

MEMORANDUM

DATE: February 8, 2016,

SUBJECT: Population Vulnerability Index and Ranking Protocol
District of Columbia Climate Change Adaptation Plan

Overview

The vulnerability of the social environment is assessed in two parts – vulnerable populations, and the physical assets that are deemed critical to the support of vulnerable populations. The latter includes a broad variety of community based organizations and facilities. Therefore, vulnerable populations are also integrated in the analysis of physical assets where most vulnerable populations are housed or receive services. These physical assets include schools, public housing, senior centers, homeless facilities and correctional facilities. The vulnerability ranking of these assets is being performed as part of this study.

In addition, a social vulnerability ranking and mapping protocol has been developed to identify most vulnerable populations in the District of Columbia (The District). The protocol outlined in this memorandum adapts the methods developed by Local Governments for Sustainability (ICLEI¹) to address and measure social vulnerability while maintaining the same characteristics of vulnerability assessment- exposure, sensitivity and adaptive capacity used for the vulnerability ranking of the assets of the built infrastructures and critical resources. The overall ranking system was modified from

¹ ICLEI - Local Governments for Sustainability <http://www.iclei.org/>

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ICLEI and included both quantitative and qualitative criteria, as well as being tied to GIS.

The use of similar ranking protocol allows for a complete integration of vulnerability ranking.

Social indicators of sensitivity and adaptive capacity were uniquely derived from the District's specific demographic and place-based indicators as reported in the Sustainable DC Plan².

A. Indicator selection for Sensitivity and Adaptive Capacity

Social indicators of sensitivity and adaptive capacity (Table 1) are informed by information documented in the Sustainable DC Plan and environmental justice literature on the human determinants of sensitivity and adaptive capacity (Kelly, Adger). The analysis includes social indicators of enhanced sensitivity to climate exposures:

| Ward | % Unemployment 2005-2009 | % without HS diploma 2005-2009 | % poverty prevalence 2005-2009 | % obesity prevalence 2007 | %adult asthma prevalence | % senior in 2010 * |
|------|--------------------------|--------------------------------|--------------------------------|---------------------------|--------------------------|--------------------|
| 1 | 7.2 | 19.0 | 16 | 18.8 | 8.4 | 7.1 |
| 2 | 4.0 | 8.1 | 15 | 12.5 | 9.7 | 8.2 |
| 3 | 3.4 | 3.4 | 6.9 | 11.7 | 8.3 | 14 |
| 4 | 7.6 | 17.0 | 9.9 | 22 | 11.6 | 15 |
| 5 | 13.0 | 19.0 | 19 | 30.1 | 10.8 | 15 |
| 6 | 8.4 | 12.0 | 18 | 19.1 | 8.2 | 10 |
| 7 | 19.0 | 20.0 | 26 | 39.9 | 12.2 | 13 |
| 8 | 17.0 | 21.0 | 35 | 41.9 | 9.9 | 8.1 |

Source: As reported in Sustainable DC Plan for 2005-2009. Quoted source: <http://www.neighborhoodinfodc.org/wards/wards.html>

*source: <http://www.neighborhoodinfodc.org/wards/wards.html>

Table 1. Census based Social Indicators per Ward

² Sustainable DC Plan, http://sustainable.dc.gov/sites/default/files/dc/sites/sustainable/page_content/attachments/DCS-008%20Report%20508.3j.pdf

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All of these indicators are thought to predispose individuals to greater risk from exposure to a given level of exposure to climate hazards. It is important to report that children under the age of five and members of the population whom are more than 65 years old are not identified in the Sustainable DC Plan, however, the label “senior” has been added as age is a significant indicator of sensitivity to heat. The vulnerability of young children is partially addressed by assessing the vulnerability of the populations who use facilities including schools and daycare centers.

For adaptive capacity, three social indicators were selected to report on: unemployment, educational attainment, and poverty. Note that sensitivity and adaptive capacity are both influenced to some extent by the same social factors, and this is taken into account in our choice of indicators.

Social Indicators:

| Sensitivity | Adaptive Capacity |
|---|---|
| Unemployment | Unemployment |
| Educational attainment (without HS diploma) | Educational attainment (without HS diploma) |
| Poverty prevalence | Poverty prevalence |
| Obesity | |
| Adult asthma | |
| Senior | |

Table 2: Sensitivity and Adaptive Capacity Indicators

Information on disabilities was not collected by the Sustainable DC Plan and therefore was not available to support the reporting of this vulnerable segment of the population. Therefore, these will be addressed qualitatively in the protocol.

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B. Sensitivity and Adaptive Capacity Ranking:

Ward -based statistics form the basis for assessing the sensitivity and adaptive capacity of the District's social environment. The District has eight (8) Wards and a sample dataset is provided in Table 3 and 4 to illustrate how a ward dataset is compiled per indicator for the District.

Calculating Sensitivity and Adaptive Capacity scores per ward

The overall sensitivity and adaptive capacity score is calculated from the individual scores resulting from ranking per indicators that are added for the total sum. This assessment is only comparing wards within the District and a more comprehensive analysis of detailed census data would be required for a more comprehensive understanding of vulnerable populations. However, as a first step, this raking provides for a prioritization of which wards are most vulnerable to the projected impact of climate change defined by flooding and heat.

| Ward | % Unemployment 2005-2009 | Rank | % without HS diploma 2005-2009 | Rank | % poverty prevalence 2005-2009 | Rank | % obesity prevalence 2007 | Rank | %adult asthma prevalence | Rank | % senior in 2010 * | Rank | Sums across wards** | Rank | Sensitivity Score |
|------|--------------------------|------|--------------------------------|------|--------------------------------|------|---------------------------|------|--------------------------|------|--------------------|------|---------------------|------|-------------------|
| 1 | 7.2 | 6 | 19.0 | 3 | 16 | 5 | 18.8 | 6 | 8.4 | 6 | 7.1 | 7 | 33 | 6 | S3 |
| 2 | 4.0 | 7 | 8.1 | 6 | 15 | 6 | 12.5 | 7 | 9.7 | 5 | 8.2 | 5 | 36 | 7 | S1 |
| 3 | 3.4 | 8 | 3.4 | 7 | 6.9 | 8 | 11.7 | 8 | 8.3 | 7 | 14 | 2 | 40 | 8 | S1 |
| 4 | 7.6 | 5 | 17.0 | 4 | 9.9 | 7 | 22 | 4 | 11.6 | 2 | 15 | 1 | 23 | 4 | S2 |
| 5 | 13.0 | 3 | 19.0 | 3 | 19 | 3 | 30.1 | 3 | 10.8 | 3 | 15 | 1 | 16 | 3 | S2 |
| 6 | 8.4 | 4 | 12.0 | 5 | 18 | 4 | 19.1 | 5 | 8.2 | 8 | 10 | 4 | 30 | 5 | S3 |
| 7 | 19.0 | 1 | 20.0 | 2 | 26 | 2 | 39.9 | 2 | 12.2 | 1 | 13 | 3 | 11 | 1 | S4 |
| 8 | 17.0 | 2 | 21.0 | 1 | 35 | 1 | 41.9 | 1 | 9.9 | 4 | 8.1 | 6 | 15 | 2 | S4 |

Source: As reported in Sustainable DC Plan for 2005-2009. Quoted source: <http://www.neighborhoodinfodc.org/wards/wards.html>

* source: <http://www.neighborhoodinfodc.org/wards/wards.html>

**|lower numbers = more vulnerable

Table 3: Sensitivity scoring per ward.

The adaptive capacity scoring scale is on a threepoint scale; please note the ranks are

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reversed to align with low adaptive capacity. The higher ranks therefore report the greatest presence of social indicators corresponding to a low adaptive capacity and is scaled accordingly:

| Ward | % Unemployment 2005-2009 | Rank | % without HS diploma 2005-2009 | Rank | % poverty prevalence 2005-2009 | Rank | Sums across wards** | Rank | Adaptive Score |
|------|--------------------------|------|--------------------------------|------|--------------------------------|------|---------------------|------|----------------|
| 1 | 7.2 | 6 | 19.0 | 3 | 16 | 5 | 14 | 5 | AC2 |
| 2 | 4.0 | 7 | 8.1 | 6 | 15 | 6 | 19 | 7 | AC2 |
| 3 | 3.4 | 8 | 3.4 | 7 | 6.9 | 8 | 23 | 9 | AC3 |
| 4 | 7.6 | 5 | 17.0 | 4 | 9.9 | 7 | 16 | 6 | AC2 |
| 5 | 13.0 | 3 | 19.0 | 3 | 19 | 3 | 9 | 3 | AC1 |
| 6 | 8.4 | 4 | 12.0 | 5 | 18 | 4 | 13 | 4 | AC2 |
| 7 | 19.0 | 1 | 20.0 | 2 | 26 | 2 | 5 | 2 | AC1 |
| 8 | 17.0 | 2 | 21.0 | 1 | 35 | 1 | 4 | 1 | AC1 |

Source: As reported in Sustainable DC Plan for 2005-2009 . Quoted source: <http://www.neighborhoodinfodc.org/wards/wards.htm>

* source: <http://www.neighborhoodinfodc.org/wards/wards.html>

**lower numbers = lower adaptive capacity

Table 4: Adaptive capacity scoring – per ward.

C. Vulnerability ranking

The final vulnerability ranking of populatoins to climate change is expressed as a function of sensitivity and adaptive capacity.

Sensitivity is the degree to which the functionality of a system is affected by a specific climate change impact, whether directly or indirectly. **Adaptive capacity** is the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments both in behavior and in resources and technologies.

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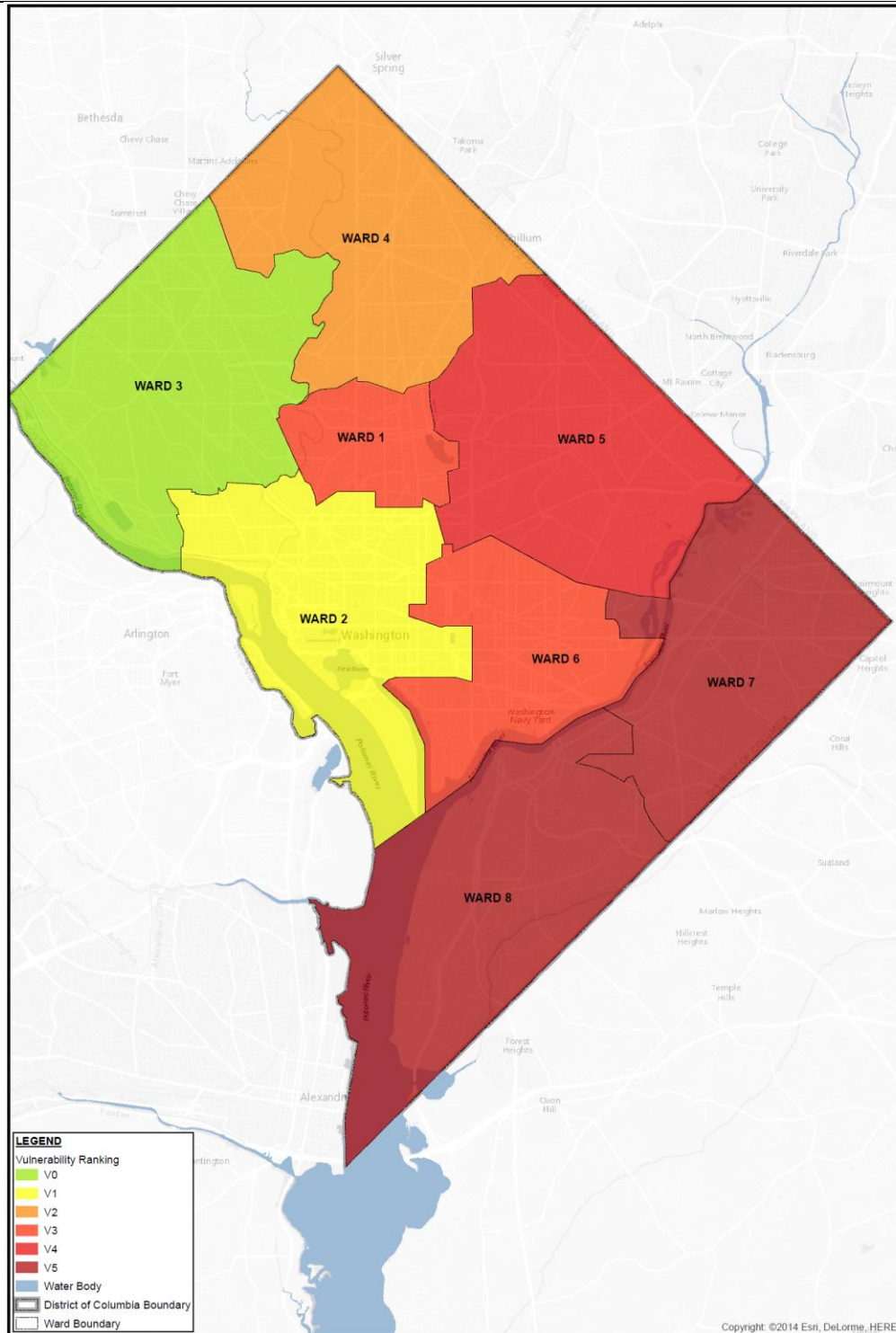
| | | Sensitivity: Low → High | | | | |
|--------------------|-----|-------------------------|----|----|----|----|
| | | | | | | |
| | | S0 | S1 | S2 | S3 | S4 |
| Adaptive Capacity: | AC1 | V2 | V3 | V4 | V5 | V5 |
| Low | | | | | | |
| ↓ | AC2 | V1 | V1 | V2 | V3 | V4 |
| High | AC3 | V0 | V0 | V0 | V1 | V2 |

Table 5. : Adapted ICLEI Vulnerability Assessment Matrix

| Ward | Sensitivity Score | Adaptive Score | Vulnerability ranking |
|------|-------------------|----------------|-----------------------|
| 1 | S3 | AC2 | V3 |
| 2 | S1 | AC2 | V1 |
| 3 | S1 | AC3 | V0 |
| 4 | S2 | AC2 | V2 |
| 5 | S2 | AC1 | V4 |
| 6 | S3 | AC2 | V3 |
| 7 | S4 | AC1 | V5 |
| 8 | S4 | AC1 | V5 |

Table 6: Reported vulnerable scoring for population per ward

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Map 1. Vulnerable Population Ranking Source: Kleinfelder, June 2015