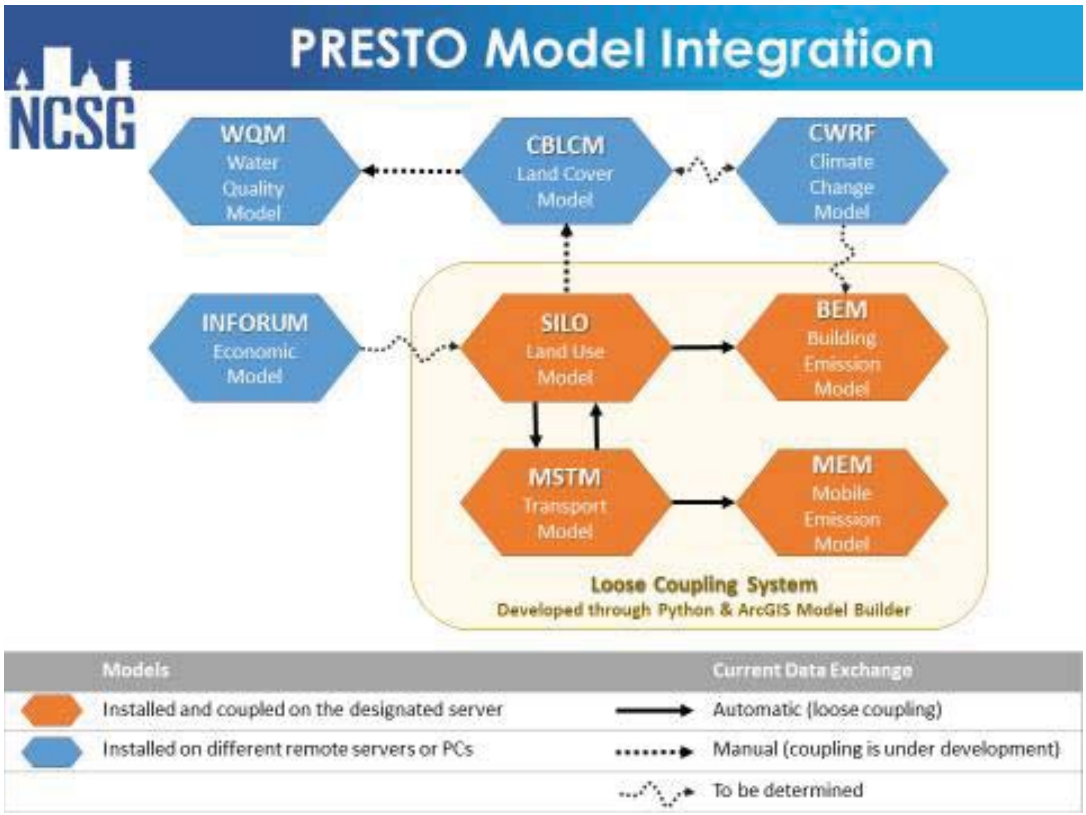
AECOM formed a multi-year partnership with the CDP in January 2012, performing to date the data analysis and information design for the CDP Cities 2012, 2013, and 2014 Global Reports. In 2014, the data sets provided by 207 participating major cities around the world included information on:

- Physical, regulatory, and social risks
- Economic opportunities from climate change
- Emissions data
- GHG emission reduction strategies
- Adaptation strategies

AECOM's team delivered extensive analysis, synthesized into a visually compelling report and infographic over a very short timeframe. The primary aim was to provide a platform for cities to be transparent about their climate related activities, to share best practices with cities globally, and to establish a benchmark for cities to report against on an annual basis. It included an infographic containing headline data about adaptation and emission reduction activities and a thematic report focused on how climate adaptation in cities creates a resilient place for business.

Plan for Regional Sustainability Tomorrow (PRESTO)

Maryland and Northern Virginia



Firm

National Center for Smart Growth, University of Maryland

Completion

Ongoing

Client

Town Creek Foundation

Key staff

Uri Avin, Fred Ducca, Sevgi Erdogan, Gerrit Knaap, Rolf Moeckel, Tim Welch

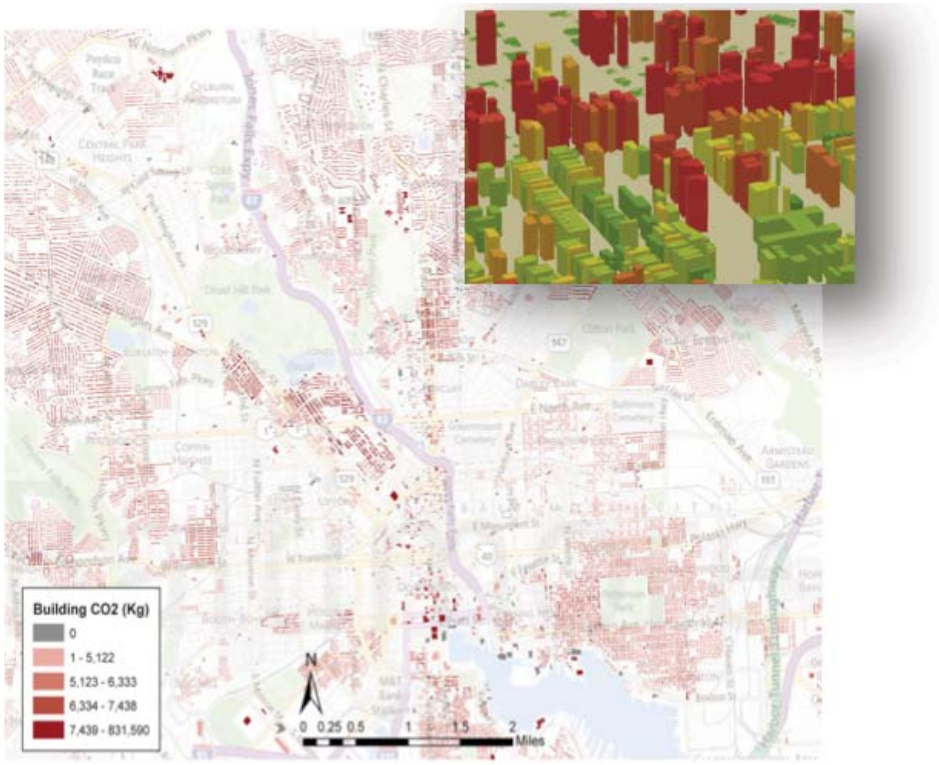
Over the past 20 years, Maryland has adopted strategies for creating sustainable communities, restoring the natural environment, and protecting farmland and natural resources at both the state and local levels.

This project develops and analyzes alternative land use and transportation scenarios for the State of Maryland and portions of Northern Virginia. The analysis includes economics, population location, transportation, air quality, and water quality models. The analytic process starts with economic models, then tightly coupled population location and transportation models, followed by air quality and water quality models. These in turn link to procedures for analyzing mobile source and building emissions models. The land use model provides input into a land cover model which forecasts land cover at the 30 meter grid scale. Land cover includes forests, agricultural, urban, and suburban categories, among others. The land cover model estimates changes in land use processes, when linked with climate change estimates of rainfall, forecasts runoff into the Chesapeake Bay. The NCSG has developed a baseline scenario and in the coming year will use the model suite to analyze the impact of various policies on the economic, land use, and environmental conditions within the state of Maryland, including GHG.

PRESTO includes a scenario advisory committee (SAC) composed of representatives from state agencies and local governments, as well as the Baltimore and Washington MPOs. The SAC assists in defining the scenarios, recommends output measures to be used, and supports the dissemination of results.

Various Climate Change Projects

Statewide, Maryland



Firm
National Center for Smart Growth, University of Maryland

Completion
Ongoing

Client
Maryland Department of Transportation, Maryland Department Of The Environment

Key staff
Fred Ducca, Sevgi Erdogan, Tim Welch

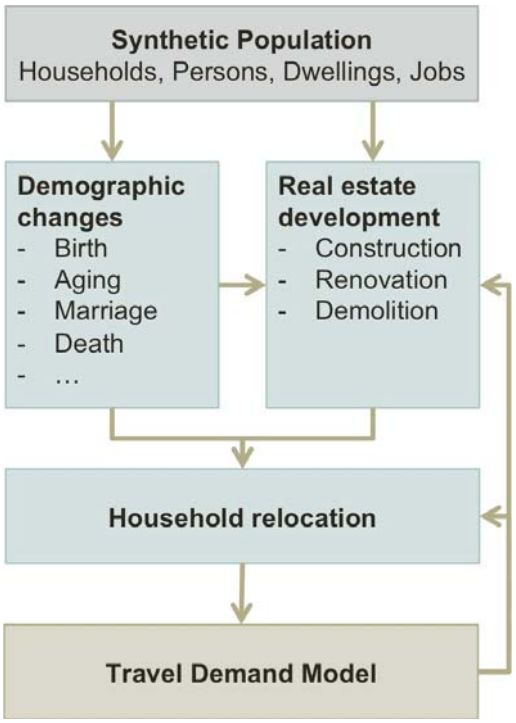
The NCSG has addressed multiple issues related to climate change. For the Maryland Department of Transportation, the NCSG conducted the Maryland Scenarios project. The scenarios project examined the impact of a variety of land use and transportation scenarios, both singly and in combination, on travel, congestion, and GHGs. Scenarios included combinations of high fuel prices, increased transit frequency, transit fare reductions, and development without zoning constraints. Analyses showed that the most effective methods to reduce congestion and emissions resulted from significant increases in fuel prices, resulting in greater use of transit, shorter trips, and more compact development patterns.

For the Maryland Department of the Environment, the NCSG is currently analyzing the emissions impacts of different levels of market penetration of zero emission vehicles (ZEV) into the on-road fleet mix. Preliminary results show that the introduction of ZEVs into one county has measurable emission reduction spillover effects on other counties as vehicles travel across the region.

The NCSG has developed an energy and emissions model that estimates residential and commercial building energy and emissions for the entire state of Maryland. The model uses a data set of over 6,000 building surveys to estimate the probability that a building will consume fossil fuel, and the level of energy consumption on a daily basis. The factors can then be applied to any building or study area in the US. The building emissions model also uses extensive power plant data to estimate emissions from the power generation sector. The model has been successfully implemented in projects that assess the efficacy of multi-sector climate action plans.

SILO Land Use Model

Various Locations



Firm
National Center for Smart Growth, University of Maryland

Completion
Ongoing

Client
Maryland Department of Transportation (MDOT), Town Creek Foundation

Key staff
Uri Avin, Fred Ducca, Sevgi Erdogan, Gerrit Knaap, Rolf Moeckel, Tim Welch

The Simple Integrated Land-Use Orchestrator (SILO) is a simple yet powerful land-use model that is fully integrated with a travel demand model. This allows representing the full land-use/transportation feedback cycle. SILO is a microscopic model, enabling the integration with both aggregate (and four-step) and disaggregate (or activity-based) travel demand models. SILO is written in Java and open-source.

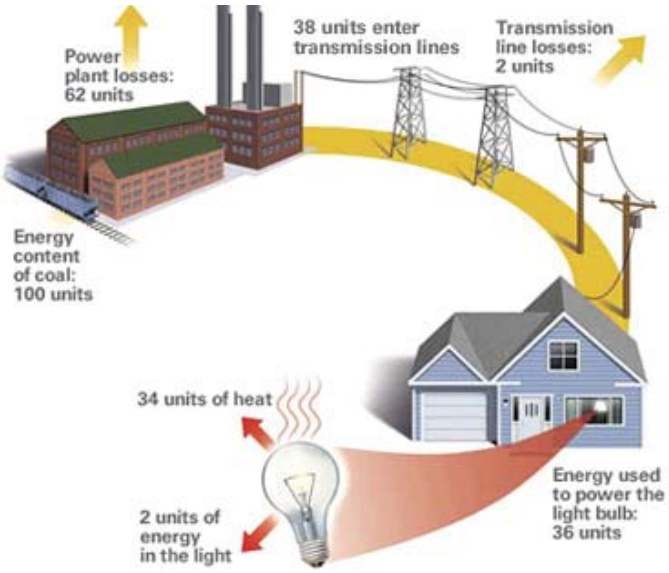
SILO was originally developed for Minneapolis/St. Paul as a research project by a consultant and is currently implemented by the NCSG for the Statewide Transportation Model (MSTM) study area. SILO is designed as a discrete choice microsimulation model. Discrete choice means that decisions (such as a decision of a household to move to a new dwelling) are modeled explicitly based on utilities at the current dwelling location and expected utilities at alternative dwelling locations. Being a microsimulation model, every household and person is simulated individually. SILO models household relocation, non-spatial demographic changes (such as birth, aging, marriage or having children), developers' decisions to build new residential buildings, and changes to dwellings over time (including renovation, deterioration and demolition). The SILO website (www.silo.zone) provides further information.

SILO is currently used in three projects at the NCSG:

- For MDOT, SILO was integrated with the MSTM transportation model to fully represent the land-use/transport feedback cycle. The impact of transit-oriented development will be analyzed for MDOT.
- For the PRESTO project funded by the Towncreek Foundation, SILO and MSTM are further integrated with environmental impact models and a land cover model. The goal of the PRESTO project is to investigate sustainable policies for the Baltimore/Washington region.
- Thirdly, SILO is used in the SESYNC project, which expands the PRESTO integration by a climate change model.

EnergySmartDC - Comprehensive Energy Plan

Washington, DC



Example of energy losses in the electrical system, National Academies

Firm
Nspiregreen, LLC

Completion
Ongoing

Client
District Department of Environment

Key staff
Veronica Davis, Chancee Lundy

Nspiregreen is working with the prime contractor to develop the Comprehensive Energy Plan (CEP), branded EnergySmart DC, for the District of Columbia. The EnergySmart DC plan provides an energy vision for the District as a national leader, with specific short (1 to 5 years) and long-term energy goals as well as strategies and initiatives for accomplishing these energy goals within the next 10 years. EnergySmart DC provides strategies that align the plan with the Mayor's Sustainable DC Plan and the Climate Action Plan (CAP). The CEP will provide a comprehensive set of energy efficiency and renewable energy goals and recommendations that will put the City on a path to reducing energy consumption, increasing local generation and clean power usage, ensuring energy reliability and affordability, and creating green jobs for District residents.

Nspiregreen is providing sound technical research, analysis and planning; engaging a technical stakeholder group for consensus building; and facilitating general public outreach about a highly technical subject to produce a plan that has District wide-implications.

CEP Development

Nspiregreen is responsible for providing technical research and writing, data collection, and analysis for specific sections of the CEP, including:

- A comprehensive analysis (including statistical modeling and benefit-cost ratios) of the current and past energy efficiency programs in the District to determine how these programs meet DC energy goals and have benefited residents and businesses.
- Defining the impact of the District's energy use on the environment by measuring the impact to air quality, and health, water quality, municipal solid waste and supplies, land use, and energy consumption, including the socioeconomic impacts of environmental consequences.

- Researching updated, ongoing measurements of the District's carbon footprint and impacts on the environment. Making recommendations based on the results of the energy efficiency and demand response potential studies.
- Developing the current transportation energy profile, including consumption data and new technologies based on current and future consumption.
- Recommending future energy efficiency strategies, based on research results, in areas such as transportation, green jobs, low and moderate-income programming, technology, renewables, and the District as a whole.

Stakeholder Engagement

The Nspiregreen team is facilitating and organizing small group stakeholder discussions with technical experts that work in specific subject matter and sector groups to make sure that that goals and recommendations of the CEP are inclusive of a wide variety of policy suggestions. Nspiregreen is soliciting subject matter experts to help build consensus among stakeholders on the overall energy reduction goals of the CEP.

Project Management + Quality Assurance

Nspiregreen is responsible for managing a DC-based team of subject matter experts in the energy field to develop the CEP. They are directly responsible for resource management roles and responsibilities of subject matter experts.

Nspiregreen is responsible for making sure the final draft of the CEP is a living document that outlines the approaches that the District can take to reduce its energy consumption, create more green jobs for District residents, and expand the use of clean and affordable energy. Elements of the CEP will form an online database that is constantly maintained as new data are received.

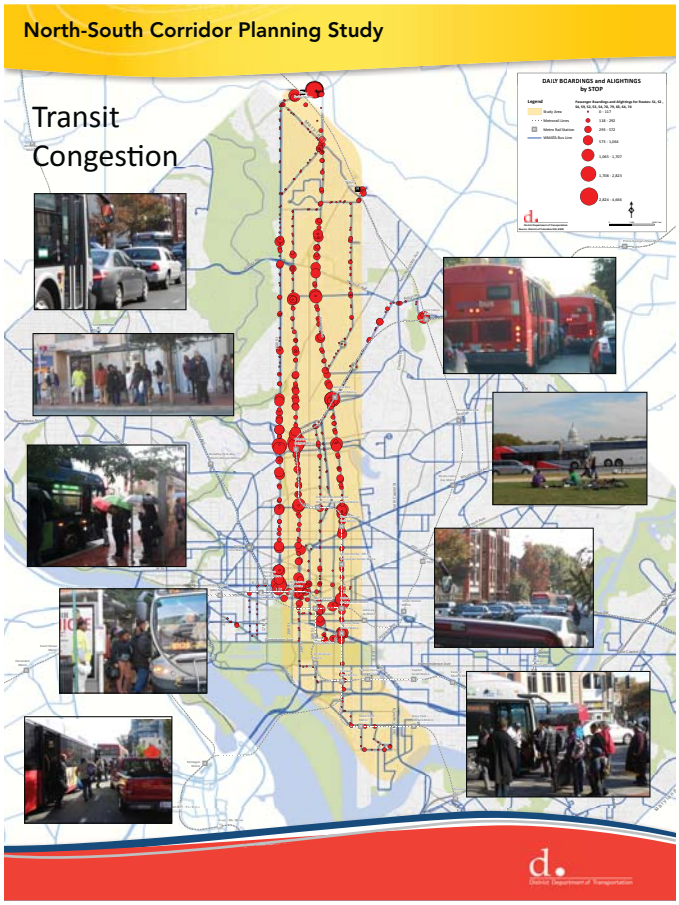
Public Outreach

Nspiregreen organized the public outreach component to share general information about the CEP through large public information meetings and smaller "special interest" public meetings and webinars, including the following:

- **Step Up to the Mic** – This was a public information meeting for the CEP that provided awareness of the plan and also provided an opportunity for community groups and other stakeholders to have an uninterrupted five minutes to make recommendations about what they wanted to see in the CEP.
- **Residential Meeting** – Nspiregreen hosted this meeting geared towards homeowners and apartment dwellers, to inform participants of DDOE energy assistance programs that were available to them and to discuss areas of concern regarding recommendations for efficiency, green jobs, technology/innovation, renewables and outreach/education methods for the CEP.
- **Business Community** – This meeting was specifically targeted at small business owners and building managers for commercial properties, such as office buildings, to discuss business community needs for energy policy and learn how the District could improve in meeting the energy needs of the business community.
- **Low- and Moderate-Income Service Providers** – Nspiregreen facilitated a meeting with non-profit organizations and local government agencies that provide assistance to low income populations to discuss how the CEP can create jobs; energy efficiency programs for affordable housing/apartments and programs; incentives and financing/grants for moderate income households. This meeting was viewed as an opportunity to define how the plan could influence programs for low- and moderate-income households and other policies.

North–South Corridor Planning Study

Washington, DC



Firm
Nspiregreen, LLC

Completion
Phase 2: Ongoing; Phase 1: 2014

Client
District Department of Transportation

Key staff
Veronica Davis, Chancee Lundy

The purpose of the North-South Corridor Planning Study is to examine possible alignments for improved surface transportation services connecting the Silver Spring/Takoma area to the Southwest Waterfront/ Buzzard Point area. The study area is focused on a nine-mile corridor that includes most of the inner Southwest, crosses the National Mall, and is generally bound by 5th Street and 14th Street, NW.

The Phase 1 planning study was completed in winter 2014. The project team identified feasible alternatives and possible design options to be advanced into the Phase 2 environmental review process and advanced engineering studies.

DDOT's Challenge

The North-South corridor is one of the more complicated corridors of the 22-mile priority streetcar system. The nine-mile corridor touches over 90,000 diverse stakeholders, which includes residents, businesses (national chains and mom-and-pop), and large entertainment venues (sports, arts, museums). This corridor requires the engagement of numerous government and quasi-government agencies. For example, to cross the National Mall requires engaging the National Capital Planning Commission, US National Park Service, US Commission of Fine Arts, and the Advisory Council on Historic Preservation. In addition, WMATA is a key stakeholder to determine how any new transit alternatives will interact with existing transit services.

Bringing Local Knowledge to Development of Alternatives

Nspiregreen provides public outreach services, including the following:

- **Overall Strategy:** developed the public involvement plan, including interagency stakeholder engagement, creating messaging for public meetings and materials, overseeing another firm that is responsible for meeting logistics and grassroots outreach.
- **Meeting Content Development:** translating technical transit language into laymans terms by creating graphics, rack cards, fact sheets, presentations, and website content for each of the public and stakeholder meetings.
- **Engaging Communities:** attending established meetings such as Advisory Neighborhood Commission, civic associations, and community groups in the study area, including Silver Spring, Maryland.

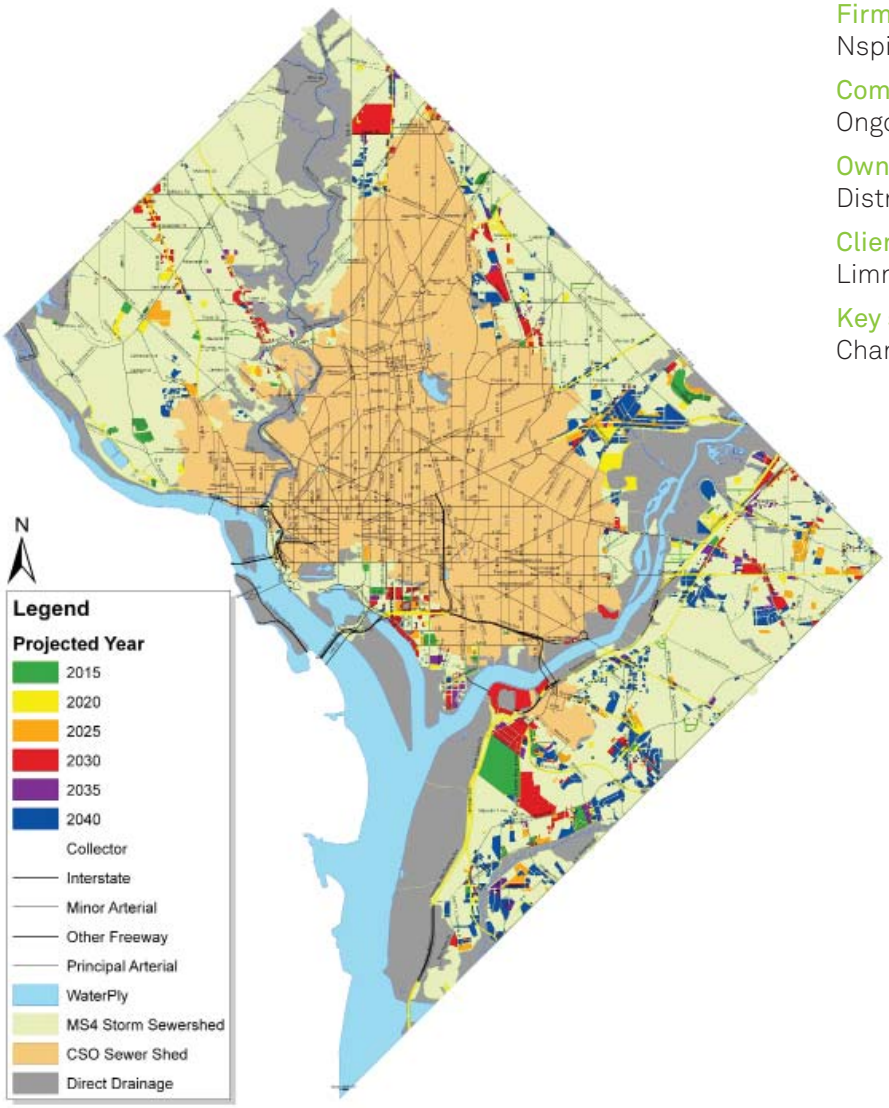
- **Engaging Agency Stakeholders:** facilitating presentations to and discussions with agencies expected to have more formal roles in subsequent environmental analysis, with a goal of better understanding institutional issues that could be either impacted by or benefited by enhanced transit service. In addition to those identified above, these include the Smithsonian Institution, National Gallery of Art, Fort McNair, and the General Services Administration. Particular attention has also been paid to informing and engaging WMATA.

In addition to public outreach, Nspiregreen is supporting the team on the development of the streetcar route alternatives that will be advanced into the Phase 2 environmental process, which includes:

- **Conceptual Alignments:** all the possible streets where a streetcar could operate
- **Tier 1 Evaluation Matrix:** narrowing the alignments by identifying important key areas, issues, planning concerns, engineering concerns, traffic concerns, and other environmental and technical criteria that can affect the development of alternatives
- **Tier 2 Evaluation Matrix:** narrow the routes down to four end-to-end alternatives. Each alternative will be evaluated using criteria such as ridership potential, travel time, travel speed, and traffic impacts
- **Documentation of transit operations performance** in the corridor based on WMATA-provided raw data
- **Final report preparation** and QA/QC of diverse written and technical study components

Consolidated TMDL Implementation Plan + Revised Monitoring Framework

Washington, DC



Development/Redevelopment Scenario Projection Year

Firm
Nspiregreen, LLC

Completion
Ongoing

Owner
District Department of Environment

Client
LimnoTech

Key staff
Chancee Lundy, Kenya Goodson

Nspiregreen is working with a prime contractor to develop a Consolidated TMDL Implementation Plan and Revised Monitoring Program to satisfy requirements contained in the MS4 Permit issued to the District by the Environmental Protection Agency. The TMDL implementation plan represents an unprecedented strategic planning effort for achieving Clean Water Act Goals for the District's waters.

Nspiregreen is responsible for providing technical support for the baseline analysis, revised monitoring framework, and growth scenario, which includes GIS modeling and development forecasting. In addition, Nspiregreen leads the stakeholder coordination efforts between governmental agencies and non-governmental organizations .

This project is very relevant to the MWCOG GHG emissions project because it:

- Demonstrates the impact of development of the built environment and its relation to stormwater runoff on the District's stormwater management system
  - Increases the need for better planning and implementation of best management practices (BMPs)
- Requires facilitation of interagency and non-governmental organization coordination

Technical Support for Implementation Plan Modeling Tool

- **Technical Research –** Nspiregreen provided statistical analysis and research for pollutant load reductions from structural and non-structural BMPs and bacterial source tracking. This research provided inputs for the modeling tool.
- **GIS Support –** Nspiregreen edited and created watershed/sewershed delineations, digitized and georeferenced printed sewershed maps, and digitized monitoring sites.
- **Development Forecasting –** Nspiregreen led the development and redevelopment forecasting analysis to input in the implementation-modeling tool. These inputs were used to determine the pollutant load reductions from projects that have the potential to trigger stormwater regulations. To build the development/redevelopment scenario, Nspiregreen established the development forecast methodology and conducted land use analysis of the MS4 area.

Stakeholder Outreach

Nspiregreen is responsible for facilitating a group of sister agencies as well as special interest groups as the implementation plan is developed. Nspiregreen assists the prime contractor with content development, provides logistical support for in-person meetings, and contributes to creation of a website to keep stakeholders abreast of project updates.

2

SCOPE OF WORK

2 SCOPE OF WORK

The AECOM team will work with MWCOG towards the *Region Forward* vision of creating a more accessible, sustainable, prosperous, and livable metropolitan Washington region

The following section provides further definition of the scope of work that was outlined in the RFP. Where requested, tasks are followed by a summary of the team's knowledge and experience providing the services and skills required to deliver the task. Please reference the personnel commitment table on the following page for an overview of the staffing and hours assigned to each task. We look forward to the opportunity to review our approach to the work with COG in more detail so that we finalize a scope that best meets the project's objectives within the available time and resources.

Task 1. Finalize Contractor's Work Plan + Schedule

AECOM will meet with the Project Director to review and confirm the details of the work plan and schedule and prepare for execution of the project contract. Prior to this meeting, we will review key relevant project documents and will be prepared to discuss any substantive issues or questions. The objectives of Task 1 will be to ensure:

- Feasible allocation of schedule time for COG and Multi-sector Working Groups (MSWG) outputs
- Adequate time for COG staff, MSWG, and sector subgroup review of the AECOM team's outputs
- Expectations of timely review, feedback and decision-making from COG, MSWG and subgroup leaders in order to meet project timelines and milestones
- Clarification that the client review process will feature consolidation of comments on each Technical Memo by COG and the MSWG. The AECOM Team will then use these comments to inform subsequent tasks and integrate comments into the Interim Technical Report and Final Technical Report
- Key meeting dates and critical path are accurately captured
- Proposed project timing and engagements of key personnel align with COG and MSWG expectations
- Key personnel are scheduled and available for participating in key points throughout the project when technical input and guidance is required
- Clarification of GHG projection needs which could influence schedule and scope for Task 4 and Task 6. Projections are essential for long-range GHG abatement planning. From the existing information provided by MWCOG, we're aware that there are existing GHG forecasts from the 2005 inventory and understand that the inventory has been updated for 2012. Assuming there are no new emissions forecasts, we assume we will need to update forecasts using existing BAU methodologies. If these forecasts are required to be prepared by the AECOM team, a scope modification to some aspect of the project may be required in order to meet scope commitments within available budget.

Schedule: *Following selection of the team*

Product: *Finalized Work Plan and Schedule*

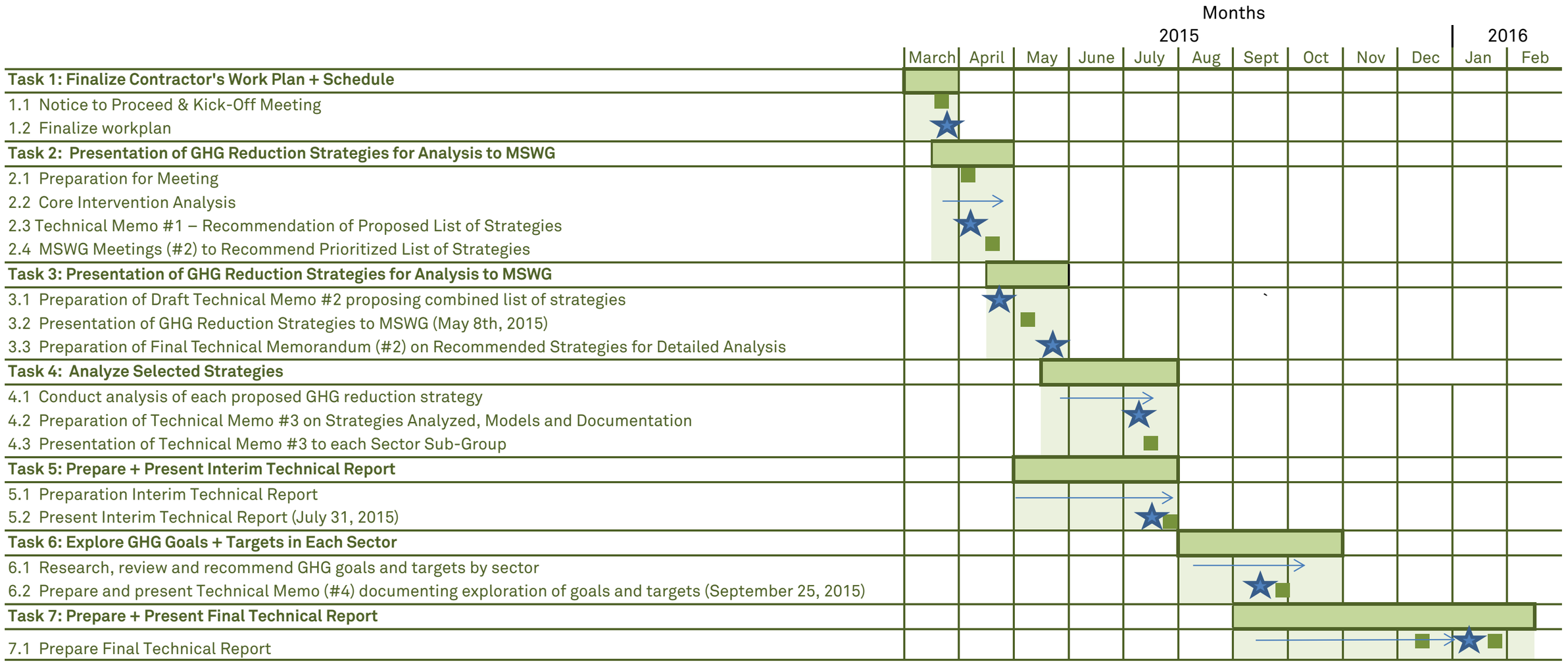
Personnel Commitment by Staff Member

The following is a representation of our staffing approach for each task within the scope of work. While the hours are approximate and will be refined in Task 1, they provide an indication of our understanding of the level of effort required as well at the level of techincal expertise.

	Project Tasks							
	Finalize Work Plan	Meetings, Review Strategies	Meetings, Strategies Draft & Final Tech Memo	Analyze Strategies	Interim Technical Report	GHG Goals & Targets	Final Tech Report & Present-ation	Total Hours
Project Personnel	1	2	3	4	5	6	7	
Claire Bonham-Carter Principal in Charge & GHG Technincal Leader, AECOM	4	15	20	30	15	20	20	124
Brian Goldberg Project Manager, AECOM	30	30	40	40	40	40	30	250
Diane Dale Land Use Lead, AECOM		15	20	15	10	5	10	75
Culley Thomas Energy/Built Environment, GHG Modeling Lead, AECOM	4	15	30	80	30	30	30	219
Jonathan Thompson Analysis & Modeling, AECOM				80	20	15		115
Amruta Sudhalkar Built Environment, AECOM				40		20		60
Jane Atkinson Built Environment, AECOM				30	10	20		60
Jason Weiss Economic Analysis, AECOM				10	10	5		25
Andrea Bohmholdt Economic Analysis, AECOM			10	80	40	40	20	190
Veronica Davis Land Use, Nspiregreen	4	40	40			20	10	114
Chancee Lundy Built Environment, Nspiregreen	8	60	40	20	10	20	20	178
Kenya Goodson Built Environment, Nspiregreen		40	40	10	20			110
Uri Avin Tranportation Lead, NCSG	4	12	12	12	10	8	5	63
Fred Ducca GHG Analysis & Modeling, NCSG	4	12	12	37	25	9	5	104
Timothy Welch GHG Analysis & Modeling, NCSG		8	8	35				51
Rolf Moeckel GHG Analysis & Modeling, NCSG		20	20	130	20	19		209
Sevgi Erdogan GHG Analysis & Modeling, NCSG				83				83
Gerrit Knaap Economic Analysis, UMD	4				10	7		21
Graduate Student GHG Analysis & Modeling, UMD		100						100

Project Schedule

The schedule below is based on information provided in page 2-3 of RFP; the project schedule will be finalized with COG in Task 1.



Schedule based on information provided (page 2-3 of RFP); schedule to be finalized with COG in Task 1

- meeting
- deliverable
- extended production of key deliverables

Task 2. Meet with Sector Subgroups + Review Proposed Strategies

The AECOM Team will work with COG and Sector Subgroups to schedule and plan two sets of meetings for the purpose of reviewing list of strategies identified by sectors subgroups; suggesting how these strategies could be integrated and combined; and, identifying potential strategy analysis methodologies for evaluating and selecting preferred strategies. The AECOM Team will co-facilitate those meetings where AECOM Team materials are presented.

Prior to each meeting, the AECOM Project Manager and sector subgroup Technical leads will coordinate with the MWSG sub-group leaders to confirm agenda and meeting organization.

2.1. Preparation for Meeting

To prepare for meeting #1, we propose to conduct a preliminary analysis internal to our team that will serve as a ground check and reference. We will consider potential strategies to address a range of key emission reduction opportunities. This 'first-cut' review of the strategies that have the greatest reduction potential will help to optimize our meeting time with subgroups. Drawing on our experience with existing emission inventory and AECOM Team models, we will begin to identity regionally appropriate major emission generating activities and sub-component (e.g., fuels, end uses, etc.). From this analysis, we will develop a list of core intervention areas for reference in the strategy development process and rank them in terms of the order-of-magnitude emission reduction potential. This will assist in the identification of any gaps and new strategies needed to fill the gaps.

2.2. MSWG Meetings (#1) to Discuss Proposed Strategies

The AECOM team will meet with the 3 sector subgroups to review working list of proposed strategies. Meetings are intended to help the sector subgroups explore how strategies can be combined and integrated where relevant as well as to discuss potential criteria for narrowing the list to preferred strategies for moving forward for further analysis.

The AECOM Team will work with the COG and MSWG to arrange meetings with the sector sub-groups in a way that efficiently uses time from both the AECOM Team and meeting participants for presentation, discussion and input. The AECOM team's technical leaders for each sector sub-group will facilitate meetings in tandem with sub-group leadership. Meetings with each group will be structured to efficiently review proposed lists and generate specific meeting outputs that advance the subgroup towards prioritized lists. Within each sub-group, key objectives include:

- Review and discussion of primary project goals, schedule and general workflow
- Discussion of proposed strategies from each sub-group
- The AECOM team's technical leader to propose additional strategies to be considered and/or potential modifications to proposed strategies
- Where relevant, initial sorting criteria for determining viable goals and stretch goals will be discussed with the sector subgroups.
- Identification and agreement on next steps regarding input into Technical Memo #1 followed by discussion in Meeting #2 for reaching consensus on proposed list of strategies to advance for analysis in Task 3.

2.3. Technical Memo #1 – Recommendation of Proposed List of Strategies

Following MWSG meeting #1 with each sector sub-group, the AECOM team will compile proposed strategies lists into Technical Memo #1, providing the sector sub-groups with recommended organization and prioritization of strategies for further development and analysis. This memo will frame the discussion for MWSG Meetings (#2). Where feasible, include preliminary order-of-magnitude analysis of GHG emissions reduction, cost (L,M,H) and selected co-benefits.

Tech Memo #1 will also provide an opportunity for the AECOM Team to recommend proposed strategies to be considered that might not have been raised by the MSWG sub-sector groups. The AECOM Team's process of identifying additional strategies will include:

- Review and identification of strategies that flow from existing COG reports and guidance such as National Capital Region documents including National Capital Region Climate Change Report (2008); Region Forward (Jan 2010); Region Infrastructure Report (Jan 2015)

2.4. MSWG Meetings (#2) to Recommend Prioritized List of Strategies

The purpose of MWSG Meetings (#2) is to reach a consensus agreement within each working group about the proposed list of strategies that should be advanced to Task 3 for further analysis and consideration. Key objectives of the meeting will include:

- Presentation and discussion of key recommendations included in Technical Memo #1
- Discussion of key criteria for selecting proposed strategies
- Development and confirmation of recommended prioritized list, including any further modifications and suggestions from sub-group and the AECOM team's technical leaders
- Confirmation of proposed criteria for determining viable goals and stretch goals
- Review of next steps, schedule and expected follow-up actions by AECOM and sector sub-groups
- Confirmation that only those strategies advanced through Technical memo #2 will be eligible for analysis in Task 4.

Schedule: *April 2015*

Product: *Meeting with each MSWG Sector Subgroup; Technical Memoranda on Proposed Subgroup Strategies*

Team Relevant Experience for Task 2

The AECOM team has considerable experience working with working groups to develop, evaluate, and prioritize a wide range of GHG reductions strategies in Land Use, Transportation, and Energy and Built Environment sectors and to facilitate discussion consensus on a narrower list of the most highly effective options, and within the resources available to the undertaking. The following is an overview of select project experience:

Building Energy Recommendations for City of Seattle

- AECOM worked alongside a Building Energy Technical Advisory Group (TAG) comprised of 19 experts in building development, management, and energy who were challenged to recommend a suite of strategies to help achieve Seattle's goal of a carbon neutral city (defined as net zero emissions) by 2050.
- The project developed a road map specifying a course of action in the near-term, mid-term, and long- term to meet this goal including identifying critical near-term pilots that could set City policy on the right path. AECOM provided a gap analysis of current activities and created a list of potential strategies, both incentive and mandate based, for new construction; strategies for existing buildings; pricing and financing strategies; and district-scale infrastructure strategies for low-carbon fuels, considering two key ways to reduce emissions. Seattle had already made considerable progress in this area, and was piloting an outcome-based code for existing buildings. The State has a fairly advanced energy code and several significant energy efficient grant programs, with pilot district energy projects in progress.
- The proposed strategies and their estimated GHG emission reductions were presented by AECOM to the TAG at monthly person meetings for discussion and debate. Through iterative discussions with the TAG and the City a roadmap was developed, made up of an interconnected suite of policies that cover energy price structuring, innovative financing options, outcome based incentives, benchmarking and disclosure, mandatory upgrades, retro-commissioning, tax energy efficiency tax exemption, energy code improvements, incentive zoning, fee bates, waste heat recovery. These included working at different scales, including lobbying the State for changes to the Building Code, and working with the utility to consider energy price structuring.

NCSG Finding: Low Cost Strategies Can Result in GHG Reductions (From Climate Action Plans Fact or Fiction?)

Analysis of the Maryland CAP revealed a set of high impact and quickly implementable mitigation strategies that should be adopted by the state to rapidly mitigate emissions. Such polices include the implementation of eco-driving education, urban parking limits and speed reduction, and harmonization. These policies are low cost options that can be rapidly deployed, require little to no new legislation or technology, and are certain to result in measurable CO2 reductions.

City of Baltimore Climate Action Plan

- AECOM advised the Baltimore Sustainability Commission and its Climate Action Plan working groups of land use/transportation, building energy, green infrastructure. These groups were composed of technical experts from city, county and state entities familiar with municipal operations, technical and fiscal considerations for proposed GHG reduction strategies.

Long Island Regional Sustainability Plan

- AECOM provided project direction as well as the technical leadership for each of the subject area working groups (economic development and housing, energy, transportation, land use, water management and waste management), comprised of government, NGO, and residents of numerous jurisdictions across Long Island. They represented broad social and political interests.
- We engaged with the working groups for each sector, providing subject area technical leaders, to facilitating the discussion to assist them in the development and prioritization of strategies.
- We developed tools to focus prioritization on the specific goals for the undertaking. We reviewed of proposed strategies, discussion of feasibility considerations and identification of additional strategies to consider for addressing GHG and broader sustainability goals.
- We worked with the community through the recovery period of Hurricane Sandy, which struck in the first month of the project, and managed to meet the original schedule due date established by NYSERDA and the office of Governor Cuomo
- The Plan received the Diamond Award from ACEC NY for Excellent in Energy Engineering in 2014.

Other Projects: Strategies for GHG Reduction Efforts

Other work with cities and regions to assist them in the development and prioritization of strategies for GHG reduction efforts, including:

- 80x50 report for Office of Long Term Planning and Sustainability, New York City
- Contribution to/or completion of over 30 Climate Action and Sustainability Plans for cities across the US including Seattle, Baltimore, New York, San Francisco, San Jose, West Hollywood, Mountain View, Counties of San Diego, Santa Clara, Solano, Yolo, Alameda, Long Island, Volusia.
- Preparation of eleven climate Action plans for municipalities in Silicon Valley area (County of Santa Clara), each including working group engagement and prioritization of strategies.
- GHG Emissions Reduction + Climate Change Management Program for NYC Department of the Environment
- Long Term Plan to Reduce Energy Consumption and Greenhouse Gas Emissions of Municipal Buildings and Operations, for NYC EDC / DCAS Developing a 2050 carbon neutral route map for the City of Seattle building sector

We have also provided the review of best practices from other leading climate protection cities and regions using a variety of sources including:

- Carbon Disclosure Project Database
- C40 Case Studies
- ICLEI Case Studies
- Center for Sustainable Communities Case Studies

Climate Change in Maryland

Our partner, **National Center for Smart Growth (NCSG),** brings expertise in strategy identification, prioritization and development for sectors including building energy, land use and transportation. The NCSG has served in two different capacities in support of the MD climate Action Plan: on the Greenhouse Gas and Carbon Mitigation Work Group of the Maryland Climate Change Commission, examining different transportation and land use options and their impacts and on a separate contract to assess and push the envelope on Climate Change Mitigation Analysis for the Maryland Department of the Environment. NCSG staff supervised and participated in a review of the Statewide Climate Change Plan and developed options for additional land use/transportation mitigation measures and impact assessments on emissions.

- NCSG staff developed tools to optimize alternative fuel vehicle (AFV) fleet operations considering limited infrastructure availability and vehicle characteristics that contribute to emission reduction efforts by: (1) supporting alternative fuel use and (2) reducing carbon-intensive freight activity. A Green Vehicle Routing Problem (GVRP) was formulated and techniques for its solution are developed. These techniques can aid organizations with AFV fleets in overcoming difficulties that exist as a result of limited refueling infrastructure and can allow companies considering conversion to a fleet of AFVs to understand the potential impact of their decision on daily operations and costs.
- For the University of Maryland Campus community, NCSG staff developed econometric models to design and improve employer trip-reduction strategies. These strategies included analyzing demand for carpooling and vanpooling demand. The NCSG leads the Purple Line Corridor Coalition and its efforts to seek consensus on key planning considerations

with stakeholder groups. The Purple Line Corridor Coalition (PLCC), administered by the National Center for Smart Growth at the University of Maryland, brings a regional corridor approach to suburban Maryland's upcoming light rail project, the Purple Line. The Purple Line Corridor Coalition engages organizations active in the planned light rail corridor, facilitates collaboration and integration, and conducts and disseminates research to assure that investments in the Purple Line achieve the maximum possible economic, social, and environmental benefits to its neighborhoods, residents and businesses.

NCSG Finding: Land Use and Economic Sector (from NCSG scenario modeling)

NCSG staff analyzed the economic structure of the state, identified 23 job centers, and demonstrated that firms in such centers realize agglomeration economies, pay higher wages, and have higher survival rates. The employees of such firms have higher rates of transit ridership to work.

NCSG staff examined the capacity for employment in Maryland's transit station areas and determined that Maryland's TODs have enough capacity to accommodate 24 percent of job growth in the state over the next 20 years.

Our partner **Nspiregreen** has been engaged in numerous planning projects with public engagement processes:

DC Streetcar North-South Corridor Study

- The team worked on the planning side conducting alternatives analysis for the transportation study in addition to stakeholder engagement. Nspiregreen developed unique interactive activities to gather data from interagency partners and residents Information gathered through these strategies was used in developing the final technical report.

District's Comprehensive Energy Plan

- The Energy Plan detailed consumption by sector and set a vision for the District with specific 1 to 5 year and long-term energy goals. The Nspiregreen team provided technical research and analysis on strategies to increase local generation, clean power usage, ensure reliability, affordability and job creation.
- The team developed strategies to meet the District's 2020 and 2050 GHG emissions reductions goals and made recommendations to the District Department of Environment for reductions in areas including residential, commercial and transportation sector. The team identified how the District's energy is generated and how it's imported and the consequences of the energy network.
- The team built consensus around the development of the Comprehensive Energy Plan by meeting with groups with specific interests in energy such as those concerned about affordability for residents to those interested in solar, microgrids and grid reliability.

Task 3. Presentation of GHG Reduction Strategies for Analysis to MSWG

Following the Task 2 meetings, the AECOM Team will prepare draft Technical Memorandum #2 for clarifying a combined list of strategies drawn from each of the three sector sub-groups. On May 8th, 2015, the AECOM Team will facilitate a discussion among the MWSG to review recommendations from draft Tech Memo #2, confirming input and modifications to the proposed list of strategies. The final output of this task will be the final Technical Memo #2 that confirms the final list of strategies to be analyzed and the methodology to be used.

3.1. Preparation of Draft Technical Memo #2 proposing combined list of strategies

The AECOM team will prepare this draft Technical Memo #2 following completion of the Task 2 meetings with each sector sub-group. The purpose of the memo will be to clarify:

- proposed list of combined and integrated strategies drawn from each sub-sector group
- proposed methodologies to use for analyzing strategies including GHG quantification, and selected co-benefits
- include preliminary, order-of-magnitude analysis of proposed strategies across key criteria including GHG reduction, cost (L,M,H) and selected co-benefits
- confirm that only those strategies advanced through this Technical memo #2 will be eligible for analysis in Task 4.
- Identify those strategies which may enable more or less detail of GHG emissions quantification, based on availability and limitations of data.

3.2. May 8th, 2015 Presentation of GHG Reduction Strategies to MSWG

The purpose of this presentation is to achieve consensus of the MSWG for the combined list of proposed GHG reduction strategies. The project's senior technical leadership will facilitate this meeting of the full working group with participation by the AECOM team's technical leaders from each sub-sector group. The objectives of this meeting will include:

- Discuss proposed list of combined strategies presented in Draft Tech Memo #2, including order-of-magnitude estimates (L, M, H) for GHG reductions, costs and co-benefits
- Receive comments and input on proposed list
- Discuss potential modifications to consider for proposed strategies
- Confirm identification of proposed viable goals and stretch goals,
- where feasible depending on order of magnitude GHG reductions and cost implications
- Review next steps and timing for finalizing Tech Memo #2 and initiating Task 4 analysis of selected strategies

3.3. Preparation of Final Technical Memorandum (#2) on Recommended Strategies for Detailed Analysis

Following the May 8th meeting, this Final Technical memo will be prepared by the AECOM team to document agreed upon short list proposed strategies; identification of viable and stretch goals; and identification of methodology to be used in subsequent Tasks for analyzing GHG reduction strategies.

Schedule: *April - May 2015*

Product: *May 8 Meeting with full MSWG; Draft and Final Technical Memoranda on Recommended Strategies for Detailed Analysis*

Team Relevant Experience for Task 3

As noted in Task 2, AECOM has extensive experience assisting cities with the refinement and subsequent development of GHG reduction strategies. AECOM has helped cities develop multi-criteria decision making frameworks to objectively prioritize strategies and focus city efforts on the most effective policy and program interventions. All AECOM team climate action plan experience includes development of a long list of strategies noting key criteria to aid decision making, to select the highest impact, most cost effective and timely strategies. Also see task 4 for an overview of tools that have been developed and employed by the team.

NCSG Finding: Fuel prices and Land Use (from NCSG "What to Expect in 2030: Effects of Fuel Price and Fuel Economy on Land Use and Transportation")

NCSG staff tested impacts of increased fuel prices on future transportation using the transportation model for year 2030 in the Capital Mega-region area. The scenarios are designed such that both the impacts of fuel prices and resulting vehicle fuel economy on land use and travel behavior are captured. The model results show that increased fuel prices and fuel economy have a significant impact on land use and travel patterns. Increased fuel prices lead to a denser land use pattern and a reduction in automobile mode share and vehicle miles traveled even though fuel economy increases. The reduction is less pronounced if fuel economy increases significantly. For informing strategy development, considerations include:

- Higher fuel prices increase auto operating costs, affecting location decisions, trip length and mode share
- The elasticity of location decisions is highly sensitive to changes in fuel prices and that improved fuel economy reduces this sensitivity.
- The greatest reduction in emissions is obtained when higher fuel prices are applied
- Increased fuel prices lead to a denser land use pattern and a reduction in automobile mode share and vehicle miles traveled even though fuel economy increases.
- The reduction is less pronounced if fuel economy increases significantly.
- When technological advances lead to very high fuel economy in the future, it may be necessary for policy intervention to increase travel cost to meet planning goals that aim to prevent sprawl.

NYC 80 x 50 GHG Plan

- NYC 80 x 50 GHG Plan goals: 80% reduction by 2050.
- AECOM was tasked by Mayor Bloomberg's Office of Long Term Planning and Sustainability to look beyond the goals and strategies of the current PlaNYC 2030, and its goal of achieving 30% reduction by 2030. The first task included analysis to work out whether such a reduction goal was technically possible, at what societal cost, and to determine which actions would need to be taken in the next five years to make sure the City sets the right course to achieve it.

Maryland Department of the Environment

For the Maryland Department of the Environment, the NCSG is currently analyzing the effects of increasing the percentage mix of electric vehicles in vehicle fleets in the Baltimore/Washington area. The NCSG is considering two scenarios, one with 60,000 electric vehicles and the other with 300,000 electric vehicles. Using the MOVES model, the NCSG anticipates that results will show that if electric vehicles are substituted for conventional vehicles in urban areas with congestion and stop and go driving they will have a greater effect than in rural areas without congestion.

Texas Instruments

Nspiregreen owner Chancee` Lundy led the GHG emissions reduction team tasked with developing reduction strategies that would be implemented globally in Texas Instruments' manufacturing facilities. Lead team and managed projects to reduce PFC Emissions by 2010 to 10% of the 1995 baseline.

- The team began with a broad list of best practices and measured practicality based on ease of implementation and cost benefit without disruption to continuous manufacturing operations.
- Ms. Lundy and the team narrowed the broad list to three primary recommendations for presentation to executive management. These recommendations included the introduction of green chemistry, technology/process changes and equipment change outs. Future emissions were forecasted based on each scenario
- Further, each of these were evaluated for their ability to meet aggressive PFC reduction goals overall impact to operations from a cost/benefit perspective and maintenance issues, in addition to company interest. Chancee supported the feasibility analysis and developed the plan, which prioritized and detailed implementation strategies.

Task 4. Analyze Selected Strategies

The purpose of this task is to analyze each strategy for GHG reductions, costs and co-benefits and provide Technical Memo (#3) documenting these quantitative and qualitative outcomes of each strategy. This task is the most labor intensive of the assignment and will a collaborative approach employing the modeling tools developed by AECOM and NCGS.

Our overall approach to quantification of GHG emissions will be driven by AECOM's CAP Toolkit/ CURB interface while integrating regional data sets and modelling inputs from the NCSG. Furthermore, the NCSG will largely inform the land use and transportation modelling by drawing on strengths of NCSG existing work in the region with its well-developed and tested models.

4.1. Conduct analysis of each proposed GHG reduction strategy

The AECOM Team will analyze the GHG reduction potential of each strategy by evaluating GHG emissions reduction, costs and selected co-benefits at intervals (2012 to 2020; 2020 to 2040; and 2040 to 2050)(pending clarification of GHG forecast data during Task 1).

While the majority of inputs will be collected from meetings with sub-sector working groups in Tasks 2 and 3, the quantification process will likely require some additional clarifications and confirmations of assumptions with MSWG and COG for informing GHG reduction and economic co-benefit estimates.

4.1.1. Approach to GHG Reduction Potential Quantifications of Energy/Built Environment

Quantifying the GHG reduction potential of Energy/Built Environment strategies will be done using AECOM's Climate Action Plan (CAP) toolkit. The CAP toolkit has been guiding AECOM's CAP work since 2005 and has been used with over 35 cities across the country.

The CAP toolkit contains region-specific building energy demand data and allows the user to model the effect of different types of energy efficiency and renewable energy measures at the community level. The impact of different policy and programs can be modeled according to the anticipated level of measure implementation (market penetration, adoption levels, etc.). The CAP Toolkit has already been tested and calibrated for the region during our preparation of the ACEC MD award-winning City of Baltimore's Climate Action Plan.

NCSG Finding: Transit headways, fares and GHG Emissions (from scenario modeling for Baltimore-Washington Region)

Reducing transit headways and fares provided for minor increases in transit ridership and minor reductions in emissions. Scenarios decreasing transit run time had much greater impact. Transit run time is a more critical factor in transit ridership than fares or headways.

NCSG data will be used to further calibrate the AECOM CAP Toolkit's building energy calculations. The Toolkit will build a bottom-up model of specific building types (e.g., residential homes and apartments, and commercial office, retail, etc. buildings). These calculated values will be calibrated to the NCSG data. The Tool will also calibrate the modeled community energy demand to the empirical activity data used to develop the existing GHG inventory. This will ensure close correlation between model GHG reduction potential estimates and the emission inventory and forecasts.

The AECOM CAP Toolkit was designed to be user-friendly and to facilitate the jurisdiction's capacity to develop and implement their selected measures. Use of the Toolkit with AECOM clients has helped ensure efficient and effective planning processes across the US. The Toolkit:

- Organizes existing conditions, greenhouse gas (GHG) emissions inventory, and forecast data, allows jurisdiction to select measures and customize the measure assumptions to the community's specific context.
- Automatically quantifies greenhouse gas reductions, energy and water savings, waste diversion, and other sustainability co-benefits.
- Provides summary outputs tables and charts that can be directly imported into public outreach materials and plan documents.
- Assists in the implementation and monitoring of the resulting plans.

Additionally, AECOM has recently developed the CURB (Climate Action for Urban Sustainability) Tool for the World Bank. The Tool provides additional functionality that can be used by the AECOM team including a marginal abatement cost curve module, and selected co-benefits assessment module. The Tool also has a capacity to evaluate the impact of grid decarbonisation strategies.

4.1.2. Approach to GHG Quantifications of Transportation and Land Use sectors

The NCSG possesses a suite of modeling tools for quantifying the benefits, costs, limited co-benefits, and implementation strategies for GHG reduction in the Land Use, Transportation and mobile source emissions sectors. The NCSG has developed models that either include or leverage the Simple Integrated Land Use Orchestrator (SILO), Maryland Statewide Transportation Model (MSTM), EPA's MOVES, the mobile source emissions estimator. In combination, these models allow the Center to assess many of the impacts of GHG emission reduction strategies.

NCSG Finding: Capital Bike Share drives Metrorail Ridership

NCSG staff analyzed relationship between bikesharing programs and transit ridership. Specifically, we explored the Capital Bikeshare program's impact on Metrorail's ridership. Two sets of analysis were conducted (1) an Origin-Destination analysis was conducted to map quarterly Capital Bikeshare trips, (2) a regression analysis. The first analysis showed that Metrorail stations have been important origin/destination of Capital Bikeshare trips. Six out of seven bikeshare stations with more than 500 trips are close to Metrorail stations. The result of regression analysis show Capital Bikeshare ridership in Metrorail transit catchment area is associated with higher transit ridership. Results suggest that 10 percent increase of CaBi ridership will lead to 2.8 percent increase in Metrorail ridership.

Maryland Statewide Transportation Model (MSTM)

The NCSG's Maryland Statewide Transportation Model (MSTM) is an advanced "four step", trip-based model sponsored by the Maryland State Highway Administration (SHA). With support from Parsons Brinkerhoff, the NCSG began the development of the MSTM in 2006. The model covers the state of Maryland and surrounding areas at a high level of fidelity The MSTM is a multi-level model that covers local trips and long-distance trips by people and freight.

The MSTM incorporates data from the MWCOG and BMC models and resolves data and boundary

differences between them, improving transit travel simulation.

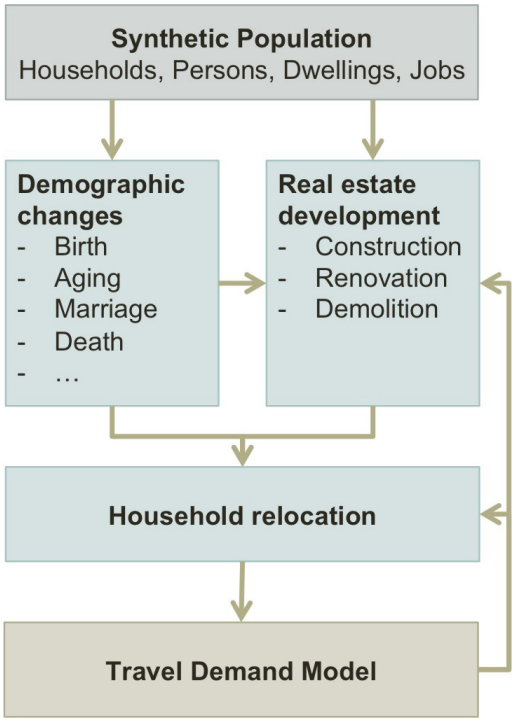
It has become a policy decision support tool that has been applied extensively for scenario analysis, corridor studies, project forecasts and future transportation performance measurement by MDOT and MDE.

Land Use GHG Quantifications using SILO

The Center will quantify the effects of land use changes on greenhouse gas reduction. The Simple Integrated Land-Use Orchestrator (SILO) is currently implemented by the National Center for Smart Growth at the University of Maryland for the Maryland Statewide Transportation Model (MSTM) study area. SILO is designed as a discrete choice microsimulation model.

SILO forecasts the location of population by income group. SILO is a simple yet powerful land-use model that is fully integrated with a travel demand model. This allows representing the full land-use/transportation feedback cycle. SILO is a microscopic model, enabling the integration with both aggregate (and four-step) and disaggregate (or activity-based) travel demand models. SILO is written in Java and open-source.

SILO is currently used in three projects at NCSG. For the Maryland Department of Transportation (MDOT), SILO was integrated with the MSTM transportation model to fully represent the land-use/transport feedback cycle. The impact of transit-oriented development (TOD) will be analyzed for MDOT. For the Plan for Regional Sustainability Tomorrow (PRESTO) project funded by the Towncreek Foundation, SILO and MSTM are further integrated with environmental impact models and a land cover model. The goal of the PRESTO project is to investigate sustainable policies for the Baltimore/ Washington region. Thirdly, SILO is used in the SESYNC project, which expands the PRESTO integration by a climate change model.



The results from SILO serve as household location inputs for the MSTM, and can be utilized as inputs for the MWCOG transportation model. With the transportation model, the Center will project travel on the transportation network for each of the study periods. The results of the MSTM serve as the inputs for MOVES which calculates GHG emissions in the transportation sector. MEM results break down the results by modal source of the emissions.

Discrete choice means that decisions (such as a decision of a household to move to a new dwelling) are modeled explicitly based on utilities at the current dwelling location and expected utilities at alternative dwelling locations. Being a microsimulation model, every household and person is simulated individually. SILO models household relocation, non-spatial demographic changes (such as birth, aging, marriage or having children), developers' decisions to build new residential buildings, and changes to dwellings over time (including renovation, deterioration and demolition).

PRESTO Project

For the PRESTO project, the NCSG developed and analyzed alternative land use and transportation scenarios for the State of Maryland and portions of Northern Virginia. The analysis includes economics, population location, transportation, air quality and water quality models. The analytic process started with economic models, then tightly coupled population location and transportation models, followed by air quality and water quality models. These in turn link to procedures for analyzing mobile source and building emissions models. The land use model provides input into a land cover model which forecasts land cover at the 30 meter grid scale. Land cover includes forests, agricultural, urban and suburban categories among others. The land cover model estimates changes in land use processes, when linked with climate change estimates of rainfall, forecasts runoff into the Chesapeake Bay. The NCSG has developed a baseline

scenario and in the coming year will use the model suite to analyze the impact of various policies on the economic, land use and environmental conditions within the state of Maryland, including GHG.

PRESTO includes a scenario advisory committee (SAC) composed of representatives from state agencies, local government as well as the Baltimore and Washington MPOs. The SAC assists in defining the scenarios, recommends output measures to be used and supports the dissemination of results.

These models are responsive to transportation pricing policies, changes in land use, and transportation infrastructure investments. The models respond to transportation and land use policies intended to reduce emissions in both sectors. The models allow the researchers to determine how changing transportation costs, zoning policies, incentives and other policies will impact the location decisions of the residential developers and families. For any scenario, the models simulate land use decisions annually, providing the Center with land use results for all time periods in the study. In ongoing analyses conducted by the NCSG, these models have allowed the Center to study the benefits of individual approaches as well as the co-benefits of multiple GHG reduction strategies applied together.

Currently the models use baseline input data from the MWCOG and BMC constrained long range plans. Initial meetings with MWCOG staff will jointly determine what input data is to be used at the start of the model runs. MWCOG will be responsible for providing the team with any modifications to baseline data.

CarbonFIT Tool: Beta-Testing at Tyson's Corner

NCSG staff helped develop a sketch planning software tool (CarbonFIT) which builds development scenarios and evaluates their greenhouse gas impacts from buildings and transportation. The tool was beta-tested in the Comprehensive Plan update for Tysons Corner, VA and applied in the Lake Tahoe GHG Scenario Analysis, NV and the MARC Scenarios and GHG Impact Analysis, Kansas City, KS.

NCSG staff analyzed the economic structure of the state, identified 23 job centers, and demonstrated that firms in such centers realize agglomeration economies, pay higher wages, and have higher survival rates. The employees of such firms have higher rates of transit ridership to work.

4.1.3. Approach to Identifying and valuing co-benefits

Selected co-benefits of each strategy will be identified and monetized using economic methods. Each strategy will be evaluated individually to determine the most successful, cost effective, and optimum strategies are selected for implementation. Co-benefits include the economic, social and environmental impacts of a strategy (the triple bottom line) which are additional to the GHG emission reduction.

Economic impacts are typically direct financial impacts, such as capital costs, operation and maintenance costs, and avoided costs. Social and environmental impacts can be characterized as externalities. Externalities can be a cost or a benefit that affect a third party, like reductions in traffic congestion.

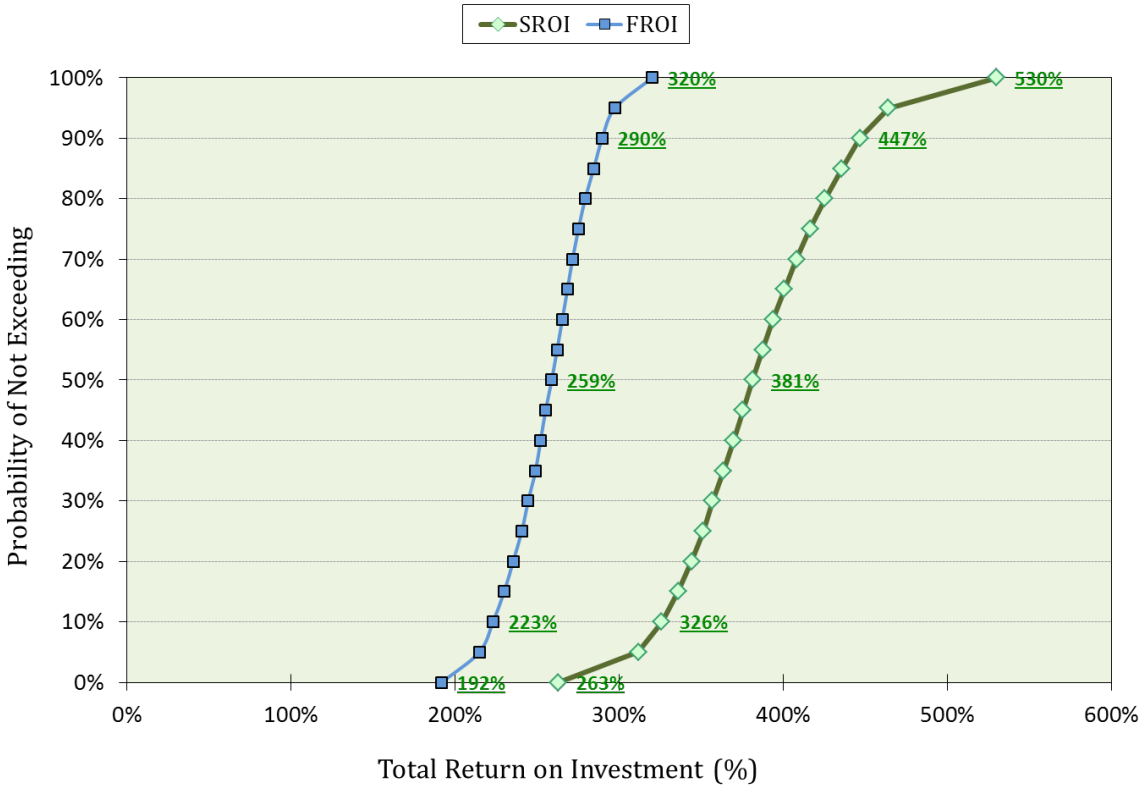
The monetized co-benefits will need to be vetted with MSWG and COG during Task 2 meetings with the sub-sector working groups to refine assumptions and vet values, for creating defensible and transparent results.

The keys to this analysis include discerning which co-benefits are pertinent, applying economic methods to monetize the impacts, building the model to evaluate the co-benefits over time, and analyzing the results.

Because some co-benefits vary over time, an uncertainty analysis is conducted to account for imprecise information or changing conditions. A Monte Carlo simulation is used to generate results that show the probability of each possible outcome. Due to uncertainty, some inputs in the model are represented by probability distributions which provide the range of values and probabilities associated with each potential value. In a Monte Carlo simulation, values are sampled at random from the input probability distributions. A Monte Carlo simulation of thousands of iterations results in a probability distribution of possible outcomes. This type of analysis provides a more complete view of what may happen by providing not only possible results but also the probability of how likely they are to happen.

Future costs and benefits are discounted to the present value using a set discount rate. The discount rate can be set at the estimated inflation rate or could be commensurate with the anticipated risk of the future costs and benefits.

This approach provides a more comprehensive picture of the triple bottom line and supports the selection of the most beneficial strategies that are defensible and transparent.



The example above shows how economic monetization can be presented:

- The co-benefit results may include the calculated net present value for each strategy, the discounted payback period, benefit-cost ratio, and return-on-investment ratio.
- A Monte Carlo simulation is used to generate results that show the probability of each possible outcome. A Monte Carlo simulation of thousands of iterations results in a probability distribution of possible outcomes. This type of analysis provides a more complete view of what may happen by providing not only possible results but also the probability of how likely they are to happen.
- An example of the financial return-on-investment (FROI) and sustainable return-on-investment (sROI) curves for a sustainable development strategy. These S-curves show the probability distributions of possible results.

4.2. Preparation of Technical Memo #3 on Strategies Analyzed, Models and Documentation

This memo will provide the MSWG with documented analyses of each proposed strategy including:

- preliminary quantification and qualitative findings for each strategy including potential GHG reductions, costs and co-benefits
- discussion of methodologies used, assumptions and limitations
- identification of viable goals and stretch goals
- identification of those strategies which might require additional input and/or assumptions to be provided by MSWG in order to be more meaningfully quantified

4.3. Presentation of Technical Memo #3 to each Sector Sub-Group

The AECOM Technical leads will present the analysis of strategies to each sector sub-group. Comments and revisions to strategy description and design will be integrated into the Task 5 Interim Technical Report. In addition to the key objectives of the Tech memo#3 noted in 4.2, the presentation to each sub-group will include:

- identification of those strategies for which additional data is needed to refine/complete quantifications, as well as those strategies which are not able to be meaningfully quantified due to a lack of available data
- suggestions for packages and/or combinations of strategies which can enable impactful outcomes
- observations of those measures which, with some modification to strategy design, might offer more significant benefits

Schedule: *May - July 2015*

Product: *May 8 Meeting with full MSWG; Technical Memoranda on Strategies Analyzed Data, Models and Documentation*

Team Relevant Experience for Task 4

Baltimore Climate Action Plan

- AECOM carried out a gap analysis task of current activities, and created a list of potential strategies, for discussion with the advisory committee and city staff drawing from previous AECOM work and other best practices from the US and internationally. Federal and state measures were included (CAFE standards and the Maryland Renewable Energy Portfolio standard). Once a short list of feasible measures has been agreed upon, AECOM has used this proprietary CAP Toolkit to demonstrate potential GHG reductions of certain measures. This quantitative output has empowered city leaders to make decisions about the political, technical, and economic feasibility of strategies that achieve reduction targets. In Baltimore, the CAP Toolkit was used to estimate the GHG emissions for each of the 38 strategies, which together contribute to a goal of 17% GHG reduction by 2020.

Maryland Climate Action Plan

Team members Uri Avin (NCSG) and Andrea Bohmholdt (AECOM) have both worked on the MD CAP to reduce GHG emissions by 25 percent (2006 baseline) by 2020.

- Development of the Plan, which spanned over 3 years, was led by the Maryland Department of the Environment (MDE) and involved the collaboration of 9 other State agencies, universities, and many stakeholders. Andrea Bohmholdt, was responsible quantifying the GHG emission reductions expected from implementing the strategies of the Plan, estimating economic impacts and co-benefits of each strategy, developing the GHG emission inventory, leading stakeholder meetings, and writing sections of the report while employed at MDE.
- Andrea Bohmholdt represented the Maryland Public Service Commission in the Maryland Greenhouse Gas and Carbon Mitigation Working Group. This was one of three working groups supporting the Maryland Commission on Climate Change. The purpose of these groups was to develop a Plan of Action to address the drivers and causes of climate change, to prepare for the likely consequences and impacts of climate change to Maryland, and to establish firm benchmarks and timetable for implementing the Plan of Action.
- The working groups collaborated to identify strategies to mitigate climate change. Mitigation strategies were categorized under the following categories: agriculture, forestry, and waste; energy supply; residential, commercial, and industrial; transportation and land use; and cross-cutting issues. It was most successful and effective when each agency took ownership of certain strategies and determined how to implement and enforce the strategies, have a net economic benefit to Maryland, and create new jobs.
- The Plan is comprised of 65 strategies which are expected to meet the 2020 target while also contributing to the restoration of the Chesapeake Bay, improved air quality and visibility, and reductions in mercury emissions. The Plan includes a comprehensive baseline GHG emission inventory of the entire State from 2006 and "business-as-usual" projections for 5, 10, and 15 year time horizons. The inventory is divided into 8 major source categories:
  - Electricity supply.
  - Residential, commercial, and industrial fossil fuel combustion.
  - Transportation.
  - Industrial processes.
  - Fossil fuel industry.
  - Waste management.
  - Agriculture.
  - Forestry and land use.

Once the Plan is fully implemented, annual benefits of $6.1 billion are expected and approximately 36,000 jobs will be created.

Architect of the Capitol Sustainability Plan

- AECOM/URS evaluated implementation strategies for achieving net-zero energy, net-zero water, and zero waste to landfill. The economic, social and environmental impacts (co-benefits) were quantified and monetized for each strategy. The results offer a comprehensive picture of the triple bottom line and provide metrics for evaluating and selecting each sustainable net-zero strategy. Sustainability strategies addressed wastewater, renewable energy, and energy efficiency measures necessary to get to net-zero energy and net-zero waste water.

Task 5. Prepare + Present Interim Technical Report

The AECOM team will prepare and present a draft Interim Technical Report to the full MSWG at their July 31, 2015 meeting and facilitate consensus on revisions to the Interim Technical Report.

5.1. + 5.2. Preparation and Presentation of Interim Technical Report

Key considerations for the report and presentation are:

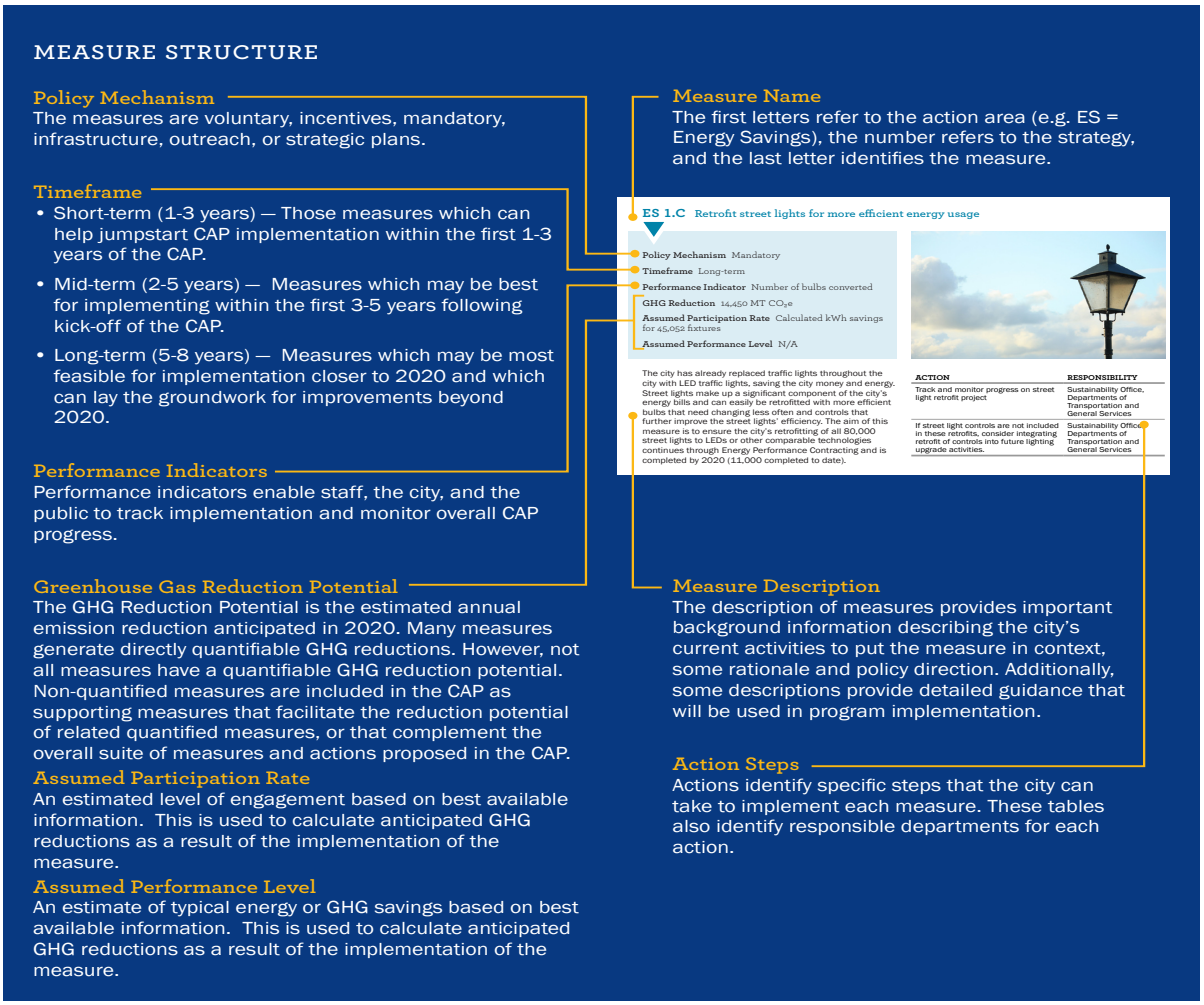
- presentation of updated analysis of strategies incorporating comments received during the Task 4 Presentation of Technical Memo (#3) on Strategies Analyzed
- revised strategies based on Task 4 outcomes with subsequently updated quantifications, where feasible given availability of data and budget
- intention to facilitate consensus for all strategies and results analyzed
- where consensus cannot be achieved on revisions to the strategies and/or results, these discussions will be documented into the draft Final Interim Technical Report.

Schedule: *May - July 2015*

Product: *May 8 Meeting with full MSWG; Interim Technical Report; Presentations to TPB, MWAQC, CEEPC and COG Board*

Example of Preparation of Technical Report Documents

(below) Sample Strategy from a CAP: GHG emissions reduction strategies define the programs, policies, and projects that members of the MWCOG will undertake to reach GHG targets. Strategies will be prioritized and refined through consultations with the MSWG. In the Technical Report, each strategy will likely include an outline of the policy mechanisms, timeframe, performance indicators, GHG reduction potential and assumptions (if applicable), and action steps to implement the strategy.



Task 6. Explore GHG Goals + Targets in Each Sector

The purpose of this task is for the AECOM Team to research, review and recommended potential GHG goals and targets for each sector based on experience from other metropolitan regions.

6.1. Research, review and recommend GHG goals and targets by sector

The AECOM team to draw from its vast international and national experience of GHG goal setting based on work with cities and regions including New York City, Long Island Region, Baltimore, State of Maryland, etc.

Three tiers of GHG goals and targets will be researched and presented including identification of potential market, technological and political constraints for:

- Tier 1 – Achievable goals and targets based on currently viable, implementable strategies. Tier 1 will include strategies that rely on market proven technologies and have a record of successful implementation within communities in the United States.
- Tier 2 – stretch goals and targets based on strategies that could become viable in the future if changes were made to existing state and local regulations. Tier 2 will include strategies that will require development of financial or regulatory mechanisms to overcome existing implementation barriers. Implementation mechanisms could be developed locally, regionally, or as the state level.
- Tier 3 – goals that targets that would require action by other levels of government in each Sector in order to achieve overall GHG reduction goals adopted by COG, if the achievable and stretch strategies identified in Tier 1 and Tier 2 are insufficient to meet overall goal. Tier 3 consists of industry changing policy interventions taken at the state or national level.

To establish appropriate emission reduction targets, it is essential to understand how emissions are expected to grow in the region over the coming decades. To facilitate this understanding, the AECOM Team will develop business-as-usual and adjusted business-as-usual emissions forecasts for 2020, 2040, and 2050. The business-as-usual forecasts reflect future emissions with the assumption that current activity intensities (e.g., energy use per household) and emission factors are held constant while population and employment grows. The adjusted business-as-usual will reflect changes in activity intensities or emission factors resulting from full future implementation of existing state or national policies. While existing state and national level policies are likely to contribute to near-term (i.e., 2020) reduction targets, additional local (tier 1), state (tier 2 and 3), and national (tier 3) actions will likely be needed for mid- and long-term target achievement.

The AECOM Team will work closely with the MSWG to ensure that Tier 1 goals are those most viable to be achieved as those within the control and influence of the MSWG. Based on our experience, shifting political, technical and economic viability can also enable Tier 2 and Tier 3 goals to become achievable.

The AECOM Team brings considerable familiarity with a range of viable GHG emissions reduction goals. AECOM's multi-year partnership with the Carbon Disclosure Project (CDP) since 2012 for performing data analysis and information design has enabled us to become knowledgeable about the GHG emissions performance, goal-setting and strategies used by more than 207 participating cities around the world. AECOM also has experience helping cities use the World Resources Institute's recently developed Mitigation Goal Standard to select a target methodology that is appropriate for their community. The standard allows cities to select from five different methods that match the community context and objectives.

The AECOM Team has considerable experience identifying the different tiers of strategies that will contribute toward the region's goals. For the Baltimore CAP and Long Island Regional Sustainability Plan, AECOM helped the sector working groups develop relevant GHG reduction targets (15% below GHG baselines for Baltimore and Long Island) based on the experience of comparable metropolitan regions that balanced viable economic, technical and political considerations.

Target setting for Tier 1 goals can be largely informed by existing building stock and potential for growth/change in the region's land use and transportation build-out. For Baltimore and Long Island, the relative age of existing building stock, limited new development of land and the limited projected increase in VMT helped to inform target setting, based on the range of GHG emissions reductions that could be influenced by proposed local strategies.

Target setting for Tier 2 and Tier 3 goals can play a significant role in influencing the MWCOG's GHG emissions reduction targets as state and Federal regulations can be considerable drivers of GHG emissions reductions. AECOM brings extensive experience modelling state-level interventions of Tier 2-type experience in California. AECOM modelling identified that state and federal Tier 3-type actions accounted for nearly a third of the Baltimore CAP's projected emissions reductions by 2020, largely due to vehicle CAFE standards and Renewable Portfolio Standard commitments. In our work on the Long Island Regional Sustainability Plan, the Tier 3 state and federal actions accounted for more than approximately 80% of anticipated GHG emissions reductions.

NCSG Finding: Inadequate Strategies Identified for Meeting Maryland GHG Goals 2020 (From Climate Action Plans Fact or Fiction?)

This research used the Maryland Climate Action Plan (CAP) as a case study on the efficacy of CAP strategies in mitigating carbon emissions. Models were constructed to estimate emission reductions for all built environment sectors including residential and commercial buildings, energy supply, and transportation. By directly modeling the strategies for these sectors, a firm conclusion is derived, finding that it will be challenging for Maryland to meet its CO2 reduction target of 25 percent below 2006 levels by 2020 with the current set of strategies. Testing each of the emissions reduction policies, the project developed a list of policies that should be abandoned, strengthened or added to the set of strategies.

NCSG staff have conducted extensive research on a range of carbon mitigation strategies and carbon mitigation goals and targets in climate action plan implemented across the United States. Staff combined this research with a comprehensive set of models to analyze mitigation strategies in Maryland's Climate Action Plan (CAP), developing guidance on the most effective emission reduction pathways. Maryland's contribution to national and global carbon reduction needs was also analyses to provide a suggested mitigation target level and date that would better contribute to a global effort to hold a maximum 2 degree Celsius average temperature increase.

The NCSG reviewed the "Multi-Path Transportation Futures Study: Vehicle Characterization and Scenario Analysis"; Energy Systems Division, Argonne National Laboratory, July 22, 2009. The study examined the potential for greater fuel efficiency in the vehicle fleet based on existing technologies. The study also addressed various actions to encourage the adoption of more fuel efficient vehicles. The actions ranged from higher fuel prices to financial support for the purchase of improved vehicles. The various policies identified in the report will serve as the basis for identifying achievable goals, stretch goals and goals requiring action by other levels of government.

6.2. Prepare and present Technical Memo (#4) documenting exploration of goals and targets on September 25, 2015

The AECOM Technical Leaders will present the findings of Task 6.1 at the September 25, 2015 meeting of the full MSWG. The purpose of the meeting will be to help the MSWG achieve consensus on setting a range of viable GHG reduction goals and targets by Sector and by Tier. Key objectives of the meeting include:

- Present a review of goals and targets (both overall goals and sector goals) based on other metropolitan regions
- Visually present goal and target recommendations to the MSWG for the MWCOG region including overall goals; sector goals; and tier 1, 2 and 3 goals
- Seek consensus and capture input for informing final goal and target-setting

Schedule: *August - October 2015*

Product: *Technical Memorandum on Exploration of GHG Goals and Targets*

Task 7. Prepare + Present Final Technical Report

Task 7 represents the culmination of all prior tasks. The AECOM Team will prepare the Final Technical Report that incorporates feedback received on goals and targets from Task 6.2 September 25, 2015 meeting with the MSWG.

7.1. Prepare Final Technical Report

The preparation of the Final Technical Report will include key inputs such as the:

- Task 5 Interim Report;
- Task 6.1 Technical Memo #4 on Documenting Exploration of GHG Goals and Targets

- Task 6.2 Comments and input on goals and targets received from MSWG meeting on September 25, 2015

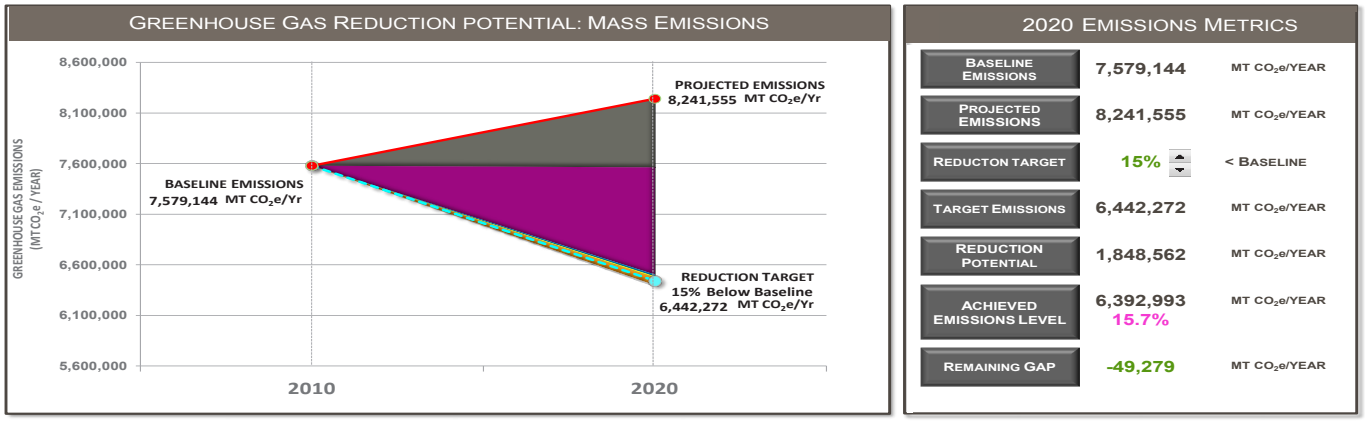
It is critical that this Final Technical Report be organized and communicated for full understanding, ownership and stewardship by the COG staff and COG Committees including TPB, MWAQC and CEEPC. AECOM Technical Team Leaders will participate with COG staff in presentations to COG Committees in December 2015 and to the COG Board in January 2016. It is understood that COG staff will lead the presentations with participation by members of the AECOM Team.

Schedule: *September 2015 - January 2016*

Product: *Final Technical Report; Presentations to TPB, MWAQC, CEEPC and COG Board*

Team Relevant Experience for Task 7

The AECOM Team consistently prepares GHG reduction strategy reports in document layouts that are easy to follow, concise and visually-compelling. We have used info graphics for illustrating and communicating GHG baselines, goals and reduction targets to public stakeholder groups and municipal officials in towns and cities throughout the U.S. Throughout the project, we will regularly consider how the clarity of graphics can be used to convey key points through presentations and written documents.



Sample GHG Wedge Graphic: Using the AECOM Climate Action Plan Toolkit, GHG emissions are projected to the target year using a business-as-usual trendline. The GHG reduction potential of strategies across all sectors is quantified and tabulated to reveal the anticipated impact of the GHG emissions reduction plan.

3

SERVICES, PRICING + SCHEDULE

3 SERVICES, PRICING + SCHEDULE

3.1. Price Proposal

The table on the following page represents the estimated level of effort per team member for each task. Hours are approximate and will be confirmed during the Task 1 effort to finalize the Contractor work plan and schedule.

3.2. Project Schedule

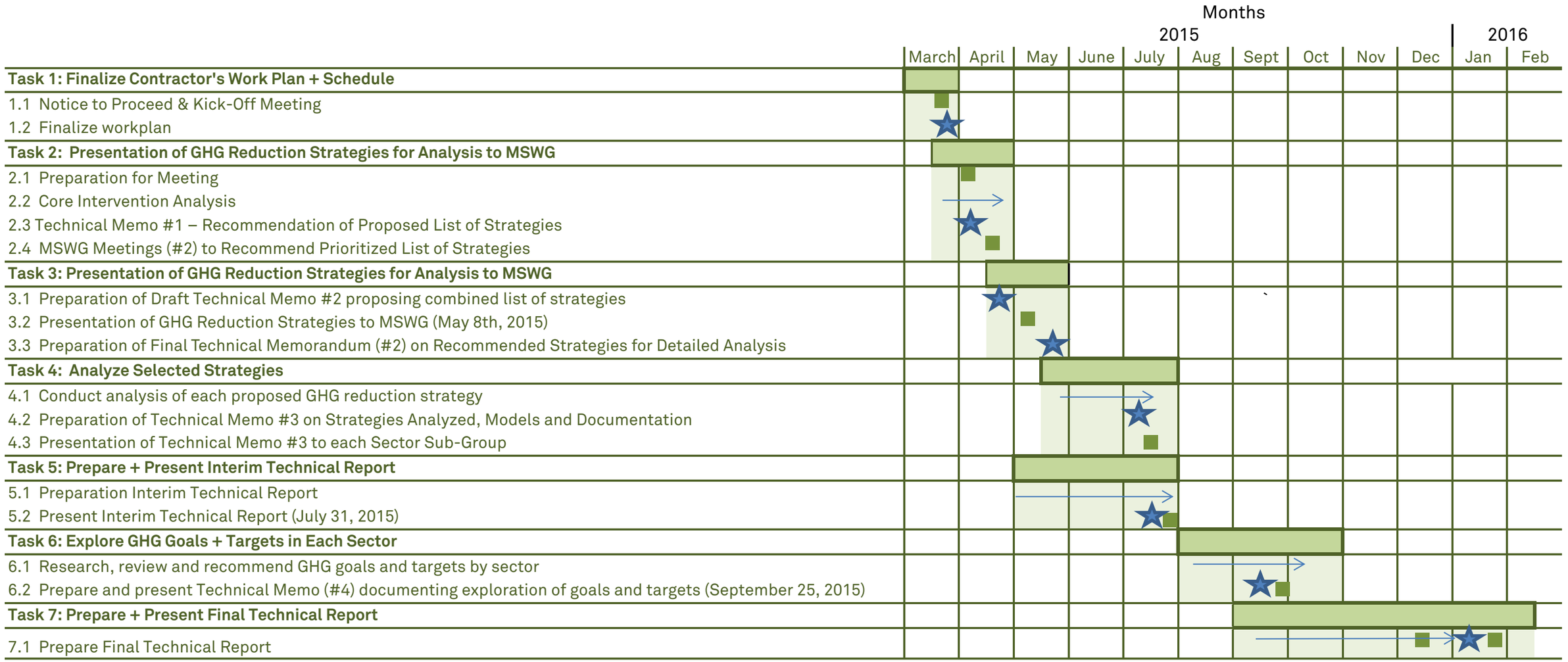
The project schedule on p.3-3 represents our understanding of the production and delivery requirements for all project materials and our commitment to work with COG to complete the project within the required work period.

Proposed Fixed Price Cost

		Project Tasks								
		Finalize Work Plan	Meetings, Review Strategies	Meetings, Strategies Draft & Final Tech Memo	Analyze Strategies	Interim Technical Report	GHG Goals & Targets	Final Tech Report & Present-ation	Total Hours	Total Costs
Project Personnel	**Hr Rate**	**1**	**2**	**3**	**4**	**5**	**6**	**7**		
Claire Bonham-Carter Principal in Charge & GHG Technincal Leader, AECOM	$ 230	4	15	20	30	15	20	20	124	$28,540
Brian Goldberg Project Manager, AECOM	$ 128	30	30	40	40	40	40	30	250	$31,943
Diane Dale Land Use Lead, AECOM	$ 268		15	20	15	10	5	10	75	$20,102
Culley Thomas Energy/Built Environment, GHG Modeling Lead, AECOM	$ 132	4	15	30	80	30	30	30	219	$28,928
Jonathan Thompson Analysis & Modeling, AECOM	$ 143				80	20	15		115	$16,474
Amruta Sudhalkar Built Environment, AECOM	$ 97				40		20		60	$5,803
Jane Atkinson Built Environment, AECOM	$ 184				30	10	20		60	$11,043
Jason Weiss Economic Analysis, AECOM	$ 185				10	10	5		25	$4,635
Andrea Bohmholdt Economic Analysis, AECOM	$ 126			10	80	40	40	20	190	$23,986
Veronica Davis Land Use, Nspiregreen	$ 162	4	40	40			20	10	114	$18,434
Chancee Lundy Built Environment, Nspiregreen	$ 162	8	60	40	20	10	20	20	178	$28,783
Kenya Goodson Built Environment, Nspiregreen	$ 121		40	40	10	20			110	$13,283
Uri Avin Tranportation Lead, NCSG	$ 164	4	12	12	12	10	8	5	63	$10,328
Fred Ducca GHG Analysis & Modeling, NCSG	$ 110	4	12	12	37	25	9	5	104	$11,487
Timothy Welch GHG Analysis & Modeling, NCSG	$ 123		8	8	35				51	$6,268
Rolf Moeckel GHG Analysis & Modeling, NCSG	$ 68		20	20	130	20	19		209	$14,135
Sevgi Erdogan GHG Analysis & Modeling, NCSG	$ 70				83				83	$5,777
Gerrit Knaap Economic Analysis, UMD	$ 184	4				10	7		21	$3,860
Graduate Student GHG Analysis & Modeling, UMD	$ 32		100						100	$3,214
Estimated project costs & travel										$12,000
Hours by Task		62	367	292	732	270	278	150		
Proposed Fixed Price Cost										**$299,019**

3.2. Project Schedule

The project schedule represents our understanding of the production and delivery requirements for all project materials and our commitment to work with COG to complete the project within the required work period. The schedule below is based on information provided in page 2-3 of RFP; the project schedule will be finalized with COG in Task 1.



Schedule based on information provided (page 2-3 of RFP); schedule to be finalized with COG in Task 1

meeting

deliverable

extended production of key deliverables

4

REFERENCES

4 REFERENCES

We invite you to contact the following client references for similar projects that our key team members have completed.

PlaNYC GHG Mitigation Study + Economic Assessment- New York, NY

Firm
AECOM

Key Personnel
Brian Goldberg, Claire Bonham-Carter, Culley Thomas, Jonathan Thompson, Jane Atkinson

Client
New York City Department of Environmental Protection

Contact Name, Title, Address, Phone Number
Levan Nadibaidze
Policy Advisor
NYC Mayor's Office of Long-Term Planning and Sustainability
253 Broadway - 10th floor
New York, NY 10007
Tel: 212.442.8131

Baltimore Climate Action Plan - Baltimore, MD

Firm
AECOM

Key Personnel
Brian Goldberg, Claire Bonham-Carter, Culley Thomas

Client, Address
City of Baltimore Office of Sustainability
417 East Fayette Street, 8th Floor
Baltimore, MD 21202

Contact Name, Title, Phone Number
Alice Kennedy, LEED GA
Sustainability Coordinator
Tel: 410.396.4556

Long Island Regional Sustainability Plan - Long Island Region, NY

Firm
AECOM

Key Personnel
Diane Dale, Brian Goldberg, Claire Bonham-Carter, Culley Thomas, Jonathan Thompson, Jane Atkinson

Client, Address
Town of North Hempstead (lead community of the Cleaner Green Community Consortium)
802 West Shore Road
Port Washington, NY 11050

Contact Name, Title, Phone Number
Igor Sikiric
Executive Director/Commissioner
Solid Waste Management Authority
Tel: 516.883.6241

Climate Action Plan Development Support for the Buildings + Energy Sector - Seattle, WA

Firm
AECOM

Key Personnel
Claire Bonham-Carter, Culley Thomas

Client, Address
City of Seattle
Seattle Municipal Tower
700-5th Avenue #1868
Seattle, WA 98104

Contact Name, Title, Phone Number
Christie Baumel

Climate Protection Advisor
Seattle Office of Sustainability + Environment
Tel: 206.233.7173

World Bank Carbon Abatement Planning Tool (CURB) - Washington, DC

Firm
AECOM

Key Personnel
Claire Bonham-Carter, Culley Thomas, Jonathan Thompson, Jane Atkinson

Client, Address
The World Bank Group - Social, Urban, Rural and Resilience Unit & C40
1818 H Street, NW
Washington, DC 20433

Contact Name, Title, Phone Number
Stephen A. Hammer, PhD
Lead Specialist: Cities and Climate Change Global Urban and DRM Unit Social, Urban, Rural and Resilience Global Practice The World Bank Group
Tel: 202.473.1220

Carbon Disclosure Project 2014 Global Cities Report - International

Firm
AECOM

Key Personnel
Claire Bonham-Carter

Client, Address
Carbon Disclosure Project (CDP)
3rd Floor, Quadrant House,
4 Thomas More Square,
Thomas More Street,
London,
E1W 1YW

Contact Name, Title, Phone Number
Conor Riffle
Director, Cities and Data Product Innovation
Tel: +44 (0) 20 7415 7019

Plan for Regional Sustainability Tomorrow (PRESTO) - Maryland and Northern Virginia

Firm
National Center for Smart Growth, University of Maryland

Key Personnel
Uri Avin, Fred Ducca, Sevgi Erdogan, Gerrit Knaap, Rolf Moeckel, Tim Welch

Client, Address
Town Creek Foundation
121 West Street
Easton, MD 21601

Contact Name, Title, Phone Number
Stuart Clarke
Executive Director
Tel: 410.763.8171

Various Climate Change Projects - Statewide, Maryland

Firm
National Center for Smart Growth, University of Maryland

Key Personnel
Fred Ducca, Sevgi Erdogan, Tim Welch

Client, Address, Contact Name, Title, Phone Number
Maryland Department of Transportation
7201 Corporate Center Drive
Hanover, MD 21076

Michelle Martin
Assistant Director, Planning and Capital Programming
Tel: 410.865.1285

Client, Address, Contact Name, Title, Phone Number
Maryland Department Of The Environment
1800 Washington Boulevard
Baltimore, MD 21230

Tad Aburn
Director of ARMA
Tel: 410.537.4125

SILO Land Use Model - Various Locations

Firm
National Center for Smart Growth, University of Maryland

Key Personnel
Uri Avin, Fred Ducca, Sevgi Erdogan, Gerrit Knaap, Rolf Moeckel, Tim Welch

Client, Address, Contact Name, Title, Phone Number
Maryland Department of Transportation
7201 Corporate Center Drive
Hanover, MD 21076

Michelle Martin
Assistant Director, Planning and Capital Programming
Tel: 410.865.1285

Client, Address, Contact Name, Title, Phone Number
Town Creek Foundation
121 West Street
Easton, MD 21601

Stuart Clarke
Executive Director
Tel: 410.763.8171

EnergySmartDC - Comprehensive Energy Plan - Washington, DC

Firm
Nspiregreen, LLC

Key Personnel
Veronica Davis, Chancee Lundy

Client, Address
District Department of Environment
1200 First Street NE, 5th Floor
Washington, DC 20002

Contact Name, Title, Phone Number
Lancelot Loncke
Associate Director, Energy Administration
Tel: 202.671.3306

North–South Corridor Planning Study - Washington, DC

Firm
Nspiregreen, LLC

Key Personnel
Veronica Davis, Chancee Lundy

Client, Address
District Department of Transportation
55 M Street SE, Suite 400
Washington, DC 20003

Contact Name, Title, Phone Number
Jamie Henson
Manager, Project Review
Tel: 202.671.1324

Consolidated TMDL Implementation Plan + Revised Monitoring Framework - Washington, DC

Firm
Nspiregreen, LLC

Key Personnel
Chancee Lundy, Kenya Goodson

Owner
District Department of Environment

Client, Address
LimnoTech
1015 18th Street, NW, Suite 900
Washington, DC 20036

Contact Name, Title, Phone Number
Dan Herrema, PE
Project Manager (LimnoTech)
Tel: 202.833.9140

5

DBE PARTICIPATION PLAN

5 DBE PARTICIPATION PLAN

AECOM's DBE Commitment

The DBE Participation Plan is included on the following page.

At AECOM, we are committed to the spirit and intent of small business programs to bring small businesses into the mainstream business environment in meaningful roles. Our approach to minority and local business utilization allows us to complement our own technical expertise with the resources available in the diverse business community. We work so that these firms on our team not only play substantive roles, but also meet the same exacting standards for quality that we demand of ourselves. We are committed to more than the simple arithmetic satisfaction of percentage goals.

AECOM strongly endorses MWCOG's principle of giving these businesses the maximum practicable opportunity to participate in all phases of its operations. Locally, AECOM actively participates in every DDOT-DBE Summit and looks forward to sustaining enduring relationships with our DBE partners. AECOM is also one of the few major national firms that has been invited to participate in the Architects/Engineers Council, Inc., a professional association of architectural and engineering firms headquartered in the District of Columbia supporting local, small, and disadvantaged business enterprises.

The following accomplishments are representative of AECOM's commitment to small and minority business partners:

- Excellence rating for our program from the Small Business Administration (SBA)
- In FY13, exceeded small business participation requirements of 23% on federal contracts, achieving 39% participation
- Outstanding ratings for our program from the Defense Contracts Management Agency (DCMA) for 12 continuous years
- 2011 NASA/AMES Research Center Small Business Industry Award, Large Business Prime Contractor of the Year
- 2011 Society of American Military Engineers Large Business Award for Outstanding Small Business Subcontracting Performance in Support of DoD Programs
- SBA's Frances Perkins Vanguard Award for outstanding utilization of WBEs in 2001 and 2008
- US Department of Homeland Security Mentor-Protégé Award in 2007 for "embracing the mentor-protégé principle of small business development
- Nunn-Perry Awards for participation in the DoD Mentor Protégé Program in 1997, 2003, and 2006

DBE Participation Plan

DBE SUBCONTRACTOR		PERCENTAGE OF CONTRACT
Subcontractor: Nspiregreen, LLC		20%
Address: 601 Pennsylvania Ave, NW South Building, Suite 900 Washington, DC 20004		
Certifying State: Metropolitan Washington Unified Certification Program, Washington, DC	**DBE Certification #:** 14-05-04-RE	

DBE Certificate

Nspiregreen, LLC's MWUCP certificate is provided on the following pages.

METROPOLITAN WASHINGTON
UNIFIED CERTIFICATION PROGRAM

DDOT • 55 M Street S.E., 3rd Floor • Washington, D. C. 20003• (202) 671-0479
WMATA • 600 Fifth Street, N. W., 3rd Floor • Washington, D. C. 20001• (202) 962-6493

District Department of Transportation

May 8, 2014
Sent *via* Regular Mail

Nspiregreen, LLC
Attention: Chance Lundy, Partner
601 Pennsylvania Avenue, NW
South Building, Suite 900
Washington, DC 20004

RE: Certification No. 14-05-04-RE

Dear Ms. Lundy,

We are pleased to inform you that your firm has been found eligible to continue as a Disadvantaged Business Enterprise (DBE) with the Metropolitan Washington Unified Certification Program (MWUCP), effective **May 8, 2014** MWUCP participants include the Metropolitan Washington Area Transit Authority (WMATA) and the District of Columbia Department of Transportation (DDOT). **Your firm is subject to the requirements of the Disadvantaged Business Enterprise regulations, *Title 49, Code of Federal Regulations, Part 26*, as amended and all laws of this jurisdiction applicable to the transaction of business.** You are currently certified in the following North American Industry Classification System (NAICS) Code(s):

NAICS CODE	Description
541820	Public Outreach
541620	Environmental Consulting
541320	Urban Planning Services

If you wish to add to the list of approved NAICS Codes, you must make such request in writing with supporting documentation to the MWUCP participant from which the original certification was received.

As a certified DBE, you are required to submit an annual "No Change"/"Notice Regarding Change" statement, attesting to your continued status as a "socially and economically disadvantaged individual". You must also submit the following: (1) a *Personal Net Worth Statement (PNW); (2) the Individual Income Tax Return for that year; and (3) the Firm's Federal Tax Return for that year. The requisite forms are available at http://dbe.ddot.dc.gov.

Nspiregreen, LLC

You can access *these forms on http://dbe.ddot.dc.gov. The "No Change"/ "Notice Regarding Change" Statement and supporting documentation should be mailed annually on or before your firm's certification date to:

District Department of Transportation
Office of Civil Rights
55 M Street S.E. 3rd Floor S.E.
Washington, DC 20003

If a change in the ownership, control or management of your firm has occurred, you must complete and submit a "Notice Regarding Change" statement immediately subsequent to the change.

Firms desiring information about DDOT procurement opportunities should go on line at http://dbe.ddot.dc.gov. To do business with WMATA, go on line at www.wmata.com or www.metroopensdoors.com to register as a vendor and for bidding opportunities.

A firm is considered graduated in all or some of the areas of work grouped under the NAICS Codes if the firm exceeds the size standards listed under the NAICS Codes. If a firm exceeds the size standard in any of its approved NAICS Codes, it is no longer certified as a Disadvantaged Business Enterprise under that specific NAICS Code. If a firm exceeds the size standards in all of its approved NAICS Codes or the established Personal Net Worth standard, it is no longer eligible to participate as a Disadvantaged Business Enterprise under the Federal U.S. Department of Transportation Program.

Your certification does not automatically expire, however; your firm must submit the required documents annually on or before your firm's certification date. Failure to provide the requested documents in a timely manner will result in immediate actions to decertify your firm's eligibility as a Disadvantaged Business Enterprise with the Metropolitan Washington Unified Certification Program.

If you have any questions, please contact Luisa Portillo, Equal Opportunity Specialist at 202-671-0630 or via email at luisa.portillo@dc.gov

Sincerely,

Luisa Portillo for

Lisa Gregory, Chief
Office of Civil Rights
District Department of Transportation (DDOT)
DDOT/LP

ATTACHMENTS

ATTACHMENTS

The following attachments are provided on the subsequent pages:

- Attachment B: Certification Regarding Debarment
- Attachment C: Contact Information Sheet

ATTACHMENT B
CERTIFICATION REGARDING
DEBARMENT, SUSPENSION, AND OTHER
RESPONSIBILITY MATTERS

The prospective vendor certifies to the best of its knowledge and belief that it and its principals:

- Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any department or agency of the District of Columbia, State of Maryland or the Commonwealth of Virginia or any of the 22 jurisdictions comprising the membership of the Metropolitan Washington Council of Governments (COG);
- Have not within a three year period preceding this date been convicted of or had a civil judgment rendered against them for commission of fraud or criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated above of this certification; and
- Have not within a three-year period preceding this date had one or more public transactions (Federal, State or local) terminated for cause or default.

Vendor understands that a false statement on this certification may be grounds for rejection of any submitted proposal or quotation or termination of any award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to 5 years, or both if federal funds are being used to support the procurement.

AECOM Technical Services, Inc.

Typed Name of Vendor

Ashley O'Connor, AICP, Vice President

Typed Name & Title of Authorized Representative

03/05/15

Signature of Authorized Representative Date

ATTACHMENT C
CONTACT INFORMATION SHEET

(*THIS PAGE MUST BE COMPLETED AND SUBMITTED WITH THE PROPOSAL)*

RFP/RFQ No.: 15-010 Federal Tax ID No.: 95-2661922

Name of Offeror: AECOM Technical Services, Inc.

Address of Offeror: 3101 Wilson Boulevard, Suite 900, Arlington, VA 22201

Telephone No: 703.682.4900 Fax No.: 703.682.4901 Website: www.aecom.com

Name of Authorized Representative: Ashley O'Connor, AICP, Vice President

Mailing Address (If different from Above): SAME

Telephone No.: 703.682.4945 Mobile No.: _____ Other:_____

Email Address: ashely.o'connor@aecom.com

Name of Contact Person for this RFP/RFQ: Brian Goldberg, AICP, LEED AP

Title of Contact Person: Project Manager

Telephone No.: 703.682.5016 Mobile No.: 202.641.7798 Other: _____

Email Address: brian.goldberg@aecom.com

AECOM

ABOUT AECOM

AECOM is a premier, fully integrated professional and technical services firm positioned to design, build, finance and operate infrastructure assets around the world for public- and private-sector clients. With nearly 100,000 employees—including architects, engineers, designers, planners, scientists and management and construction services professionals—serving clients in over 150 countries around the world, AECOM is ranked as the #1 engineering design firm by revenue in *Engineering News-Record* magazine's annual industry rankings. The company is a leader in all of the key markets that it serves, including transportation, facilities, environmental, energy, oil and gas, water, high-rise buildings and government. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering customized and creative solutions that meet the needs of clients' projects. A *Fortune 500* firm, AECOM companies, including URS Corporation and Hunt Construction Group, have annual revenue of approximately $19 billion. More information on AECOM and its services can be found at www.aecom.com.

AECOM

3101 Wilson Boulevard
Suite 900
Arlington, VA 22201
T 703.682.4900 F 703.682.4901