

**Testimony by Claudia Barragan**

*Re: McMillan Park and Proposed Planned Unit Development (PUD) in  
Zoning Commission Case No. 13-14*

For Friends of McMillan Park and DC for Reasonable Development

**May 1, 2017**

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This testimony adopts and concurs the testimony provided by witnesses of Friends of McMillan Park and DC for Reasonable Development. As an urban planning practitioner, I specifically read, concur and adopt the testimony provided by Laura Richards, on April 19<sup>th</sup> 2017.

My name is Claudia Barragan, I am testifying on behalf of the Friends of McMillan Park (FOMP) as an immigrant and resident of ward 5, and a professional urban planning and designing expert. My testimony raises issues in the Notice of Remand as well as in the process of master planning and zoning approval of the development proposal of the McMillan Sand Filtration Site and the proposed developments' compliance with the D.C. Comprehensive Plan. It also includes my expert opinion ratifying the prior testimonies and specifically the main issues raised by the D.C. Court of Appeals in its Order remanding this matter for further proceedings.

**Amending the District's Zone Map is a different action from approving the PUD project**

- The Commission is authorized to amend the DC Zone Map as not inconsistent with the FLUM, a key map carrying legal weight by and through the Comprehensive Plan. The Commission cannot amend the Future Land Use Map (FLUM). Amending the FLUM requires a legislative act by the Council.
- The Commission cannot arbitrarily remap a parcel to high-density zoning in the face of the FLUM's role as the Districts' long-term framework plan for a 20-year built environment. Yet, in this case, the Commission first served the Applicant by arbitrarily remapping the entire PUD site to two different high-density commercial zones and then approves a PUD project to fit the proposed development of this high-density remapping.
- The Commission must recognize that unlimited Zone Map amendment power was not granted to Zoning Board, as the enabling statute states in clear terms.

*§ 6-641.02 "Zoning maps . . . , and amendments thereto, shall not be inconsistent with the comprehensive plan..."*

- The Commission has overstepped its authority, not necessarily in approving the actual PUD project (buildings and land use), but instead the Commission's act of amending the DC Zone Map in an inconsistent manner with the FLUM (thus also amending the FLUM).
- The Commission does not have the power to amend the Zone Map as inconsistent with the FLUM. Only the Council and Mayor can legislatively change the FLUM's anticipated future development designations throughout DC. As per the Home Rule Act that process must allow for appropriate District resident involvement which includes providing meaningful consultation to the local planning agencies:

*...In carrying out his responsibilities under this section, the Mayor shall establish procedures for citizen involvement in the planning process and for appropriate meaningful consultation with any state or local government or planning agency in the National Capital region affected by any aspect of a proposed District element of the comprehensive plan (including amendments thereto) affecting or relating to the District.*

- If the Commission had continuous unlimited power in amending the DC Zone Map, the FLUM would be a useless component of development review, and therefore render the entire current amendment of the Comprehensive Plan useless.
- Moreover, the PUD remapping to high density commercial zones will also energize harmful community-wide impacts of displacement onto surrounding low-rise residentially zones. There is no analysis on the record evaluating the social and environmental impacts of the remapping to the adjacent neighborhoods. As an urban design professional, I know that designing/planning higher densities, can in turn destabilize the character and social characteristics of the surrounding single-family residential districts. Including the negative impacts that higher valued zoning has on the surrounding property taxes for existing low-income neighbors and for future affordable housing projects in the area.
- The flexibility of the FLUM is touted by the Applicant and Commission as the rationale for the high-density remapping. But “flexibility” of the FLUM in this parcel and within the impacted surrounding low-density neighborhood has long been requested by the community to not be exerted. Therefore, the Commissions’ decision to ignore the community’s feedback and instead adhere solely to the Applicant’s choice of density is against the Comprehensive Plan and Home Rule mandate.
- McMillan Park is legislatively set to be remapped to moderate density zoning, not high-density zoning. The Applicant had the flexibility to choose from an array of moderate and medium density zone districts described in these FLUM designations, but instead chose two high density commercial districts. The Applicant’s analysis of the Future Land Use Map (FLUM) and the Commission’s understanding of their flexibility is wrong and must be clarified as a question of law.

## **Gentrification**

- The lack of analysis and conclusory comments by the Applicant about gentrification and destabilizing land values by the PUD project and PUD remapping onto the areas around McMillan Park are unacceptable on their face. Most researchers find that gentrification & displacement pressures increase with growth and development, even in areas with already expensive housing costs. For example, the Bay area.

*"The Bay Area is one of the most expensive and challenging housing markets in the country. ... Anticipated growth will place even more pressure on the region's housing market. ... Researchers generally agree that new transit investment will bring higher property values to the surrounding area (except in the immediate vicinity of the transit station). This could spur a process of gentrification, which will be beneficial to some – but not to those who cannot bear rent increases and are forced to leave the neighborhood." – Mapping Susceptibility to Gentrification: The Early Warning Toolkit, August 2009, by Karen Chapple, Faculty Director, Center for Community Innovation.*

- Following on, there is little to no baseline reporting from the city's planning and housing agencies or the Applicant describing the scope of vulnerability and demographic impact of the residents living in adjacent residential areas. The baseline reporting should also account for the demographic pressures to a wider locally scaled community, either at the area element and ward level. Because mass development of this site will create acute socio-economic pressures already being felt in the diversity of wealth in the ward. There is no analysis of actual at-risk affordability for specific properties, residential or commercial, in the surrounding areas by any relevant District agencies on the record.
- A social impact assessment must be included as part of this development review to allow the Commission to fully express its duty in judging the impacts by the PUD application. Such an assessment must include much deeper and detailed analysis of the directly impacted community in the surrounding areas – delineating the impact zones and the social indicators, evaluating public health indicators and economical burdens that the community will be forced to endure if the PUD remapping and project are approved.
- Furthermore, DC's Planning agencies continue to fail to examine the community's environmental values in terms of the protection of cultural heritage and site-specific ecological assets. See generally, Impact Assessment and Project Appraisal, Volume 21, Number 1, March 2003, "SIA principles, International Principles For Social Impact Assessment," by Frank Vanclay.
- Thus, the Commission cannot express its role in judging and balancing impacts versus amenities without using the already available reliable and robust data sets. Using ethnographical surveys of the existing land use, people, and businesses specific to the surrounding areas around the PUD site.
- The Office of Planning must take this case back to relevant District agencies to re-review the existing baseline quality of life, prevailing character, aesthetic, and neighborhood demographics and cultural assets.
- The current analysis by the applicant and its supporters mistakenly analyzes gentrification from a regional and citywide lens. Instead gentrification impact analysis must be done at the surrounding neighborhood and hyper local scale.
  - *My long-established work in urban planning in ward 5, specifically in developing the 2007 CUA/Brookland metro small area plan for the Office of Planning, exemplifies that by now there is enough data at the similar neighborhood level to appropriately analyze the public health and social impacts of ongoing gentrification/displacement by high density development.*
  - We planners have enough data to study and analyze the burdens being faced by ward 5 residents, and Bloomingdale, Shaw neighborhood low income residents of color, and businesses in near the PUD site. **STRONGHOLD, plus WARD 1 to the WEST.**
- A regional or citywide scale gentrification/displacement analysis provides zero relevance to the direct impacts this PUD application will create on the basic quality of life, prevailing aesthetic character, cultural community assets and neighborhood demographics, people, ecology, businesses and culture.

### **Proximity of the Medical Office Mixed Use Buildings to the surrounding community**

- This urban design choices on land use placement were clearly made without prioritizing commonality of land use. Instead they were clearly made to take advantage of high market value viewshed/vista advantages. Placing massively tall buildings including a 2-story tall grocery along the North-East section of the site, will create massive traffic, while allowing for expensive market-value views, down North Capitol. The same can be said for the advantageous placement of the two mixed-use multi-family buildings and a critical anchor on the North-West portion of the site. The phasing of the project is also conflicting, given that there is no market demand need to start with the design approval of the high end multi-family buildings.
- It is urban design choices like this that prove the lack of carefully designed solutions that could minimize the negative social impacts that will burden the low-rise residential communities to the north-east, east, south, and south-west. These neighbors are more impacted by the PUD project, and by the amendment to the Zone Map than the surrounding area buildings to the north/north-west. Attached find Birds-eye views of the McMillan Park and the surrounding area.

### **Review of the DDOE Environmental Assessment (Exhibit 896F)**

- The record does not account for the Applicant's self-certified Environmental Impact Screening Form (EISF), so the Commission cannot understand how the Applicant relayed information that served as foundation for DC Department of the Environment's (DDOE) environmental analysis and Environmental Assessment report (EA) signed by Melinda Bolling, Director of DCRA, and delivered to DMPED's Gilles Sticker on August 29, 2016. In fact none of the materials provided by the Applicant are on the record. See "Page 2" of the EA, or Page 7 of PDF document.  
*It is arbitrary omissions and obvious errors in DDOE's assessment that should send up red flags:*
- It is undisputed that the PUD project in its form now will generate at least 25000+ additional vehicle trips on Saturday's alone. It is unclear if the Applicant admitted this information to DDOE or other planning agencies or that these agencies took this data point into account in any real way. What is clear is that the sheer additional volume of traffic will affect air, water, noise and environmental quality that residents currently enjoy.
- The EA makes no mention of the nearly doubling of existing traffic in the surrounding area. That means the analysis may not be considering the reality of the increased traffic volume generated by the PUD project, thus the Commission and the surrounding residents cannot assess these adverse impacts onto existing public transit ways, onto emergency response time, and increased noise and other air pollution that will prevail.
- The EA makes no mention that DDOT says the funding of capital improvements to "mitigate" the traffic "have not been identified." (DDOT Memorandum dated March 13, 2017, by Jamie Henson of DDOT, Exhibit 898, page 2).
- The EA says the community had no comments on the project. The community could not

participate because they weren't explicitly asked to provide comment. The DDOE EA review clearly was not transparent and therefore fundamentally inconsistent with relevant DC Comprehensive Plan policies expressly requiring transparency, participation and appropriate outreach in environmental decision making. DDOE and DCRA could have reviewed the Zoning record and the hundreds of public comments provided on the project, or listened to the agency transcripts. Neither DDOE nor any other relevant DC agency has provided evidence showing good faith efforts in reaching out to the legally-enabled McMillan Advisory Group to even consider their comments.

- The EA suggests there are no water bodies in the area surrounding the site. EA Report, "Page 9" or Page 15 of the PDF. Just across the street from the McMillan Park is the reservoir. Smith Spring is nearby. Flowing from the north to south and under McMillan Park are important historic tributaries and creeks which flow from and are of the Anacostia and Potomac waterbasins, most famous is the historic Tiber Creek. See attached.
- It is undisputed that these important and threatened water features are highlighted in detail on topographical maps of DC as attached and in the United States Department of the Interior, National Park Service / National Register of Historic Places Registration Form, NPS Form 10-900, <https://www.nps.gov/nr/feature/places/13000022.htm>
- These topographical/watershed, water features and long established natural water catchment zones on and around the site ought to be protected to be considered in line with the city's sustainability policies and programs ([www.sustainabledc.org/](http://www.sustainabledc.org/)). Thus, the water catchments and the ecological evolution of native or invasive plants and wildlife within them must at least be evaluated as existing conditions and for impact per the Comprehensive Plan, and federal regulations. Let me remind the commission that Birds are federally protected, and any harmful impact on aquatic areas which often provide foraging habitat for a variety of migratory bird must be mitigated. USFWS offers several recommendations to mitigate possible negative impacts of habitat fragmentation which protect over 159 migratory bird species
- For as long as it has remained gated and without development, there now exists an established community of urban organisms at McMillan Park – plants, animals, fungi and bacteria of the natural park escarpment as Olmsted beautifully adorned the landmark waterworks below. This park may have an ecosystem that is all dependent on one another and its environment as a unified element. Protecting the existing ecosystems is equally important to understanding existing conditions at the site now. An existing ecological conditions analysis must be part of the development review &/or the EA in its commitment to maintain and protect the city's water quality, and vulnerable ecologies.
- Another similar missing environmental analysis, is the lack of examination by DC Archaeological teams as part of OP purview, despite the acknowledgement in the EA that the sediments under the site are from the "Cretaceous age." DDOE EA, "Page 16", Page 12 of the PDF.
- A thorough landscape and wildlife assessment must be included, to understand the native ecosystems and fossils and artifacts on the site now. <https://doee.dc.gov/service/2015-district-columbia-wildlife-action-plan>
- There is obvious interplay between the existing natural features and those of the infrastructure and planning for this project. In total, the projects impacts are still so far unevaluated.

- The EA makes no mention of the fumes that may be coming from the parking garages holding more than 3,000 cars and vehicles. Not to mention, there is no clear analysis of the expected increase in the diesel vehicles serving the site, whether this be buses, delivery trucks, ambulances, refuse vehicles, or other vehicles servicing the site.
- This lack of impact evaluation is unacceptable, especially given the DC Attorney General's recent acknowledgment of the dangers of toxic emissions from vehicles. Attached.
- The EA does not consider in any meaningful way how the project may increase noise and other polluting emissions onto the surrounding existing sensitive areas, including the existing hospitals and lowrise residential communities.
- Hospitals are known by the city as especially sensitive to development impacts, heavy construction, sustained noise and other threats like flooding.
- There is no evaluation of how paving over two thirds of McMillan Park affects the ground surface temperatures for the PUD site and surrounding area. <http://tinyurl.com/ddoe-heat-island-study>
- And, there is no analysis of the capacity and conditions of the public water/sewer systems that exist and serve the community now. Moreover, there are no projections how the PUD project will affect these public services in the surrounding area 20 years after the PUD project is built. How about 50 years? 75 years? <http://tinyurl.com/mcevaou>
- There are no thermal mapping or other calculations the Applicant or DDOE points to that show pre- and post-PUD project heat island affects or surface temperatures at the park now and in the surrounding area. <http://tinyurl.com/dc-severe-weather-prep>
- There is no analysis of the PUD project and the remapping vis-a-vis increasing climate change impacts or as to how the site is nearly dead center in a major flood zone. This flies in the face of key city planning policies. Attached.
- There is no agency review showing the efficacy and current capacity of the water and sewer pipes as it relates to the size and use presented by the PUD project. And, thus there are no conclusions to the ability of the project to account for expedited climate change events.
- Beyond the very limited-scope of review in the submitted EA, there are no evaluations on the record contending with these city policies of planning and development in the context of climate change. Clearly the PUD project and its impacts must be considering the climate change models and policy planning directives and guidelines the city has adopted.
  - <http://tinyurl.com/h9ssr5p>
  - <http://tinyurl.com/dc-climate-change-ready>
  - <http://tinyurl.com/lzdqz4b>
  - <http://tinyurl.com/kezgao9>
  - <http://tinyurl.com/op-key-indicators>

### **Adverse Impact Evaluation**

- The Comprehensive Plan's Implementation Element expects "at least an evaluation" of the impacts a PUD application will have on the existing public services and quality of life "in the surrounding area" around the PUD site.

- A proper development review before the Commission means, per the PUD regulations and in relation to applicable Comprehensive Plan policies, a “comprehensive” and “transparent” development review “specific to the circumstances” of the PUD application. Include an evaluation of real impacts “on the surrounding area” in the Commission’s authorized role “to protect the welfare” of existing residents, businesses, fauna, public services, and quality of life for the surrounding areas that will be concretely impacted by the PUD application.
- Relevant DC housing agencies are required to be called upon by the Office of Planning to fulfill the Comprehensive Plan directives and guidance seeking information of adjacent area and property-specific vulnerabilities to displacement due to social indicators, using demographics, social & health impacts of the people living and working near the PUD.
- Relevant DC small business and economic development agencies must pursue the directives and guidance of the plan policies seeking to protect local small businesses from displacement from increasing land values brought on by PUD projects, especially ones that can dramatically shift the prevailing landscape physically and financially.
- Relevant DC community service agencies, like emergency responders must be required to take seriously the effect on emergency response time that the PUD application may present given an increase in emergency service demand by such a large new PUD project and its operational safety needs.
- The same measurements also must be evaluated as far as community educational facilities and performance levels provided by public schools and libraries that currently serve the areas surrounding the PUD site, both before and after the project may be built.
- The analysis of relevant District agencies like the Department of Health must be called upon to evaluate health and pollution impacts from the PUD’s additional refuse, noise, and impacts to air and water quality so to understand the acute impacts by the PUD application on the existing quality of life for the surrounding areas, and health impacts on those specifically living nearby.
- To understand these adverse impacts and scope as such, provide information specific to those who will be directly affected, i.e. those living and operating businesses around the PUD. This has not happened yet, and the on-record agency reports, after the Court’s remand do not provide information specific to the surrounding area.
- Thus, without a comprehensive public review, the Commission has not shown they considered meaningful assessments of the surrounding areas and the impacts to the community. This is unacceptable in the context of modern-day planning mandates in the District, per the American Institute of Certified Planners (AICP) protocols and ethics (<https://www.planning.org/ethics/ethicscode.htm>).

### **Language Access is Imperative**

- Language includes jargon. DC’s zoning jargon isn’t easily interpreted by the average economically and ethnically diverse District family. Immigrant communities in the district are directly affected by these large-scale development projects. Specifically, the threat of displacement. Access for the broader community to participate is often limited even for the educated native speaking public as exemplified in the proceedings of this case, Zoning Commission meeting on March 23, 2017.

- This zoning case has gone on record of closing and disallowing public filings about a proposed development of a major 25-acres open space site in the district. The Commission's actions of disallowing a diverse membership advocacy group, do not provide confidence for a just process which allows immigrant tax-paying residents who are non-native speakers, to provide equal testimony & public filings. There are not many community-organizations that center their advocacy on inclusivity and the empowerment of communities of color to participate in the District's development affairs. Ignoring us immigrants and the laws that protect us, is unacceptable and unlawful.
- Let me remind this commission that the DC Language Access Act of 2004, includes DCOZ, DCOP, DOEE, DMPED in its mandate. It is imperative that the Commission consistently adheres to its mandate and allow for the access and participation of immigrants to provide testimony. This includes as deemed pertinent to select experts who are immigrants. Only through the adherence to local and federal laws that protect us immigrants from being discriminated by the lack of access to participate in Zoning decisions. As an immigrant, urban planner and a DC resident, I ask the Commission to please adhere to the Districts' law. Also, for the agency's record to be open wide at this stage.

### **Conclusion**

- Development review must be comprehensive and pursue Comprehensive Plan policies that guide and direct appropriate and transparent land use decisions specific to the case and surrounding area.
- The issues demonstrated above and the related adverse effects such as displacement, impacts on the environment and public services, social impacts, negative health impacts and other adverse effects, as well as adequate mitigations thereof must be pursued rigorously, responsibly and openly at the earliest stages of development review, as in now before the Zoning Commission. This is the only way forward for a predictable built environment for all involved in the areas surrounding the PUD site.
- Given all the stated issues, omissions, concerns, and law, it is clear the required comprehensive review has not yet been done in this case, leaving the surrounding area vulnerable to adverse impacts by and through opaque and arbitrary decision-making. The Office of Planning, relevant District agencies and Zoning Commission must act in accordance with the law to remedy these contested concerns.

Signed,



**/s/n Claudia Barragan**

*Incorporated by reference find the attached curriculum vitae (CV) and related reports, studies, and other documents important to this testimony.*

**REFERENCED CITY POLICIES,  
STUDIES & REPORTS**  
*... in addition to those already attached & incorporated*



# STATE DATA CENTER 2009-2013 ACS KEY DEMOGRAPHIC INDICATORS

These indicators were derived from data produced by the U.S. Census Bureau and may differ from data produced by other entities. See notes on next page.

2009-2013 American Community Survey, Key Demographic Indicators										
Key Indicators	United States	District Total	Ward 1	Ward 2	Ward 3	Ward 4	Ward 5	Ward 6	Ward 7	Ward 8
<b>Total Population</b>	311,536,594	619,371	79,145	75,186	80,544	79,111	79,342	83,821	65,777	76,445
<b>Population by Sex (%)</b>										
Male	49.2%	47.3%	49.3%	50.7%	45.0%	47.8%	47.6%	49.3%	42.9%	45.3%
Female	50.8%	52.7%	50.7%	49.3%	55.0%	52.2%	52.4%	50.7%	57.1%	54.7%
<b>Population by Age (%)</b>										
Under 5 years	6.4%	5.9%	5.2%	2.8%	4.7%	6.6%	6.2%	4.9%	7.0%	9.9%
Youths, Under 18 years	23.7%	17.0%	12.0%	5.1%	13.3%	20.1%	18.4%	13.0%	25.1%	30.5%
18-64 years	62.9%	71.6%	80.7%	86.1%	71.3%	64.9%	67.9%	77.2%	61.4%	62.0%
Seniors, 65 years and over	13.4%	11.4%	7.3%	8.8%	15.4%	15.0%	13.7%	9.8%	13.5%	7.5%
Median Age (years)	37.3	33.8	31.5	30.5	36.4	39.5	36.1	34.4	37.9	28.6
<b>Population by Race (%)</b>										
White	74.0%	45.1%	54.3%	75.9%	83.2%	25.2%	16.5%	51.1%	2.0%	4.4%
Black	12.6%	50.1%	21.6%	8.8%	2.5%	58.8%	74.9%	40.2%	95.6%	94.0%
American Indian & Alaska Native	0.8%	0.3%	0.3%	0.4%	0.3%	0.3%	0.4%	0.4%	0.2%	0.1%
Asian	4.9%	3.5%	4.6%	9.4%	5.7%	1.9%	1.4%	4.5%	0.2%	0.3%
Native Hawaiian & Other Pacific Islander	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%	0.2%	0.0%	0.0%
Some Other Race Alone	4.7%	3.6%	6.6%	2.3%	7.4%	10.4%	5.0%	7.3%	0.9%	0.4%
Two or More Races	2.8%	2.1%	2.4%	3.2%	3.9%	2.5%	2.0%	2.5%	1.1%	0.9%
<b>Hispanic/Latino Population (# and %)</b>	51,786,591 16.6%	59,479 9.6%	16,626 21.0%	6,710 8.9%	7,027 8.7%	15,004 19.0%	6,664 8.4%	5,102 6.1%	1,398 2.1%	948 1.2%
<b>Foreign-born Population (%)</b>	12.9%	13.8%	23.0%	18.2%	18.8%	21.9%	11.1%	9.7%	3.2%	2.4%
<b>Commuting to Work</b>										
Population 16 years and over (#)	139,786,639	312,875	50,266	47,580	46,491	38,394	34,199	49,014	23,730	23,201
% Private vehicle (drove alone)	76.3%	34.0%	23.1%	21.1%	37.8%	45.9%	43.0%	30.4%	44.4%	40.2%
% Private vehicle (carpooled)	9.8%	5.9%	5.3%	2.7%	6.4%	7.7%	7.7%	5.1%	7.6%	8.0%
% Public transportation	5.0%	38.4%	46.1%	29.0%	37.4%	36.4%	36.3%	39.1%	42.6%	43.4%
% Walked	2.8%	12.2%	11.9%	36.4%	7.6%	2.3%	6.0%	14.6%	1.9%	3.2%
% Other Means	1.8%	4.7%	8.1%	5.1%	4.0%	3.5%	4.4%	6.0%	1.4%	1.4%
% Worked at home	4.3%	4.8%	5.6%	5.7%	6.8%	4.2%	2.6%	4.9%	2.1%	3.9%
<b>Mean Travel Time to Work (minutes)</b>	25.5	29.7	29.3	24	28.6	32.6	30.6	26.5	36.6	37.9
<b>Households with Vehicle (%)</b>	90.9%	63.3%	56.2%	52.1%	77.6%	75.1%	67.6%	66.0%	60.2%	50.3%
<b>% Unemployed</b>	6.2%	7.4%	5.8%	3.0%	2.8%	8.1%	10.6%	5.8%	12.9%	13.6%
<b>Educational Attainment</b>										
Population 25 Years and Over (#)	206,587,852	430,307	58,049	51,994	58,563	57,164	54,867	64,571	42,520	42,629
% High School Graduate or Higher	86.0%	88.4%	86.7%	95.2%	97.2%	86.1%	84.8%	90.6%	82.7%	80.6%
% Bachelor's Degree or Higher	28.8%	52.4%	62.7%	82.5%	85.1%	43.6%	33.2%	62.8%	17.1%	12.3%
<b>Income</b>										
Median Household Income	\$33,046	\$65,810	\$77,601	\$94,246	\$106,151	\$64,245	\$53,058	\$87,393	\$38,660	\$36,263
Mean Household Income	\$73,487	\$181,876	\$98,473	\$136,657	\$162,287	\$102,060	\$84,169	\$111,261	\$59,820	\$42,813
Per Capita Income	\$28,155	\$45,280	\$45,648	\$71,392	\$78,301	\$46,805	\$28,846	\$52,879	\$22,833	\$16,944
<b>Poverty (%)</b>										
Families in Poverty	11.3%	14.8%	8.9%	4.4%	1.3%	9.4%	17.4%	10.7%	24.2%	33.1%
Individuals in Poverty	15.4%	18.6%	13.2%	12.5%	9.5%	13.2%	21.5%	14.6%	27.2%	38.4%
Under 18 years in Poverty	21.6%	28.7%	21.9%	5.1%	2.1%	18.4%	27.1%	22.0%	40.0%	50.6%
<b>Housing Occupancy</b>										
Total Housing Units (#)	132,057,804	298,327	37,301	43,653	41,380	32,476	35,108	42,069	33,023	33,317
Vacant Housing Units (%)	12.5%	11.6%	8.5%	12.9%	7.8%	8.9%	12.6%	10.3%	16.4%	16.8%
Occupied Housing Unit (%)	87.5%	88.4%	91.5%	87.1%	92.2%	91.1%	87.4%	89.7%	83.6%	83.2%
% Owner-occupied Units	64.9%	42.1%	34.7%	36.2%	51.6%	59.2%	47.2%	44.5%	39.9%	21.5%
% Renter-occupied Units	35.1%	57.9%	65.3%	63.8%	48.4%	40.8%	52.8%	55.5%	60.1%	78.5%
Homeowner Vacancy Rate	2.2	2.6	1.2	2.1	1.0	2.4	3.4	4.3	3.3	4.7
Renter Vacancy Rate	7.3	6.4	3.1	6.9	5.4	6.9	9.0	3.9	9.4	7.5
<b>Median Value of Owner-occupied Housing Units</b>	\$176,700	\$445,200	\$502,700	\$603,400	\$776,300	\$454,000	\$352,100	\$515,400	\$236,000	\$244,200
<b>Median Monthly Gross Rent</b>	\$904	\$1,242	\$1,353	\$1,768	\$1,682	\$1,071	\$990	\$1,392	\$870	\$923
<b>Households by Type</b>										
Total Households (#)	115,610,216	263,649	34,136	38,037	38,167	29,573	30,679	37,743	27,593	27,721
Family Households (#)	76,744,358	112,278	11,434	8,443	15,591	16,690	14,349	14,686	14,668	16,417
Married-couples (%)	48.7%	23.0%	19.2%	19.4%	35.1%	33.6%	20.0%	24.3%	15.0%	14.0%
Female Householder, no husband (%)	13.0%	15.9%	9.8%	1.9%	4.0%	18.0%	21.5%	11.9%	32.9%	39.0%
Male Householder, no wife (%)	4.7%	3.7%	4.4%	1.0%	1.7%	4.8%	5.3%	2.7%	5.3%	6.3%
Non-family Households (#)	38,865,858	151,371	22,702	29,594	22,576	12,883	16,330	23,057	12,925	11,304
Living Alone (%)	27.5%	45.4%	46.0%	60.3%	46.7%	35.0%	43.9%	45.8%	42.9%	36.6%
<b>Average Household Size</b>	2.63	2.20	2.16	1.65	1.97	2.54	2.40	2.06	2.36	2.63
<b>Average Family Size</b>	3.22	3.20	3.18	2.55	2.75	3.47	3.48	2.94	3.35	3.52
<b>Language Spoken at Home</b>										
Population 5 years and over (#)	291,484,482	582,870	75,009	71,991	76,745	73,992	74,402	79,679	61,192	64,839
English Only (%)	79.5%	84.2%	75.1%	78.8%	78.6%	75.2%	87.8%	83.5%	96.0%	96.7%
Language Other Than English (%)	20.7%	15.8%	24.9%	21.2%	21.4%	24.8%	12.2%	11.5%	4.0%	3.3%
Spanish (%)	12.9%	7.6%	14.7%	6.9%	7.1%	15.9%	6.7%	4.7%	2.2%	1.7%

# DC Resilience Workshop Briefing

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**Frederick Goldsmith**

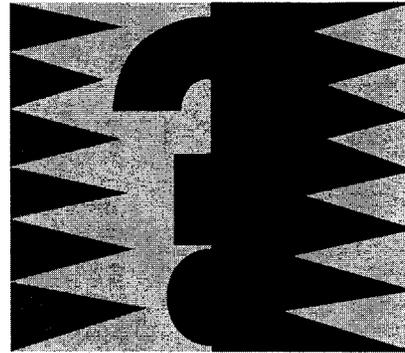
**Critical Infrastructure Specialist**

**Plans and Preparedness Division**



# Questions

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Patrice White, Deputy Director of Planning, Preparedness and Mitigation Division

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CENTER FOR CLEAN AIR POLICY : RESOURCE LIBRARY : OVERVIEW OF DC HAZARD MITIGATION EFFORTS

RESOURCE

Overview of DC Hazard Mitigation Efforts

March 2013 | Fred Goldsmith, HSEMA

This presentation was part of the Severe Weather & Critical Infrastructure Resilience: Preparing Washington D.C. workshop, which was co-hosted by CCAP, the District Department of the Environment and the District Office of Planning.

Download This Resource

Tags: Adaptation, Extreme Weather, Infrastructure, Resilience, Weathering Climate Risks

RESOURCES



WHERE WE WORK

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## SEVERE WEATHER & CRITICAL INFRASTRUCTURE RESILIENCE: PREPARING WASHINGTON D.C. WORKSHOP

3.14.13

The Center for Clean Air Policy (CCAP), the District Department of the Environment (DDOE), and the District Office of Planning (OP), held the *Severe Weather & Critical Infrastructure Resilience: Preparing Washington D.C.* workshop to gather stakeholder input to help shape future resilience efforts to ensure they reflect stakeholder knowledge, experience and priorities.

The meeting convened participants from government agencies, real estate companies, utilities, business improvement districts, trade associations and NGOs. The topics included weather and climate risk expected for the District, best resilience practices for the electricity and insurance sectors and visualized what resilience solutions would look like and how we could measure them. The group recommended a number of next steps:

- Vulnerability studies on sea level rise, severe weather and urban heat
- Economic scenario analyses
- "What If" flooding analysis
- Increase green infrastructure
- "Undergrounding" power lines
- Install Metro ventilation grate extensions
- Improve transportation choices (resilience benefits of biking, walking, and public transit)
- Identify further collaboration opportunities.

For more information, please read the report and/or executive summary.

### Presentations:

1. Welcome & Introductions. **Steve Winkelman**, Director of Adaptation, Center for Clean Air Policy
2. Weather- and Climate-related Risks in DC: Current and Projected. **Deke Arndt**, Chief, Climate Monitoring Branch, National Climatic Data Center
3. Weather- and Climate-related Risks in DC: Nearby risks: Recent work in Alexandria, Virginia. **Laurens Van der Tak**, Vice President, CH2M Hill
4. Overview of Sustainable DC. **Brendan Shane**, Chief, Office of Policy & Sustainability, DDOE
5. Overview of DC Hazard Mitigation Efforts. **Fred Goldsmith**, Critical Infrastructure Specialist, HSEMA
6. Best Resilience Practices, Part 1: Electricity. **Brent Dorsey**, Director, Corporate Environmental Programs, Entergy
7. Best Resilience Practices, Part 2: Insurance. **Stephen Weinstein**, Senior VP, RenaissanceRe
8. Best Resilience Practices, Part 3: Visualizing Solutions & Measuring Benefits. **Steve Winkelman**, Director of Adaptation, Center for Clean Air Policy

### EVENTS



### WHERE WE WORK



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14 days ago / retweet

# Claudia Barragan

230 Varnum St NE, Washington D.C. 20011 • phone: 240-381-0937 • email: cmbarragan@gmail.com

www.thecityecologist.com ■■■

Environment and urban planning practitioner with over 15 years of experience in community development, passionate about social equity as vital for urban sustainability & effective environmental justice policies.

## EDUCATION

**Exec. Master's Int. Service & Environmental Policy (2015)**  
American University, Washington DC

**B.A. French & Int. Business Mgmt. (2000)**  
University of Maryland College Park, MD

**B. Architecture (2000 - 2002)**  
Florida Atlantic University, FL

**Study Abroad, Engineering/French Language**  
EPF-École D'Ingénieurs, Paris, France (1998)

## RELEVANT PROJECT BASED EXPERIENCE

**Engagement in GIS initiative, Evaluation and Research Program**  
2015 - 2016 *Rainforest Alliance, Washington D.C.*

**Innovation Consultant**

- Develop user-driven web-based mapping content and applications for in-house experts and field specialists.
- Expand the organization's spatial analysis capacity by combining forest cover data, field analysis and story maps, all within a multimedia-mapping environment to advance sustainable agriculture projects.
- Research on "Precision Agriculture" tools for on-the-fly spatial data collection (GIS/RS/GPS) and remote sensing (RS) to update integrated resource management and ecosystem analysis.

**Forest, livelihoods, Peri-Urban Youth-migration Practicum**  
June 2014 *Iracambi Research Center, Minas Gerais, Brazil (American University Research Abroad)*

**Researcher/Urban Development Analyst**

- Conducted survey of peri-urban youth, rural local farmers, urban gardeners & city food-security administrators.
- Researched in Brazil's Atlantic Forest rural region used GIS to integrate theory and front-line data to create maps and infographics to disseminate the findings and present at academic and industry conferences.
- Prepared final report offering implementable solutions for alleviating youth migration to urbanized areas.

**Community / Urban Sustainable Development**

**Urban Planner/Designer**

2003 - 2010 *Public/Private Sector, Urban Planning, Campus Planning (RTKL, SmithGroup, LandDesign)*

Designed and developed master plans, TOD, feasibility & zoning analysis, building stock surveys, set forth by DC's comprehensive plan & sustainability neighborhood plans. consultant capacity (*DCOP, DHS/GSA, DMPED*)

*Public projects:* Saint Elizabeths East Campus & Saint Elizabeths West Campus Master Plan, Brookland/CUA Metro Station Small Area Plan, DC SW Building Stock Survey, Muslim Community Cntr Silver Spring MD

*Private projects:* Founder's Square, Arlington VA LEED-ND Pilot program, Residences at 4100 Georgia Avenue NW, Seminary Town Center Master Plan Alexandria VA, National Harbor Master Plan Oxon Hill, MD

**Westport Neighborhood / Annapolis Road Enhancement Study**

**Project Manager, Urban Planner**

2010 - 2012 *Neighborhood Design Center, Baltimore, MD*

Provided planning services for the Westport neighborhood association a working class community in Baltimore

- Recruited, lead and managed a team of 7 designers and planners, to prepare a restoration plan for a blighted section of the Annapolis Road corridor. Worked one-on-one with association board members and residents.
- Facilitated community meetings using GIS tools & maps to inform neighbors and determine spatial priorities.

**Environmental Impact Assessment (EIS/NEPA) & Master Plan**

**Site Analyst / Urban Planner**

2005 - 2008 *DHS/US Coast Guard Headquarters; St. Elizabeths Campus, D.C. (SmithGroup/JJR, RTKL)*

Part of a multidisciplinary team, conducted numerous site analysis using GIS spatial tools to assess the environmental impacts of 3.8 million gsf of new development conveyed in the 2010 EIS/NEPA/Section 106 report for two US Federal Agencies campus master plan on a 182-acre Nat. Historic Landmark site.

- Performed Viewshed Analysis using LiDAR DEM data including building and trees surface, and site slope analysis determining adverse impacts to 73.2 acres of land including steep slopes.
- Using visualization tools prepared & presented analysis, to regulatory agencies for consensus building.

## **International Sustainable World Class Urban Development**

**Senior Urban Planner/Designer**

2003 - 2005 & 2007 - 2010 Private Sector, Sustainable Development, Urban Planning (LandDesign, RTKL)

Collaborated on 10+ international projects designing master plans and reports for regional and urban infill mixed-use development projects in China, Central America, Middle East and India.

### *People's Republic of China:*

Tai Lake Ecological & Leisure Park, Tai Lake  
Xuhui New Waterfront Master Plan, Shanghai  
Zhengzhou Economic & Technology Dev. Plan, Zhengzhou

### *Other Regions:*

India Entertainment City, Navi Mumbai, India  
Gov. Complex Feasibility Study Riyadh, Saudi Arabia  
Los Proceres Miced-Use Dev. Tegucigalpa, Honduras

## **Geo-Design and Campus Master Planning**

**Urban Planner / Designer / GIS innovator**

2006 - 2010 Public & Institutional Sector, Campus Planning (RTKL, SmithGroup)

- Early Geodesign adopter, developed expertise in 3D visualization to provide value-based decision processes.
- Lead team in updating & maintaining geodatabase. Researched & acquired data from multi-language sources.
- Produced campus master plans, establishing long-term sustainability & connectivity initiatives.

*Projects:* University of District of Columbia Master Plan, King Street Art Center & Takoma Park Montgomery College MD, John Hopkins University Belward Research Campus Master Plan, Gaithersburg, MD

## **PROFESSIONAL EXPERIENCE**

- 2015 – Present **Consulting Services, Washington D.C.**  
*Environmental Policy & Urban Development Consultant* – Community-based & non-profit orgs.
- 2015 – 2016 **Rainforest Alliance, Washington D.C.**  
*GIS Innovation Consultant* - International non-profit organization that works to conserve biodiversity and sustainable livelihoods.
- 2013 – 2015 **Instituto Internacional para Desarrollo Local (IIDEL) Onward International**  
*Program Representative* - An organization missioned to build technical capacity of city administrators & urban planners in Latin America.
- 2010 – 2012 **Neighborhood Design Center, Baltimore, MD**  
*Project Manager/Design Planning Consultant* - Non-profit community based organization provides pro-bono planning/design services to disenfranchised neighborhoods.
- 2008 – 2010 **RTKL Associates Inc./ Arcadis, Washington, DC**  
*Senior Designer; Urban Planner* - Global architecture, urban planning and design firm, delivers consulting, and project infrastructure services to the private and public sectors.
- 2005 – 2008 **SmithGroup/JJR, Washington, DC**  
*Urban Designer, Planner* - National Architecture, sustainable design firm, specialize in the healthcare, science & technology, higher education, engineering and environmental science.
- 2004 - 2005 **Wiencek and Associates, Gaithersburg, MD**  
*Staff Architect and Planner* - Regional architecture firm, specializing in socially responsible multifamily housing, urban infill revitalization, artist housing, cultural & education sectors.
- 2002 – 2004 **LandDesign Inc. Alexandria, VA**  
*Project Design Assistant* - National landscape design firm offers urban design, planning, branding, & civil engineering solutions to public and private sector clients across the globe.

## **SKILLS**

### **Computer Skills; Geo-Technical**

- Esri ArcGIS & AGOL, Google Earth Pro,
- AutoCAD, BIM Revit, 3D modeling, SketchUp

### **Specialized Analytical Skills:**

- Zoning/Land Use Analysis, Geo-Spatial, DEM
- NEPA/Sec. 106 EIA; Environmental and Social Impact Assessments

### **Graphics Skills; Publish/Edit & Web**

- Adobe Creative Illustrator, Photoshop, InDesign
- MS Office, Prezi, Wordpress, SPSS

### **Communication & Innovation Skills:**

- Organizer, surveys, analytics & outreach
- Fluent in Spanish, Portuguese, French

## CONFERENCES AND PRESENTATIONS:

- April 17, 2015 **Urban Environmental Stewardship Conference** - University of Maryland College Park  
Curated selected project poster: *"Rural to Urban Youth Migration: peri-urban agricultural and food system livelihoods & stewardships; Belo Horizonte, Minas Gerais, Brazil."*
- March 17, 2015 **Annual Spring Lect. Dr. William Julius Wilson** American Univ. Metropolitan Policy Center  
Graduate Winner Spring 2015 Student Poster Competition: *"Geopolitical Ecologies of Racial Dispersal: Paths of Fragmentation and Gentrification in the D.C. Region"*
- Dec. 5, 2014 **Rural Coalition 2014 Annual Winter Forum** - Global Via Campesina Network, USDA and UN officials to strategize on Farm Bill Reform - American University, Washington D.C.  
Selected Poster Session: *"Agricultural Livelihoods: Rosário Da Limeira, Minas Gerais Brasil"*
- Feb. 22, 2014 **International Student Conference on Urban Sustainability**, Curitiba, Brazil  
Universidade Livre do Meio Ambiente & Universidade Tecnológica Federal do Paraná  
Selected Abstract & roundtable discussion: *Urban Mobility - "Sustainability Study: Westport Neighborhood / Annapolis Road Enhancement Study"*

## BOARD LEADERSHIP & AFFILIATIONS

- 2016 - present Elected Exec. Board Member & Chair, Environmental Justice Committee, DC Sierra Club
- 2016 - present Exec. Board DC Language Access Coalition
- 2014 - 2016 Exec. Board DC Latino Caucus: Communication Officer & Board member
- 2012 Organizing for America (OFA) Fellow – Obama presidential campaign, Latinos for Obama
- 2015 - present Society for Conservation GIS - member
- 2009 - present DC GIS steering committee - member

## AWARDS & VOLUNTEERING ACTIVITIES

- 2014 - 2016 Neighborhood Design Center – Prince George's County, MD  
\*2010 Volunteer of the Year: Neighborhood Design Center Baltimore, MD
- 2012 - present DC City Wildlife Center Volunteer
- 2007 - present Urban Plan School Facilitator (Urban Land Institute) Washington D.C. Chapter

## MASTER PLAN APPROVED REPORTS PUBLICATIONS & DOCUMENTS

- 2009 The University of District of Columbia Van Ness Campus Plan  
[http://www.udc.edu/docs/facilities/UDC\\_Campus\\_Plan\\_Final\\_Exhibits.pdf](http://www.udc.edu/docs/facilities/UDC_Campus_Plan_Final_Exhibits.pdf)
- 2009 Saint Elizabeth's East Redevelopment Framework Plan  
<http://planning.dc.gov/DC/Planning/In+Your+Neighborhood/Wards/Ward+8/Saint+Elizabeths+East+Redevelopment+Framework+Plan>
- 2008 Brookland CUA Metro Station Small Area Plan  
<http://planning.dc.gov/DC/Planning/In+Your+Neighborhood/Wards/Ward+5/Brookland+CUA+Metro+Station+Small+Area+Plan>
- 2008 NEPA-Environmental Impact Statement - Saint Elizabeth's  
[http://assets.stelizabethsdevelopment.com/documents/document\\_center/6\\_Chapter\\_3.pdf?CFRTREEITEMKEY=D95](http://assets.stelizabethsdevelopment.com/documents/document_center/6_Chapter_3.pdf?CFRTREEITEMKEY=D95)
- 2007 Saint Elizabeth's Master Plan West Campus - Submission to NCPC  
2007 Master Plan Alternatives ([link](#)) & 2005 Land Use Feasibility Study ([link](#))  
[http://stelizabethsdevelopment.com/document\\_center.cfm](http://stelizabethsdevelopment.com/document_center.cfm)

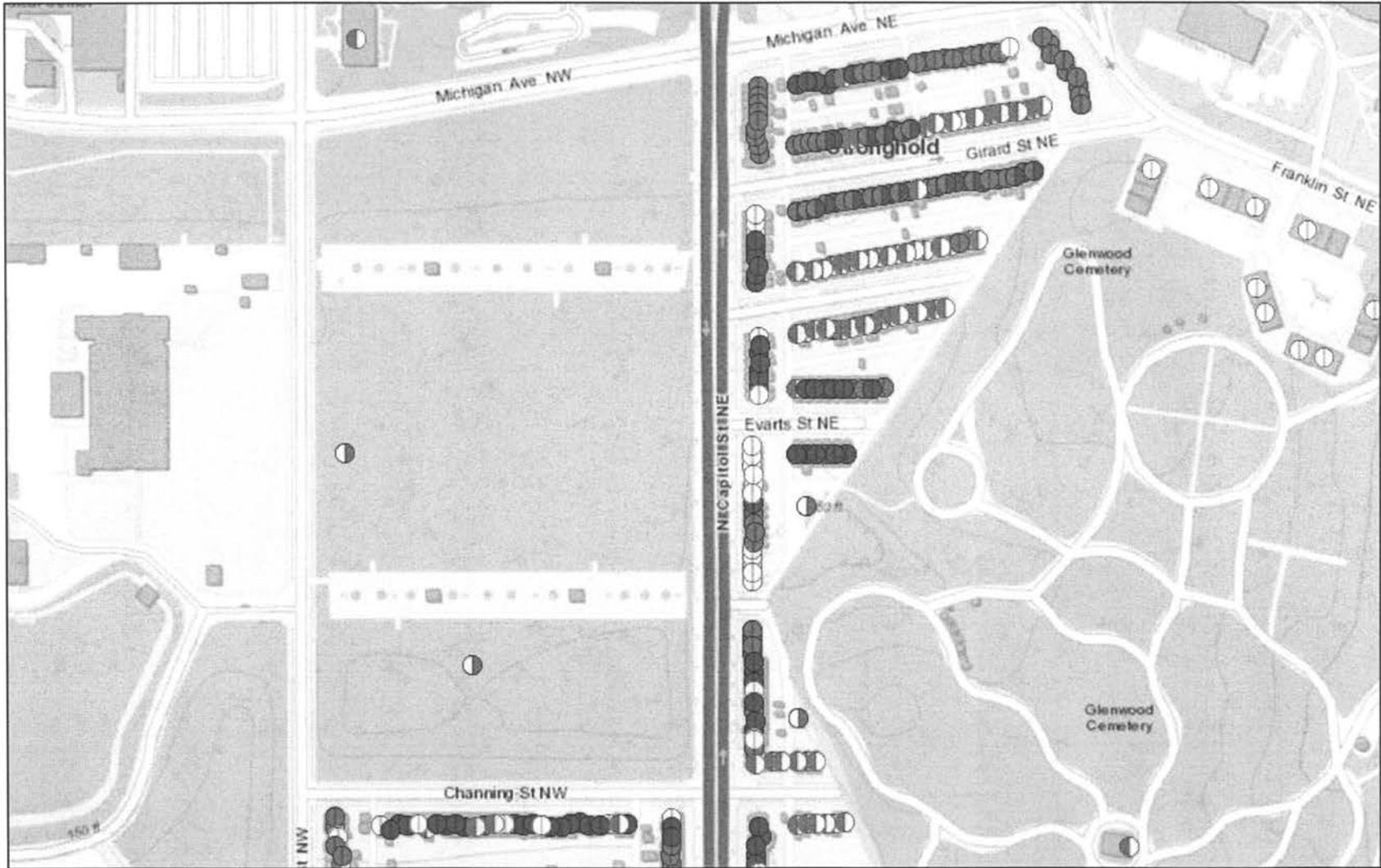
## RESEARCH PROJECTS IN PROGRESS

*Geopolitical Ecologies of Racial Dispersal: Paths of habitat Fragmentation & Gentrification in the D.C. region*

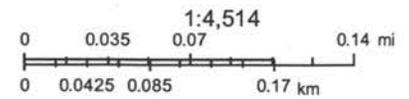
## **ATTACHMENT**

Birds Eye View of McMillan Park  
and Surrounding Areas

# DC Water Service Information



March 23, 2017

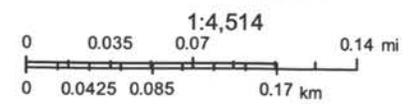


Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey,

## DC Water Service Information

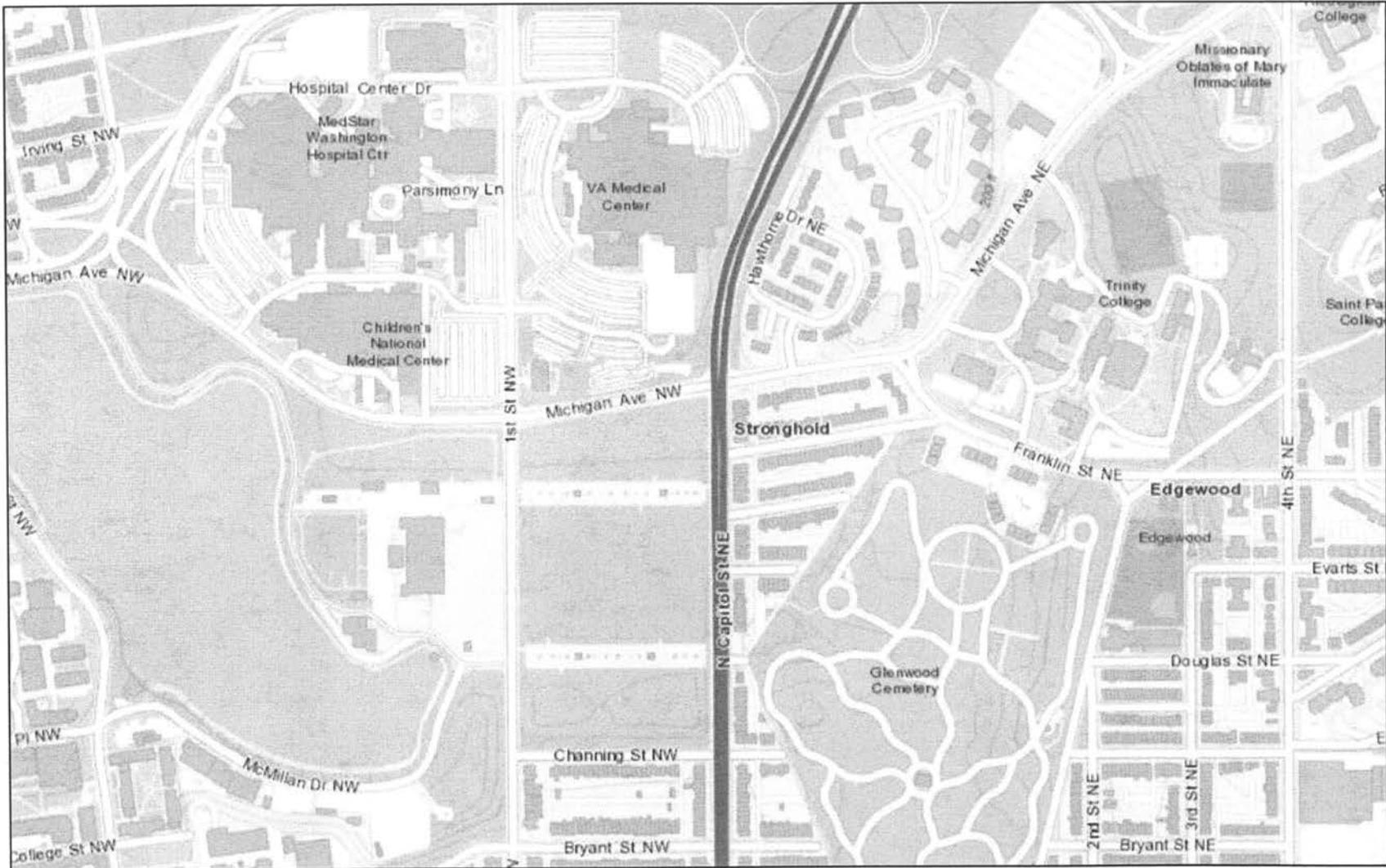


March 23, 2017

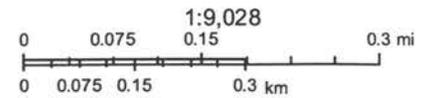


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

# DC Water Service Information



March 23, 2017

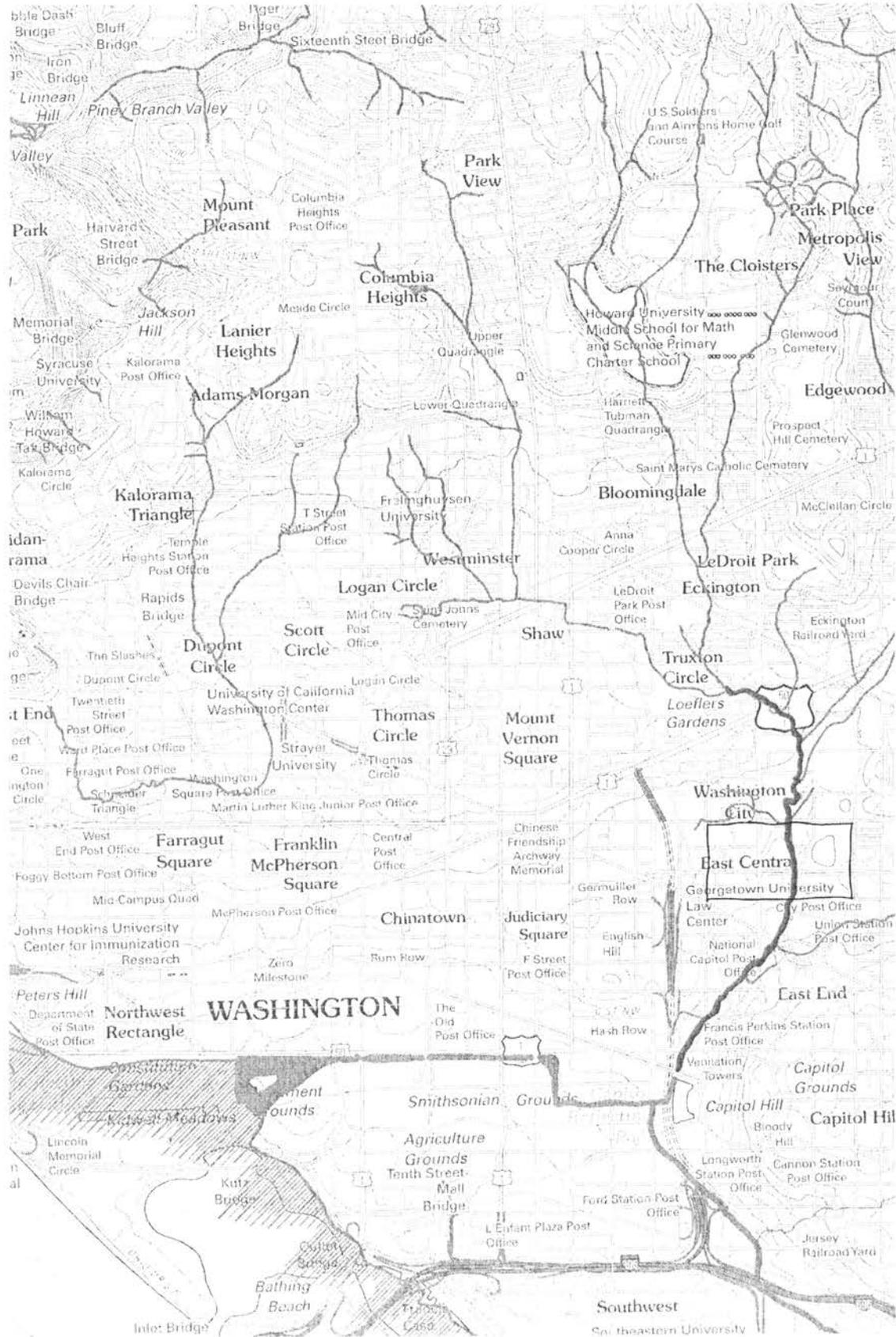


Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey,

## **ATTACHMENT**

DC Maps Water Features In and  
Around McMillan Park

1857 WATERCOURSES AGAINST A MODERN MAP OF WASHINGTON, D.C.



United States Department of the Interior  
National Park Service

# National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in National Register Bulletin, *How to Complete the National Register of Historic Places Registration Form*. If any item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. **Place additional certification comments, entries, and narrative items on continuation sheets if needed (NPS Form 10-900a).**

## 1. Name of Property

historic name Washington City Reservoir; McMillan Park Reservoir and Sand Filtration Plant

other names/site number McMillan Park Reservoir Historic District (preferred)

## 2. Location

street & number \_\_\_\_\_ 


 not for publication

city or town Washington, D.C. \_\_\_\_\_ vicinity

state District of Columbia code DC county \_\_\_\_\_ code 001 zip code \_\_\_\_\_

## 3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended,  
I hereby certify that this X nomination \_\_\_ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60.

In my opinion, the property X meets \_\_\_ does not meet the National Register Criteria. I recommend that this property be considered significant at the following level(s) of significance:

\_\_\_ national \_\_\_ statewide X local

\_\_\_\_\_  
Signature of certifying official/Title Date

\_\_\_\_\_  
State or Federal agency/bureau or Tribal Government

In my opinion, the property \_\_\_ meets \_\_\_ does not meet the National Register criteria.

\_\_\_\_\_  
Signature of commenting official Date

\_\_\_\_\_  
Title State or Federal agency/bureau or Tribal Government

## 4. National Park Service Certification

I hereby certify that this property is:

\_\_\_ entered in the National Register \_\_\_ determined eligible for the National Register

\_\_\_ determined not eligible for the National Register \_\_\_ removed from the National Register

\_\_\_ other (explain:) \_\_\_\_\_

\_\_\_\_\_  
Signature of the Keeper Date of Action

McMillan Park Reservoir Historic District  
 Name of Property

Washington, D.C.  
 County and State

**5. Classification**

**Ownership of Property**  
 (Check as many boxes as apply.)

- private
- public - Local
- public - State
- public - Federal

**Category of Property**  
 (Check only one box.)

- building(s)
- district
- site
- structure
- object

**Number of Resources within Property**  
 (Do not include previously listed resources in the count.)

Contributing	Noncontributing	
20	4	buildings
1		sites
67		structures
1		objects
89	4	<b>Total</b>

**Name of related multiple property listing**  
 (Enter "N/A" if property is not part of a multiple property listing)

N/A

**Number of contributing resources previously listed in the National Register**

0

**6. Function or Use**

**Historic Functions**  
 (Enter categories from instructions.)

INDUSTRY/PROCESSING/EXTRACTION/

Waterworks

**Current Functions**  
 (Enter categories from instructions.)

INDUSTRY/PROCESSING/EXTRACTION/

Waterworks

**7. Description**

**Architectural Classification**  
 (Enter categories from instructions.)

20<sup>th</sup> CENTURY REVIVALS/Italian

Renaissance/Colonial Revival

**Materials**  
 (Enter categories from instructions.)

foundation: Concrete

walls: Concrete and Brick

roof: Terra cotta tiles

other:

**Narrative Description**

McMillan Park Reservoir Historic District

Washington, D.C.

Name of Property

County and State

The McMillan Park Reservoir is a legacy of the City Beautiful Movement and an engineering achievement for the city. Much of the filtration system's mechanics, including the clear water basins and the sand filtration bins occurs underground and is thus not visible. However, other associated buildings and structures, including the regulator houses, the original sand bins, washers, and other structures, most of which date from between 1901 and 1905 when the plant was originally constructed, are readily visible from afar, and survive as important visual landmarks in the city.

The following is a description of the individual resources (buildings, structures, site and object) within the McMillan Park Reservoir Historic District. The list identifies the contributing structures, buildings, sites and object in that order. A list of the non-contributing resources follows.

**The McMillan Reservoir Basin (Structure):** The McMillan Reservoir Basin, originally called the Washington City Reservoir, was established by an Act of Congress in 1882. Its selected site in the vicinity of Howard University was intended to improve the water service to the eastern part of the city, and the large size of the reservoir was designed to provide better sedimentation. Approximately 66 acres of land were required for construction of the basin and its buildings. Work on the four-mile-long Washington City Tunnel that would supply the reservoir with water was begun in 1882, and excavation of the basin itself began in 1883. Construction of the basin was completed in 1888, but it remained empty for fifteen years until 1902, when the Washington City Tunnel was finally completed, connecting the reservoir to the city's aqueduct system.

The reservoir basin occupies 38 acres and holds 100 million gallons of water and serves as a sedimentation basin for the water before cleansing. The basin is riveted along the sides with beautifully laid riprap stone work. As originally constructed, the basin was dug out by day laborers working with horses and scrapers. The basin was dug to form an earth dam over the copious Smith's Spring which had been providing water to the city for several decades. A concrete conduit along the basin floor extends from the East Shaft Gatehouse to the Circulating Conduit Structure. This ensures that the water entering the reservoir enters at the western end of the reservoir and is subject to the maximum setting time before being pumped up to the filter beds at the eastern end of the reservoir. The basin was altered at its northeastern corner when the wash water energy dissipater was added in 1986.

**The Springhouse (Structure):** The cylindrical springhouse in the center of the reservoir basin was designed by Captain T.W. Symons, U.S. Army Corps of Engineers in 1886 and built in 1887. It sits toward the center of the basin on a 22-foot-high concrete foundation, braced by five underwater concrete buttresses. The structure is Moorish Revival in style with an arched shaped entrance and low onion dome. Occupying the spring head of Smith's Spring, it was the centerpiece of the newly dug reservoir.

**North Clear Water Basin (Structure) (WA-80):** The North Clear Water Basin is the original underground reservoir constructed in 1904 to store the water after being filtered. Clean water was transported from the filter beds to this reservoir basin through cast iron mains. The regulator houses controlled the flow of water to the reservoir using sluice gates. From the basin, water passed directly into the city's mains. The reservoir remains in operation today.

**South Clear Water Basin (Structure) (WA-81):** The South Clear Water Basin was constructed at McMillan Reservoir in 1939 to increase the clear water storage capacity at the plant. The construction of this second basin necessitated the removal of the McMillan Fountain and the elaborate park landscaping on this parcel.

**Filtration Beds (26) (Structures):** The plan for the McMillan Filtration plant called for a total of 29 slow sand filter beds organized around three service courts. The service courts are essentially linear alleés running parallel and perpendicular to each other between the underground beds and depressed from them. Court #1 is located west of First Street and runs north-south between Filters 1-2 and 3-5. Court #2 intersects Court #1 at the north end and runs east-west the full breadth of the site to either side of First Street. On its east side, Court #2 separates Filter Beds 10-14 from 15-19 and on its west side separates Filter Beds 6-9 from Filter Beds 2 and 5. Court #3 is located at the southern end of the filtration site, east of First Street. It runs east-west and separates Filter Beds 20-24 from 25-29. The service courts are paved with scored concrete.

The filter beds, completed in 1904, are subterranean concrete basins with concrete covers. Historically, the beds were filled with approximately 50 inches of sand and gravel, graded from top to bottom from fine sand to gravel. Water entered the filter beds through the top, flowed through the sand and gravel and collected in the central cast-iron drain located below the sloping floor of the filter bed. The suspended material from the water clung to the top layer of sand. When the flow of water was impeded by the accumulation of filtered particles in the top layer of sand, it was necessary to clean the sand. In such a case, which was common and part of the process, the sand was removed, sent to sand washers for

McMillan Park Reservoir Historic District

Washington, D.C.

Name of Property

County and State

receiving reservoir, formed by an earthen dam across the Little Falls Creek, provided both a place for the turbid Potomac River water to settle and a storage site for times when the conduit was closed due to muddy Potomac water. From the Dalecarlia Reservoir, water was channeled through a two-mile extension of the conduit to a 36-acre distributing reservoir west of Georgetown (Georgetown Reservoir). From the distributing reservoir, water was delivered through cast iron pipes to various areas of the city.<sup>viii</sup> The system, which remains in use today, includes a masonry dam at Great Falls, six bridges, several miles of tunnels, twelve miles of water conduits, brick air vents, siphons, pumping stations, reservoirs, and filtration and treatment plants, including McMillan Reservoir and Sand Filtration Plant. The Washington Aqueduct, listed in the D.C. Inventory of Historic Sites and the National Register of Historic Places, is also a National Historic Landmark.

The McMillan Reservoir, built 1883-1888, and the Sand Filtration Plant, built 1902-1905 are part of subsequent phases of construction of the Washington Aqueduct system, intended to improve the quantity and quality of water being distributed to the residents of Washington, D.C. Because the McMillan Reservoir and Sand Filtration Plant were not part of the original design of the Washington Aqueduct, the site was not included in the National Register nomination on the Washington Aqueduct.

#### Improvements to the Aqueduct and Construction of the McMillan Reservoir:

Population expansion in the federal city after the Civil War led to the need for increased capacity in the city's water supply. Concerns were raised not only over the quantity of water, which was in short supply, but over the quality of water provided by the Washington Aqueduct. Water generally was muddy and unappealing to drink. A series of changes to the Washington Aqueduct over the course of many years were undertaken to address these concerns. Three of the most significant improvements included modification of the Great Falls dam to increase the volume of water diverted into the aqueduct; the construction of a new reservoir (McMillan Reservoir) north of Washington to improve water service to the eastern areas of the city<sup>ix</sup>; and, the establishment of a filtration plant to ensure a clean water supply.<sup>x</sup>

To improve the water flow to the eastern parts of the city, Congress authorized the creation of this second, new reservoir (Washington City Reservoir and later, McMillan Reservoir) on July 15, 1882. Major Garrett J. Lydecker, then engineer commissioner, chose the site for this new storage facility on high ground near Howard University. The site selected for the new reservoir was one of the city's largest and most well-known springs and had been supplying water to the city for fifty years. In 1832, Congress had purchased one-acre of the ground, which included several springs, from its then-owner, Joseph A. Smith, deputy clerk (later Clerk of the Court) of the Old Circuit Court. In 1833 pipes were constructed for carrying water two miles south to the U.S. Capitol for fire protection and for "*aqua pura*."<sup>xi</sup> Four years later a six-inch cast iron water main fed by Smith Spring supplied water to twelve fire hydrants on Pennsylvania Avenue.

Excavation of the new reservoir at Smith's Spring began in 1883 and was completed in 1888. Day laborers working with horses and pick axes dug the basin and built a dam across the valley of Smith's Spring. In 1887, the round brick springhouse sporting a small Moorish-style onion dome was built to stand directly over the spring in the center of the basin where it remains today. Despite completion of the reservoir basin in 1888, it remained dry for years awaiting completion of the water tunnel which was to link McMillan to the existing Georgetown Reservoir four miles away. This four-mile-long tunnel, known as the Washington City Tunnel was begun in 1882, but was not completed until 1902. Upon completion of the tunnel, the reservoir was put into operation. Three buildings were constructed in association with the new reservoir and city tunnel: the Castle Gatehouse, built at Georgetown Reservoir to control the flow of water to the West Shafthouse; the West Shafthouse built at the Georgetown Reservoir to monitor the flow of water into the tunnel; and the East Shaft

<sup>viii</sup> Goodwin & Associates, "Washington Aqueduct Architectural Survey: District of Columbia and Montgomery County, MD," Report prepared for the U.S. Army Corps of Engineers, March 1998, p. 52-57.

<sup>ix</sup> Montgomery Meigs himself advocated for the construction of a second distributing reservoir, so construction of the new reservoir effectively revived an unrealized component of his original 1853 plan. See "McMillan Park Reservoir," D.C. Historic Preservation Application for Historic Landmark, 1990.

<sup>x</sup> Goodwin & Associates, p. 58.

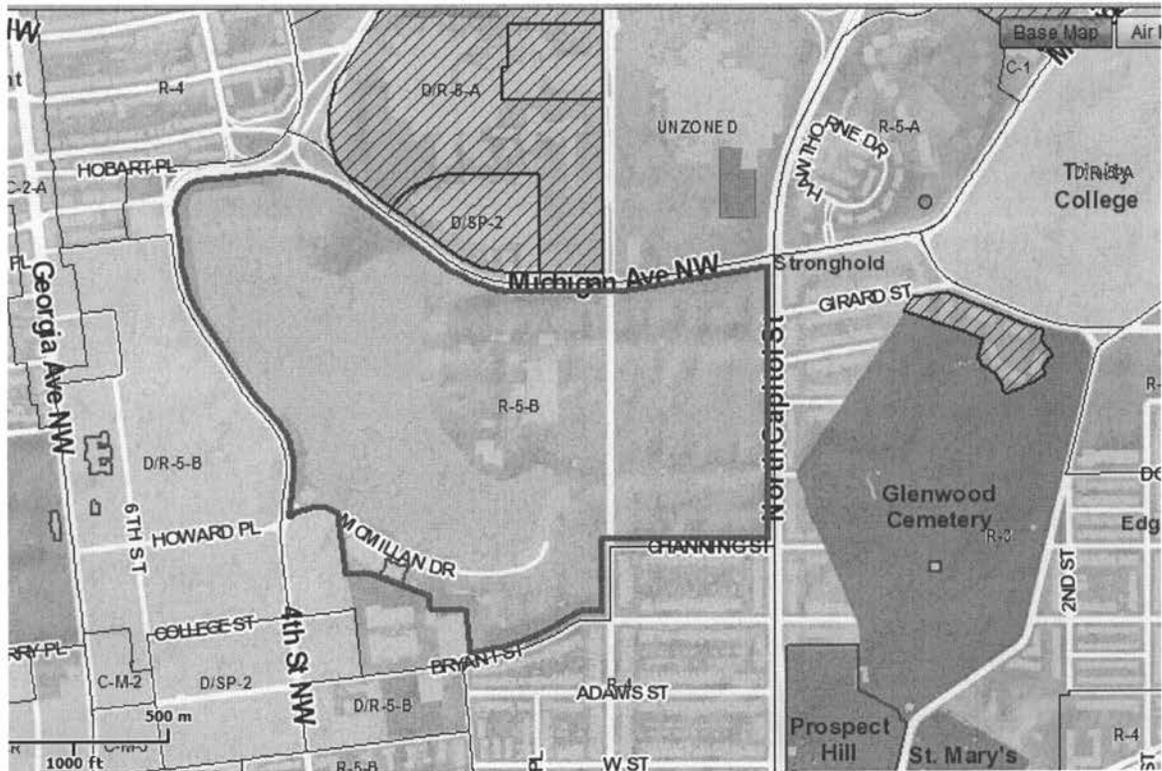
<sup>xi</sup> John Proctor, "Washington Suburban Development," *The Evening Star*, June 11, 1933.

United States Department of the Interior  
National Park Service

National Register of Historic Places  
Continuation Sheet

McMillan Park Reservoir Historic District
Name of Property Washington, D.C.
County and State
Name of multiple listing (if applicable)

Section number MAPS Page 1



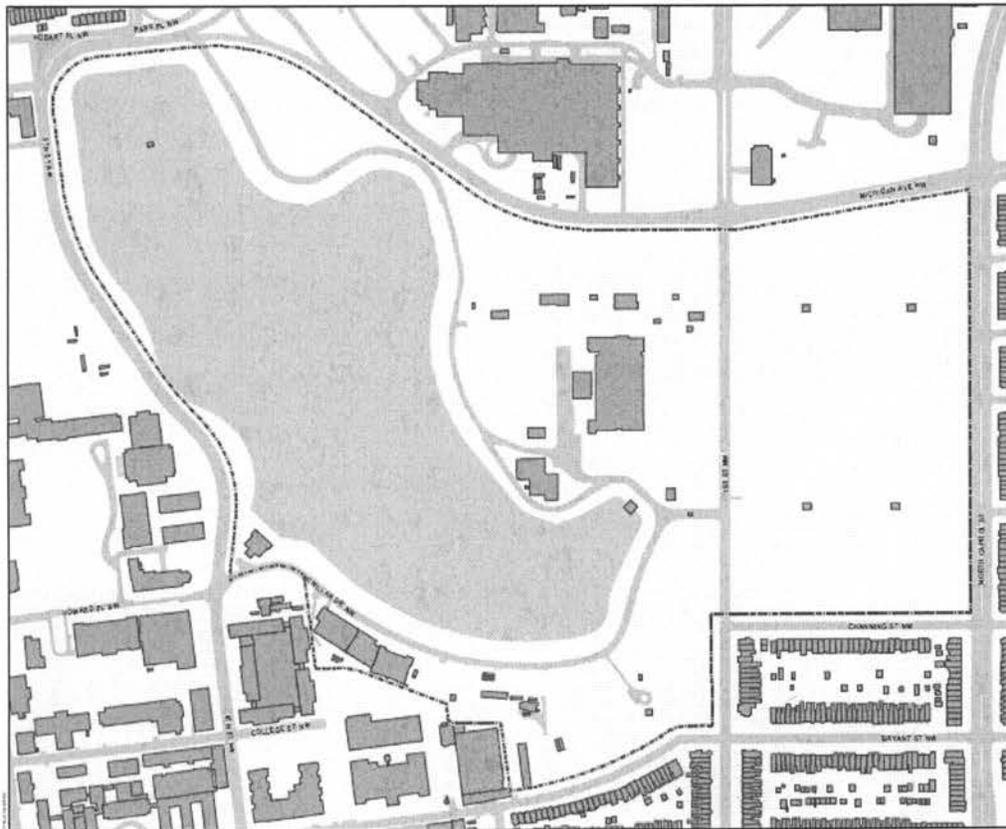
Map showing McMillan Park Reservoir Historic District (from Property Quest, D.C. Office of Planning, 2012)

**United States Department of the Interior  
National Park Service**

**National Register of Historic Places  
Continuation Sheet**

McMillan Park Reservoir Historic District
Name of Property Washington, D.C.
County and State
Name of multiple listing (if applicable)

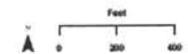
Section number MAPS Page 2



**McMillan Park Reservoir  
Historic District**



- Historic District
- Buildings



Government of the District of Columbia  
Adrian M. Fenty, Mayor  
Office of Planning - February 13, 2008  
This map was created for planning purposes from a variety of sources. It is neither a survey nor a legal document. Information provided by other agencies should be verified with them where appropriate.

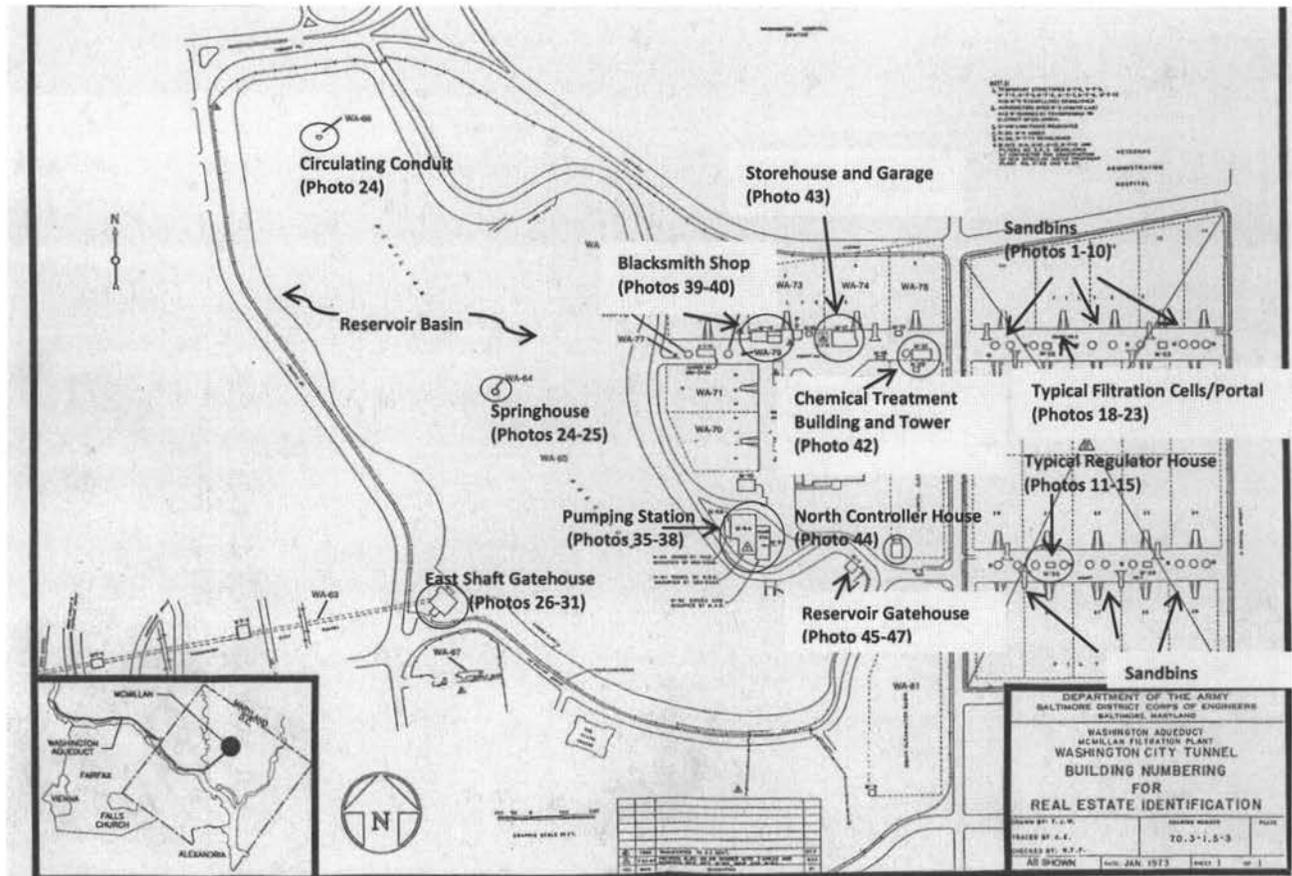
Site plan of McMillan Park Reservoir Historic District  
D.C. Office of Planning, 2008

United States Department of the Interior  
National Park Service

National Register of Historic Places  
Continuation Sheet

McMillan Park Reservoir Historic District
Name of Property
Washington, D.C.
County and State
Name of multiple listing (if applicable)

Section number MAPS Page 3



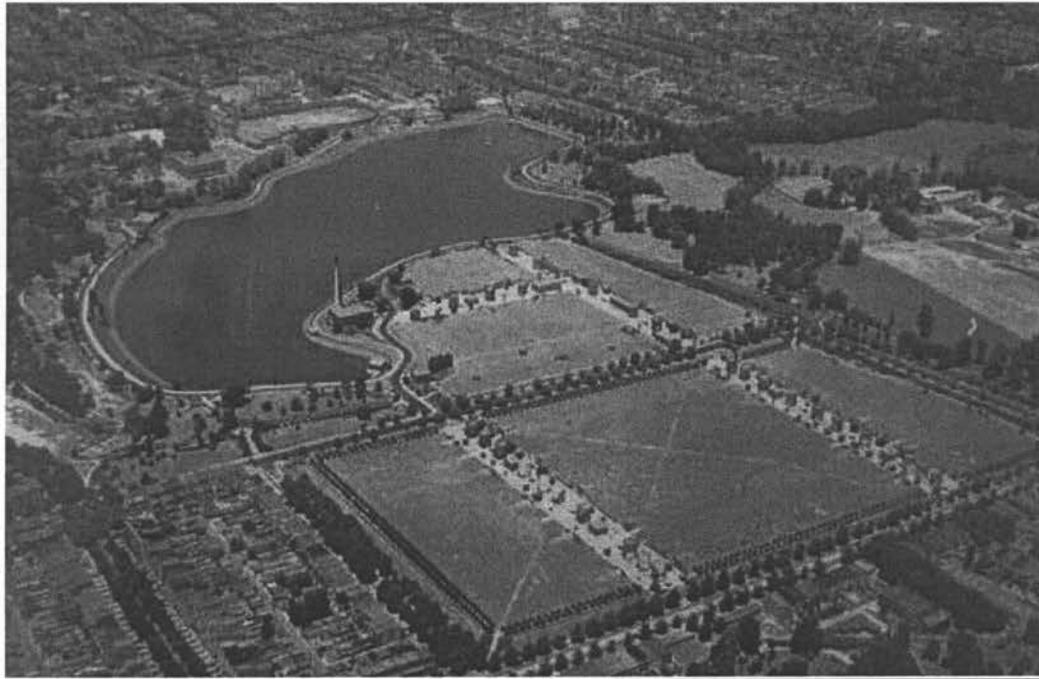
Site Plan and Key to Photographs

**United States Department of the Interior**  
National Park Service

**National Register of Historic Places**  
**Continuation Sheet**

McMillan Park Reservoir Historic District
Name of Property
Washington, D.C.
County and State
Name of multiple listing (if applicable)

Section number Historic Images Page 1



Aerial Photo of Site, ca. 1930  
Courtesy of the Archives of the Washington Aqueduct

## **ATTACHMENT**

DC's Attorney General on  
Emmissions and Health

**GOVERNMENT OF THE DISTRICT OF COLUMBIA  
OFFICE OF THE ATTORNEY GENERAL**

[oag.dc.gov](http://oag.dc.gov)



**FOR IMMEDIATE RELEASE:** Thursday, March 16, 2017



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## **Attorney General Joins Colleagues from Nine States in Opposing Rollback of Vehicle Emission Standards**

*Rolling Back Standards Would Undermine Nation's Efforts to Fight Air Pollution and Protect  
Public Health, AGs Say*

**WASHINGTON, D. C.** – Attorney General Karl A. Racine has joined a coalition of states in expressing opposition to President Trump's action that directs federal agencies to reconsider vehicle emission standards.

The coalition, which was led by New York Attorney General Eric Schneiderman and includes the attorneys general of New York, Maine, Maryland, Massachusetts, Oregon, Rhode Island, Vermont, Washington State, and the District of Columbia, as well as the Commonwealth of Pennsylvania's Department of Environmental Protection, issued the following joint statement:

*"President Trump's action represents a dramatic wrong turn in our nation's efforts to fight air pollution from passenger cars and trucks, and protect the health of our children, seniors, and all communities.*

*Weakening these commonsense standards would undermine successful efforts to combat the pollution emitted by vehicles - emissions that cause widespread, substantial harm to public health and are one of the largest sources of climate change pollution. An extensive technical study by the Environmental Protection Agency already found that the standards are fully and economically achievable by the auto industry. Relaxing them would increase the air pollution that is responsible for premature death, asthma, and more – particularly in our most vulnerable communities.*

*We will vigorously oppose attempts by the Trump Administration to weaken our vehicle emission policies and put our public health at risk, and we won't hesitate to stand up for the right of our states to adopt stricter pollution standards that provide critical protections to the health of our residents and our environmental*

---

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resources.”

Attorney General Racine added, **“Air pollution is not limited by state boundaries, which is why we must work together and stand up for emission standards that protect our environment and our most vulnerable residents.”**

### **Background on Vehicle Emission Standards**

Because motor vehicles emit a variety of air pollutants harmful to human health and the environment and are a significant source of air pollution, Section 202 of the Clean Air Act requires the Environmental Protection Agency (EPA) to establish national emission standards for new motor vehicles. Section 209 of the Act authorizes the State of California to adopt emission standards that are generally more stringent than the federal standards, and Section 177 of the Act authorizes other states to adopt those same standards for new motor vehicles sold within their states.

In 2012, EPA adopted emission standards limiting greenhouse gas emissions from new passenger cars and light-duty trucks for model years 2017-2025 and beyond. California has adopted parallel vehicle emission standards limiting greenhouse gas emissions for those same model years, which New York and several other states have adopted as state law. The combined emission standards, together with harmonized emission standards for other pollutants that are on the books, are expected to result in substantial reductions in greenhouse gas emissions, dependency on foreign oil, and consumer fuel costs:

- Over the lifetimes of the vehicles sold during the 2017-2025 model years, the standards are expected to cut greenhouse gas emissions by two billion metric tons—the equivalent of the annual emissions of 422 million cars currently on the road—and save approximately four billion barrels of oil.
- Combined with the first phase of vehicle emission standards for greenhouse gases for model years 2012-2016, the standards for the 2017-2025 model year vehicles are projected to save families more than \$1.7 trillion in fuel costs and reduce the country’s dependence on oil by more than 2 million barrels per day in 2025.

In January 2017, EPA determined, in its “midterm evaluation,” that the current federal standards applicable to cars and light duty trucks for model years 2022-2025 are readily achievable by the auto industry. After an extensive technical review, based in significant part on information from industry, advocates, and other interested parties, EPA found that “automakers are well positioned to meet the standards at lower costs than previously estimated.” The agency concluded that, while the record supported making the standards even more stringent, it decided “to retain the current standards to provide regulatory certainty for the auto industry.” California is in the process of completing a midterm review for its parallel standards after participating in the federal process and conducting its own analysis of the feasibility of the standards.

The states issuing the joint statement have a longstanding history of working with California to adopt and enforce vehicle emission standards to combat air pollution. For example, several of the states successfully defended the first vehicle emission standards California issued to limit greenhouse gases from new motor vehicles in 2005. Subsequently, they joined California in successfully defending—in the D.C. Circuit Court of Appeals—EPA’s 2009 decision to grant California a waiver to adopt its greenhouse gas emission regulations. Several of the states also brought the landmark *Massachusetts v. EPA* case in which the Supreme Court held that EPA has the authority under the Clean Air Act to regulate greenhouse gas emissions from vehicles that

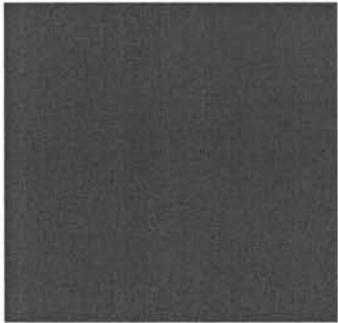
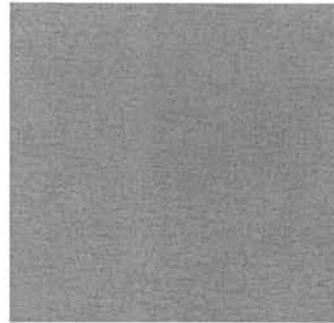
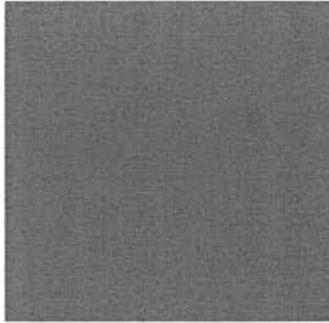
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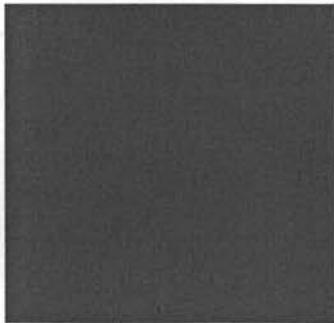
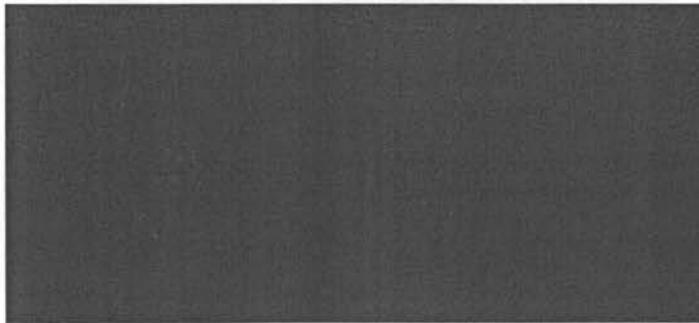
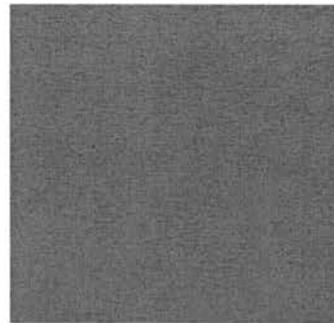
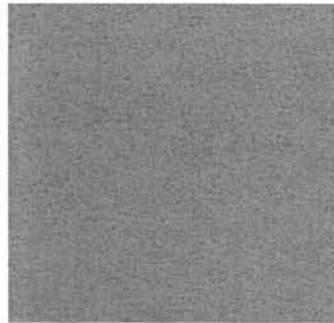
## **ATTACHMENT**

City Policies Regarding  
Development and the Environment,  
and Climate Change Modeling



# CLIMATE READY DC

The District of Columbia's Plan to Adapt to a Changing Climate



# CLIMATE READY DC

The District of Columbia's Plan to Adapt to a Changing Climate

## ACKNOWLEDGMENTS

The scientific research and technical analysis conducted to support Climate Ready DC was funded by the District of Columbia Sustainable DC Innovation Fund (DOEE ID# 2013-9-OPS). Dozens of individuals from District, regional, and federal agencies and organizations provided valuable input throughout the planning process.

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Perkins + Will

Kleinfelder

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Department of Health

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Department of Transportation

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Homeland Security and Emergency Management Agency

Office of Planning

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Georgetown Climate Center

Metropolitan Washington Council of Governments

National Capital Planning Commission

National Park Service



## TABLE OF CONTENTS

<b>Foreword</b> .....	<b>1</b>
<b>Climate Change Impacts for DC</b> .....	<b>2</b>
<b>Climate Risks and Vulnerabilities</b> .....	<b>4</b>
<b>Adaptation Strategies</b> .....	<b>8</b>
<b>Action Items</b> .....	<b>13</b>

## FOREWORD

### Introduction

Cities across the country and around the globe are recognizing their responsibility to prepare for a changing climate, and the District is no exception. In recent years, we have seen how climate change is already impacting us with record-breaking heat waves and snowstorms, flooding caused by rising sea levels and heavy rains, and the destructive 2012 derecho storm. These events are sobering reminders that without action, increasingly severe weather events will threaten to disrupt our power grid, harm our economy, and cost lives.

Recognizing the need to prepare and adapt, the Sustainable DC Plan established a goal to make the District more resilient to future climate change. Climate Ready DC is the District's strategy for achieving this goal while helping to ensure that our city continues to grow greener, healthier, and more livable. The District also remains committed to reducing our contribution to climate change by cutting our GHG emissions by 50% by 2032 and 80% by 2050.

### Process

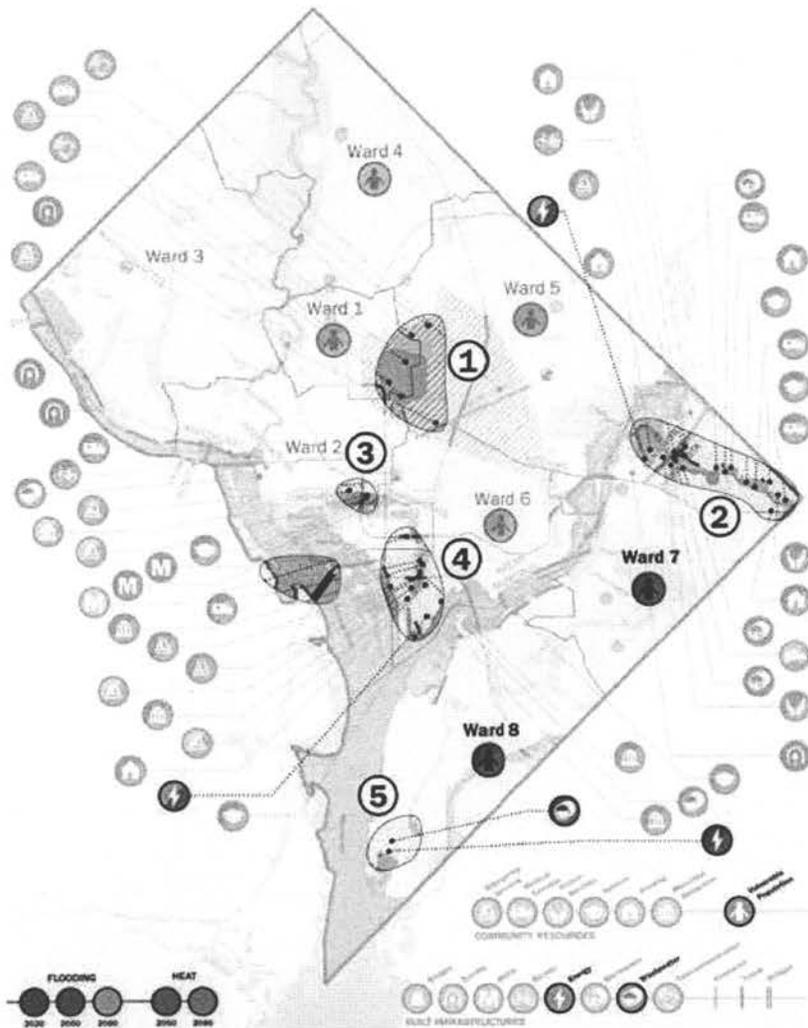
During the last two years, the Government of the District of Columbia—led by the Department of Energy & Environment (DOEE)—has been working with a team of technical experts to develop Climate Ready DC. In consultation with stakeholders from District agencies, as well as regional organizations and the federal government, the team assessed the impacts of climate change on our businesses and residents, especially those most physically and economically vulnerable during emergencies. The plan has been informed and strengthened by input from numerous community partners to ensure that the actions called for reflect the challenges, needs, and priorities of District residents in all eight wards—many of whom have already been impacted by climate change. Through community meetings, events, and an online survey, we received comments from more than 300 people and organizations on the draft plan. This final version incorporates many of those comments, and the others will be an integral part of the implementation planning process for Climate Ready DC.

It is clear from our discussions with stakeholders and the comments we received that the District must prioritize better solutions for communities that, in addition to the impacts of climate change, face fundamental challenges related to housing affordability, rising utility costs, and limited access to services and economic opportunities. Our most vulnerable residents should not only bounce back after disasters, but bounce forward. This fundamental principle is echoed by our Sustainable DC goals to advance equity and diversity. To ensure the goal of providing equitable access to services, resources, and economic opportunities remains at the forefront of this and future initiatives, DOEE will convene a group of diverse community stakeholders and city leaders to guide the equitable implementation of Climate Ready DC.

### What is Climate Change Adaptation?

Climate change adaptation means being prepared for a changing climate by taking action to reduce the potential impacts of climate change to people, buildings, and infrastructure like water systems, roads and electricity, and natural gas networks.

Priority Planning Area Map



### Measuring Risk

Risk is measured based on the probability of occurrence and the consequence of an impact such as flooding. For example, given the same probability of flooding, an electrical substation was considered to be at higher risk than a Capital Bikeshare station. The loss of one electrical substation would have a greater consequence as it could leave many residents and businesses without power, while the flooding of a Bikeshare station would likely impact fewer people and be easier and less expensive to repair.

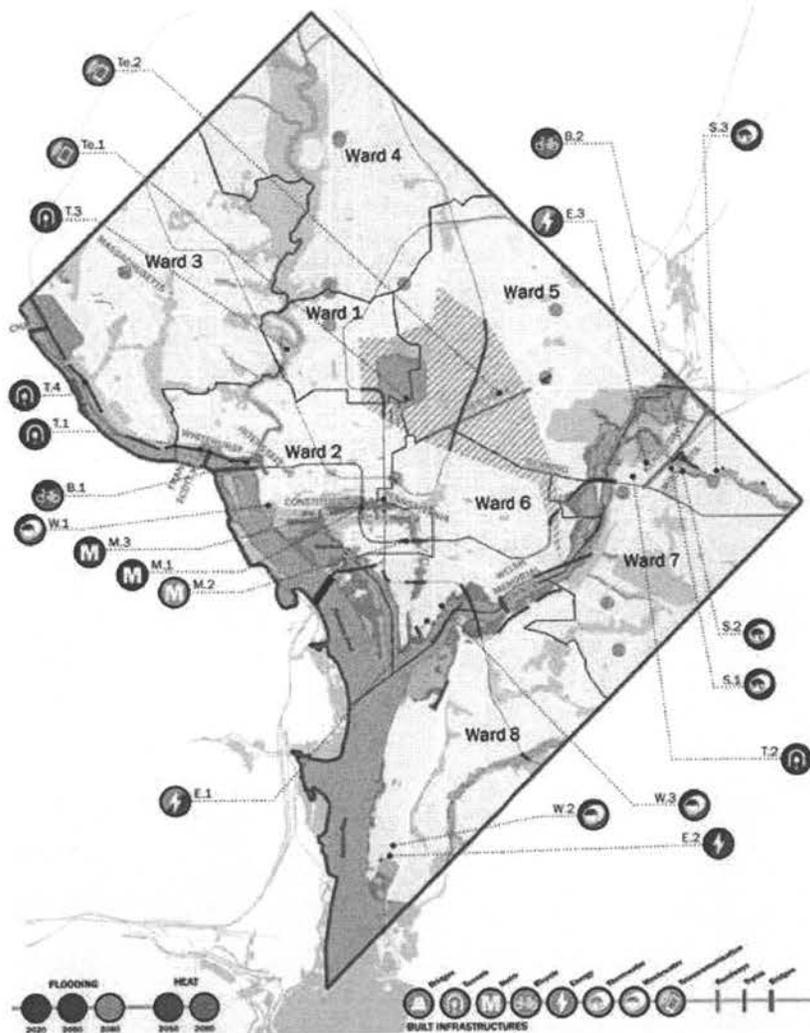
### Infrastructure

The District's energy, transportation, water, and communication systems are essential to keeping the city running. The 2012 derecho—a severe storm that knocked out power in many parts of DC for several days during a record-breaking heatwave—highlighted the potential consequences of infrastructure failures on providing services. Ensuring the resilience of these systems to future changes in climate is a priority for Climate Ready DC.

The infrastructure map that follows illustrates the infrastructure assets that were identified as being at greatest risk. The key findings for each system include:

- **Transportation:** The Metrorail system is at-risk to increased heat and flooding. Several underground stations already experience regular flooding while above ground rail lines, including Metrorail, MARC, VRE and Amtrak lines, could be damaged by hotter and longer heatwaves in the future. Key bridges that span the Potomac and Anacostia Rivers and many major roadways, including several that are currently designated as emergency evacuation routes, are also at risk from flooding and sea level rise.
- **Energy:** Three of the District's 19 electric substations evaluated by the study were identified as at-risk to flooding now or in the future. Substations are essential to distributing power throughout the District.
- **Water:** Stormwater and sewer collection systems, which were designed based on historic rainfall events, will be strained by more frequent and severe rain events and potential inundation from sea level rise and coastal storms—resulting in localized flooding and increased stormwater run-off.
- **Communication:** Local cellular, TV, and radio systems were found to be only marginally impacted by climate change. However, these systems rely heavily on electrical networks, so they are also at risk when the electricity infrastructure is compromised.

Infrastructure Map



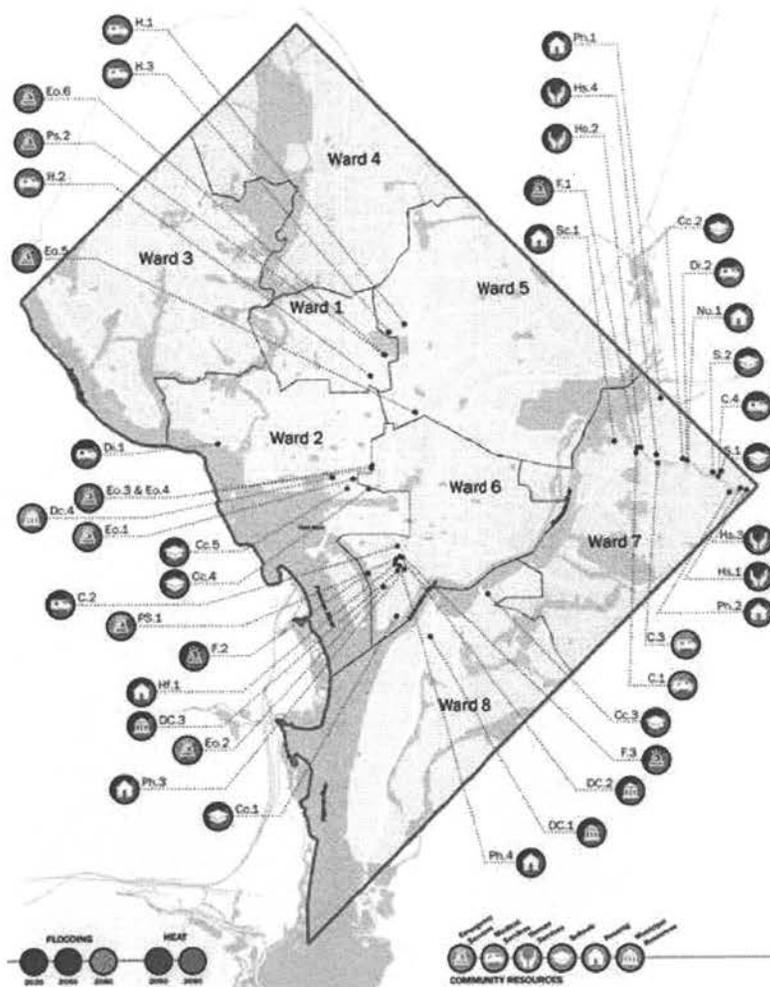
## Community Resources

The District's community resources include all of the facilities that provide public services to residents, visitors, and businesses, including public safety, healthcare, and education. Many of these facilities, like schools and recreation centers, also serve as emergency shelters and cooling centers during severe weather and heatwaves.

The following Community Resources map shows the community resources at greatest risk based on their location in areas likely to be exposed to flooding. All buildings are assumed to be at risk to extreme heat by 2080 given that current building systems are designed to operate under cooler temperatures. The map shows that the at-risk community resources are concentrated in a few areas:

- **Watts Branch:** Ward 7 is home to the largest number of vulnerable community resources, including schools, medical services, and public housing located along the flood-prone Watts Branch.
- **Downtown DC:** The area around Federal Triangle is home to several District agency headquarters and operations centers that are at risk to flooding from both heavy rain events and sea level rise from the Potomac River, as demonstrated by the 2006 flood.
- **Southwest DC:** Several District agencies, public housing properties, police and fire stations, and schools located in Southwest DC are at risk from future flooding.

Community Resources Map



## People

Climate change will not affect everyone equally. Individuals who are most vulnerable to climate change are those who are more sensitive to events like heatwaves and those who have less capacity to adapt and respond to the stresses caused by climate change. For example, older adults tend to be more sensitive to heat and more likely to suffer heat stroke or worse. And, an individual who can afford to install and run air-conditioning has greater capacity to adapt to heat waves than someone who cannot afford air-conditioning. In order to identify the areas of DC that include the largest number of residents with higher vulnerability, we assessed social and economic indicators, including unemployment, poverty prevalence, rates of obesity and adult asthma, and age.

The results, shown in the Vulnerable Populations map, demonstrate that vulnerability to climate change is not evenly distributed across the District. Wards 7 and 8 are most vulnerable given high levels of unemployment, poverty, obesity, and asthma, as well as a large elderly population. Moderately vulnerable wards are: 5, 6, 1, and 4.

## Natural Resources

Climate change will also impact the District's natural environment, including our streams and groundwater, wildlife, and plants. A separate assessment of the vulnerability of District wildlife and habitat was completed for the 2015 District of Columbia Wildlife Action Plan (WAP). The WAP identifies the species and habitats at greatest risk to the effects of climate change and recommends climate-smart management actions for habitat restoration and protection.

JUNE 2015

# CLIMATE PROJECTIONS & SCENARIO DEVELOPMENT

CLIMATE CHANGE ADAPTATION PLAN FOR THE DISTRICT  
OF COLUMBIA

RFA: 2013-9-OPS

PREPARED FOR



PREPARED BY



PERKINS  
+WILL



## **ACKNOWLEDGMENTS**

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JUNE 2015

# CLIMATE PROJECTIONS & SCENARIO DEVELOPMENT

CLIMATE CHANGE ADAPTATION PLAN FOR THE DISTRICT  
OF COLUMBIA

RFA: 2013-9-OPS

PREPARED FOR



PREPARED BY



PERKINS  
+WILL



# CONTENTS

<b>EXECUTIVE SUMMARY</b>	<b>8</b>
<b>01 INTRODUCTION: WHY PREPARE FOR CLIMATE CHANGE</b>	<b>15</b>
PLANNING HORIZON	18
METHODOLOGY FOR DEVELOPMENT OF FUTURE PROJECTIONS	19
UNCERTAINTY AND LIKELIHOOD IN CLIMATE CHANGE PROJECTIONS	21
<b>02 CLIMATE CHANGE PROJECTIONS FOR THE DISTRICT</b>	<b>25</b>
TEMPERATURE PROJECTIONS FOR 2020s, 2050s, AND 2080s	27
PRECIPITATION PROJECTIONS FOR 2020s, 2050s, AND 2080s	32
INTERIOR FLOODING HAZARDS	38
SEA LEVEL RISE PROJECTIONS FOR THE DISTRICT	44
STORM SURGE PROJECTIONS FOR THE DISTRICT	48
EXTREME WIND EVENTS	54
NORTHEASTERS	55
<b>03 RECOMMENDED SCENARIOS</b>	<b>57</b>
SEA LEVEL RISE/STORM SURGE	59
PRECIPITATION	60
TEMPERATURE	61
<b>04 NEXT STEPS</b>	<b>63</b>
<b>REFERENCES</b>	<b>68</b>
<b>ATTACHMENTS</b>	
1. CLIMATE CHANGE PROJECTIONS FOR THE DISTRICT OF COLUMBIA, ATMOS Research & Consulting, March 2015	
2. METHODOLOGY FOR DEVELOPING DESIGN STORMS, Kleinfelder, March 2015	

# LIST OF TABLES AND FIGURES

## FIGURES

- FIGURE 1: OBSERVED CHANGE IN VERY HEAVY PRECIPITATION EVENTS
- FIGURE 2: CLIMATE CHANGE PROJECTIONS FOR THE DISTRICT CORRESPONDING TO TWO SCENARIOS FOR THIS STUDY
- FIGURE 3: HISTORICAL AND PROJECTED SUMMER TEMPERATURES
- FIGURE 4: OBSERVED AND PROJECTED FUTURE DAYS PER YEAR WITH DAILY MAXIMUM AIR TEMPERATURE AND HEAT INDEX.
- FIGURE 5: NUMBER OF DAYS PER YEAR WITH MORE THAN 1" AND 2" OF PRECIPITATION IN 24 HOURS
- FIGURE 6: BAR CHARTS COMPARE 24-HOUR AND 6-HOUR DESIGN STORMS FOR EACH OF THE PLANNING HORIZONS
- FIGURE 7: FLOODING OF FEDERAL TRIANGLE AREA FROM JUNE 24-26, 2006 STORM
- FIGURE 8: FEMA FLOOD INSURANCE RATE MAPS, 100-YR AND 500-YR FLOODS
- FIGURE 9: HISTORICAL FLOODING AREAS IN WASHINGTON, DC
- FIGURE 10: RELATIVE SEA LEVEL RISE (RSLR) AT WASHINGTON, DC, WATERFRONT
- FIGURE 11: USACE "HIGH", "INTERMEDIATE," AND "LOW" SCENARIO PROJECTIONS FOR RELATIVE SLR IN WASHINGTON, DC FROM BASE YEAR OF 2014
- FIGURE 12. RELATIVE SEA LEVEL RISE (RSLR) INUNDATION MAPPING IN WASHINGTON, DC, FOR USACE "HIGH" SCENARIO, FOR YEARS 2018, 2068, AND 2100
- FIGURE 13: SLOSH HURRICANE STORM SURGE INUNDATION MAPPING FOR WASHINGTON, DC, FOR PRESENT DAY CATEGORY 1, 2, AND 3 STORMS
- FIGURE 14: THREE- AND FOUR-FOOT RELATIVE SEA LEVEL RISE COMPARED WITH USACE RSLR PROJECTIONS FOR WASHINGTON, DC, FROM BASE YEAR 2010
- FIGURE 15: FEMA 100-YEAR PLUS 3 FEET INUNDATION MAP FOR WASHINGTON, DC

## TABLES

- TABLE 1: WEATHER STATIONS USED IN THIS ANALYSIS
- TABLE 2: SUMMER DAYS IN THE DISTRICT WITH OFFENSIVE, DANGEROUS AIR MASSES PRESENT
- TABLE 3: TABLE OF PRECIPITATION INDICATORS
- TABLE 4: TABLE OF CALCULATED DESIGN STORMS FOR PRESENT, 2020S, 2050S, AND 2080S COMPARED TO NOAA ATLAS 14
- TABLE 5: MAJOR HISTORICAL FLOODING EVENTS IN THE DISTRICT
- TABLE 6: USACE "HIGH", "INTERMEDIATE" AND "LOW" SCENARIO PROJECTIONS FOR RELATIVE SLR IN WASHINGTON, DC, FROM BASE YEAR OF 1992
- TABLE 7: USACE "HIGH", "INTERMEDIATE" AND "LOW" SCENARIO PROJECTIONS FOR RELATIVE SLR IN WASHINGTON, DC, FROM BASE YEAR OF 2014
- TABLE 8: HISTORICAL HURRICANES WITH TRACKS WITHIN 150 MILES OF THE DISTRICT

# 02

CLIMATE CHANGE PROJECTIONS FOR THE DISTRICT

## TEMPERATURE PROJECTIONS FOR THE 2020s, 2050s, AND 2080s

Over the coming century, average and seasonal temperatures in the District are expected to increase. The District is vulnerable to the adverse health impacts of heat, and will face challenges in the years to come as a result. Both mortality (deaths) and morbidity (e.g., hospital visits or reported illnesses) can be exacerbated by extreme heat. The elderly and those with underlying health conditions such as obesity and diabetes are at greater risk for heat-related illness. (Basu and Samet, 2002). Populations with respiratory or circulatory disease also face greater physiological challenges during extreme or prolonged heatwaves (Anderson and Bell, 2009).

Mean summer temperature projections are based on simulations for all three weather stations described in Table 1. For baseline conditions (1981-2000), summer daytime maximum temperatures average around 87°F and nighttime minimum temperatures average around 66°F. The magnitude of projected change is similar for both daytime and nighttime temperatures with values increasing 2.5-3°F by the 2020s, 5-7°F by the 2050s, and as much as 6-10°F by the 2080s, depending on which scenario is used (Figure 3). Lower nighttime temperatures are important during a heatwave from a public health perspective because of the relative relief from high daytime temperatures. As minimum nighttime temperatures increase, there is less relief and higher likelihood of heat-related illnesses.

A threshold of 95°F was chosen as the indicator of extreme temperature as the District's Heat Emergency Plan is activated

and cooling centers are opened when either the actual temperature or the heat index reaches 95°F. The number of days per year with maximum air temperature greater than 95°F historically averages 11 days per year. Projections indicate an increase to 18-21 days by the 2020s. By the 2050s, the number of days is expected to increase to between 30 and 45, depending on whether projections correspond to the lower or higher scenario. By the 2080s, the number of days above 95°F could average around 40 days under the lower and 70 days per year under the higher scenario, respectively (Figure 4).

A critical measure for temperature is the heat index, which combines ambient air temperature and relative humidity to determine what the temperature feels like to the human body. For the baseline period (1981-2000), there are 29 days per year with a heat index over 95°F. By the 2020s, there are expected to be around 50 such days. By the 2050s, there may be 70 to 80 such days and by the 2080s, the number of days with heat index at or exceeding 95°F could average around 70 under the lower scenario and 105 under the higher.

Heat waves, defined as three or more consecutive days with a daily maximum heat index value above 95°F, are also likely to be more frequent and last longer. According to this definition, historically there has been anywhere from 0 to 8 heat waves per year, averaging 4 heat waves per year over the period 1991-2010. The average number of heat waves per year is expected to rise to 6 events by the 2020s, 7 events per year by the 2050s, and 8 events by the 2080s. The

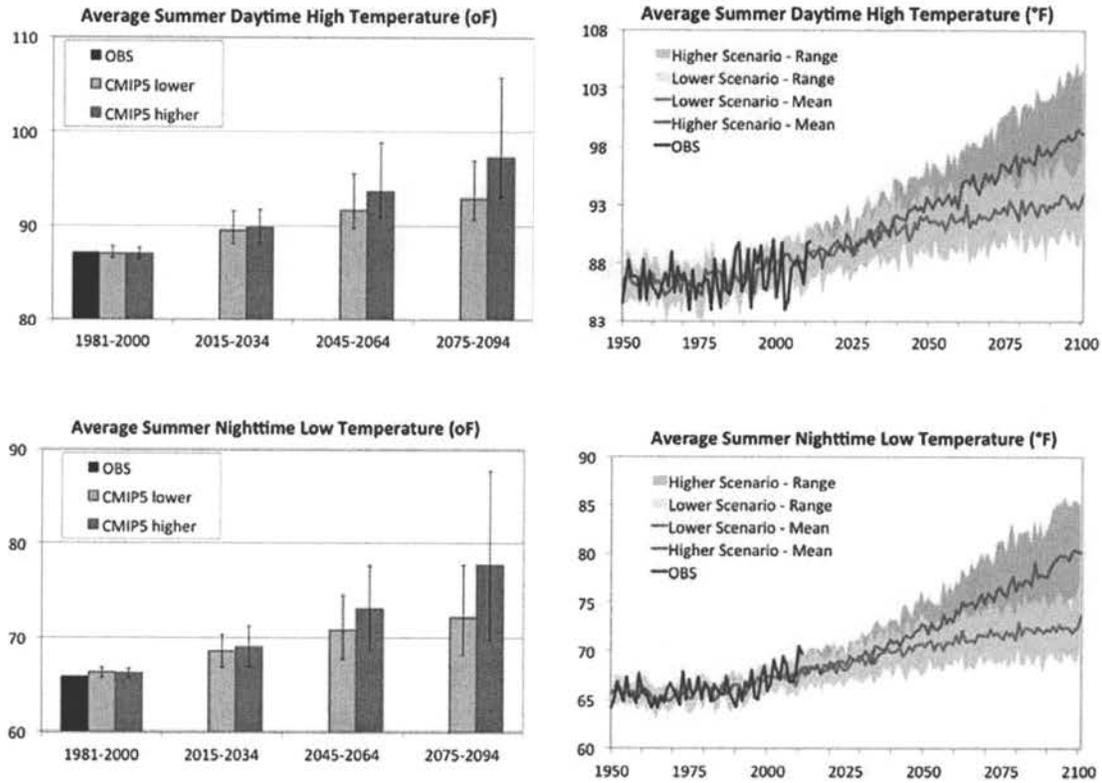
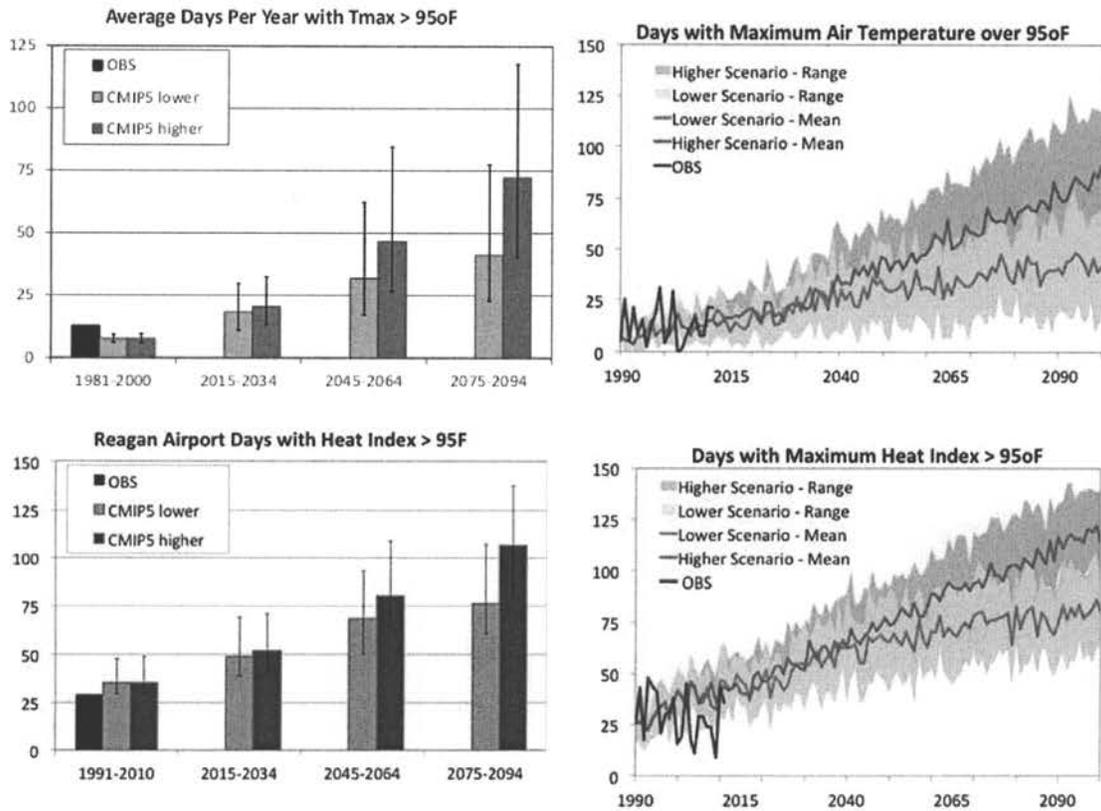


FIGURE 3: Historical and projected summer (Jun-Jul-Aug) (a) average daytime maximum or high and (b) average nighttime minimum or low temperature averaged across the three weather stations used in this analysis under higher (red) and lower (orange) future emission scenarios.

For the bar charts, the uncertainty range, indicated by the thin vertical lines above and below each bar, encompasses the range of projections from the nine different global climate models used in this analysis.

For the time series plots, the solid line indicates the multi-model average for each year while the shaded range encompasses the range of projections from the nine different global climate models.

In each plot, the black bar or line indicates observed values.  
 (Source: ATMOS, May 2015. See Attachment 1)



**FIGURE 4:** Observed (black) and projected future days per year with (a) daytime maximum air temperature (averaged over all three weather stations) and (b) daytime maximum heat index over 95oF (for the Washington Reagan National Airport station only, since the other weather stations do not have the relative humidity observations required to calculate heat index) under higher (orange) and lower (yellow) future scenarios. 1990 is the first date of relative humidity observations at Washington Reagan National Airport.

For the bar charts, the uncertainty range, indicated by the thin vertical lines above and below each bar, encompasses the range of projections from the nine different global climate models used in this analysis. Each coloured bar represents the average of 180 years of simulations, while each black bar represents the average of 20 years of observations.

For the time series plots, the solid coloured lines indicates the multi-model average for each year while the shaded range encompasses the range of projections from the nine different global climate models. The solid black line indicates the single annual value for observations that year. As such, the black line is much more similar to the shaded range (which shows year to year values) rather than the coloured lines (which average across 9 model-years).

The primary reason for differences between the observed and multi-model mean values for the historical period is the lack of data in the historical observed record (beginning at 1990 only).

(Source: ATMOS, May 2015. See Attachment 1)

## INTERIOR FLOODING HAZARDS

Due to its location at the confluence of two tidally influenced rivers, the District is influenced by three primary types of flooding: interior (inland drainage), riverine and coastal. Different storm events will result in various combinations of flooding – some resulting in more inland impacts, while others may be more coastally influenced. It is interesting to note that storm surge has the potential to turn drainage outlets into inlets with the potential for causing flooding miles away from the coast as it travels through the piped infrastructure and surfaces in remote, interior sections. Table 5 summarizes major historical flooding events in the District dating back to 1889.

The Federal Emergency Management Agency (FEMA) updated its Flood Insurance Rate Maps (FIRMs) for Washington, DC in 2010. FIRMs were issued for 100-year (1%) and 500-year (0.2%) recurrence intervals. FIRMs are based on historical data (up to 2003) and account for both riverine and tidal flooding (Figure 8). Flood inundation estimates were developed with the Hydrologic Engineering Center-River Analysis System (HEC-RAS) computational model to obtain backwater elevations using flood frequency inputs, and created as follows:

- Flood frequencies for nontidal river segments were based upon frequency analysis at nontidal gauges.
- Flood frequencies for tidal river segments were based upon gauges in the tidal portions.

- Flood frequencies for ungauged river segments and watersheds were based upon rainfall-runoff relationships or regression equations. It was not reported how flood frequencies were determined in the tidal portions of ungauged streams.

NOAA tidal gauge 8594900 is an important data source due to its location near the confluence with the Potomac and Anacostia Rivers. Data from this gauge was used to correlate flood frequencies and tidal elevation for both rivers (FEMA, 2010). Tidal gauge 8594900 data was also used for sea level rise projections in this study.

Current FEMA flood mapping is based on riverine modeling with historical flood frequency inputs, and does not account for potential future effects of climate change. For example, if FEMA riverine modeling inputs were revised to account for 100-year, 24-hour precipitation projections, then projected 100-year flood depths and extents would increase relative to current estimates.

There are historic precedents for similar events. In June 2006, 6 inches of rain fell in a 6 hour period, which is comparable to the 200-year, 6-hour storm event as shown in Table 3. The event caused extensive flooding in the Federal Triangle Area. As captured in Figure 7, several Federal buildings were damaged and businesses were interrupted as a result of inundation of two DC Metro train stations that were inaccessible for several hours.

## HISTORIC FLOOD AREAS

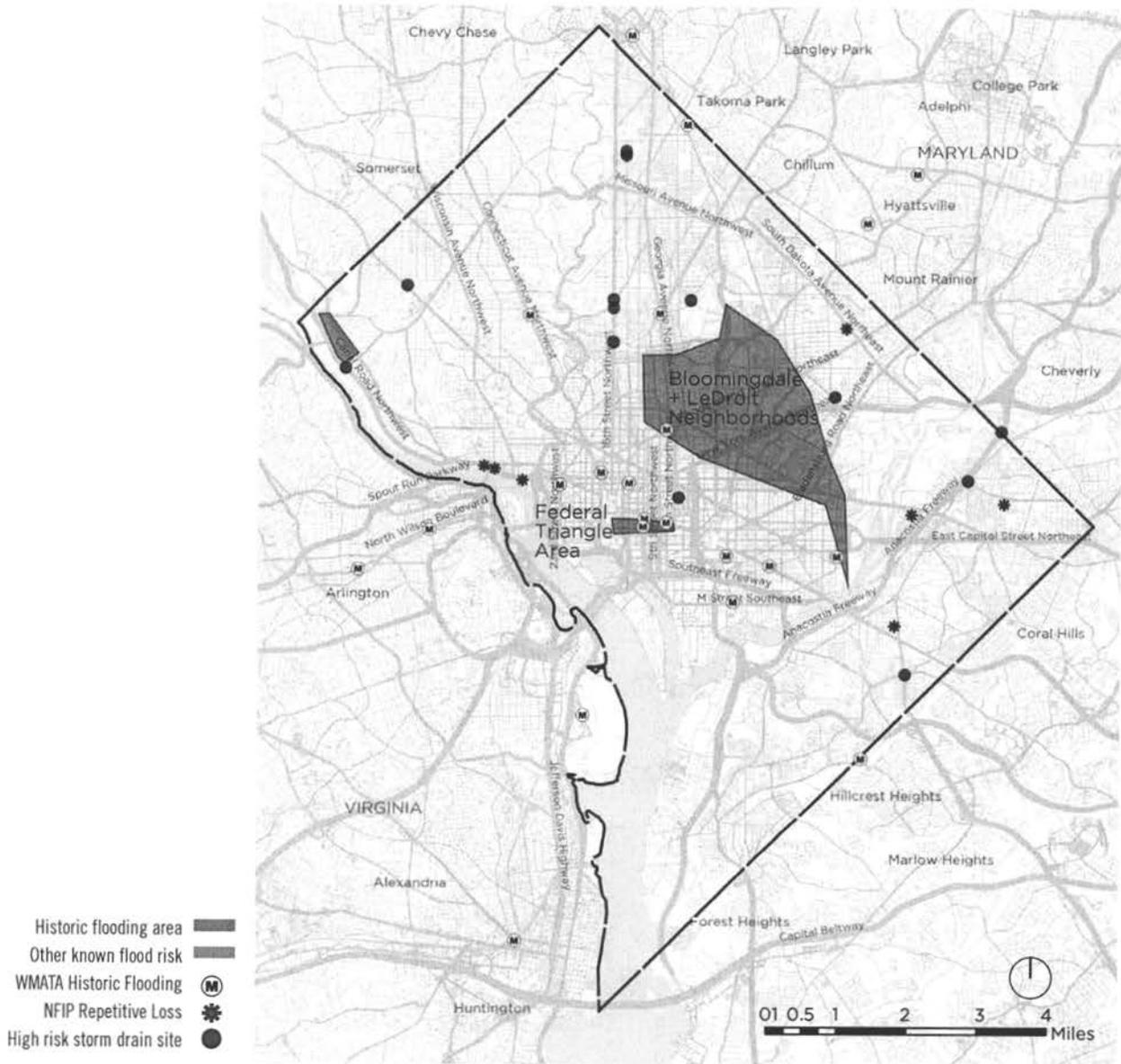


FIGURE 9: Historical flooding areas in Washington, DC (Source: Kleinfelder as identified by stakeholders, November 2014)