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| **Report To:** | **Halton-Hamilton Source Protection Committee** |
| **Report No.:** | **SPC-24-03-03** |
| **From:** | Martin Keller, Senior Manager, Watershed Planning and Source Protection |
| **Date:** | March 19, 2024 |
| **Subject:** | **Progress Report - Climate Change Vulnerability Assessment** |

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**Recommendation**

**THAT** the Halton-Hamilton Source Protection Committee receives for information the staff report SPC-24-03-03 Progress Report - Climate Change Vulnerability Assessment

**Executive Summary**

Groundwater and surface water face potential impacts from climate change, including rising temperatures, prolonged droughts, altered rainfall patterns, and increased extreme weather events. The Government of Ontario is proactively addressing these challenges by integrating climate change considerations into drinking water source protection planning and management processes. The goal is to identify and mitigate adverse effects on both the availability and quality of drinking water sources.

The current assessment focuses on climate change vulnerability concerning potential water quality impacts. Led by Conservation Ontario and provincial staff, a specialized Climate Change Vulnerability Assessment Tool (CCVAT) was developed for assessing both surface water and groundwater source quality at the local level.

In the Halton-Hamilton Source Protection Region (HHSPR), encompassing 10 municipal drinking water systems, funds were allocated to utilize the CCVAT tool for a comprehensive vulnerability assessment. Staff are currently finalising the results of the vulnerability assessment using the CCVAT tool.

**Report**

Groundwater and surface water are impacted by climate change, including by rising temperatures, increased duration and frequency of drought periods, changes in rainfall amount and intensity, increased number, and frequency of extreme weather events, and resulting changes to the hydrologic cycle. The Government of Ontario is proactively addressing the potential impact of climate change on drinking water sources and has integrated climate change considerations into planning and management processes for drinking water source protection. The objective is to identify and mitigate adverse effects on both the availability and quality of drinking water sources. This includes evaluating the potential impacts on source water quantity, which was incorporated into water quantity risk assessments within the Drinking Water Source Protection program.

This assessment addresses potential water quality impacts as a result of climate change. Under the lead of Conservation Ontario and provincial staff, a dedicated climate change vulnerability assessment tool (CCVAT) was developed for assessing both surface water and groundwater source quality at the local level as it relates to a changing climate. In the Halton-Hamilton Source Protection Region (HHSPR) there are 10 municipal drinking water systems relying on surface water or groundwater. HHSPR received funds from the Ministry of Environment, Conservation and Parks to utilise the CCVAT tool and complete a climate change vulnerability assessment of areas affecting all 10 HHSPR drinking water systems.

Staff are currently undertaking the climate change vulnerability assessment by utilizing the CCVAT tool. Figure 1 below outlines the CCVAT steps and basic assessment completed at each step.

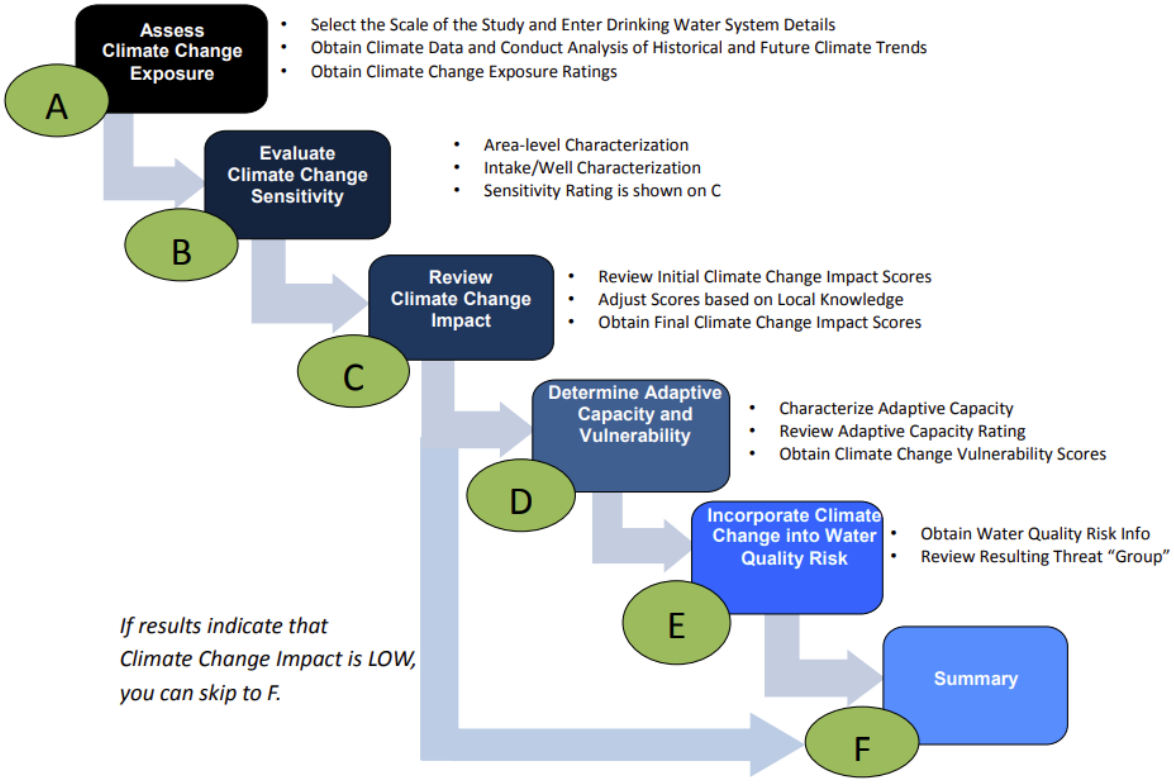


***Figure 1 - Overview of the CCVAT Assessment Tool***

The CCVAT tool operates on the Microsoft Excel platform, where each step depicted in Figure 1 functions as an individual worksheet. These worksheets are interconnected and incorporate embedded macros. While certain sections require manual input, the results are automatically generated based on the provided information. The subsequent overview outlines each step of the assessment along with preliminary results.

Climate Change Exposure

The initial phase of the CCVAT assessment involves evaluating climate change exposure by assigning ratings based on historical and projected climate trends. Exposure refers to the susceptibility of an assessment area to climate variations. The analysis includes selecting a study scale, climate change scenario (RCP 8.5), and obtaining climate data. Historical and future trends, along with variability, are determined, and uncertainty is assessed.

Study Area Selection:

Recognizing Lake Ontario water quality can be impacted by runoff from the entire watershed, the lake-based systems use the source protection area as the assessment scale, while groundwater systems are evaluated at either the sub-watershed (Kelso), catchment (Campbellville), or groundwatershed scale (Walkers Line, Carlisle, Freelton and Greensville).

Climate Change Scenario Selection:

RCP 8.5, a high-emissions scenario recommended by CCVAT guidance, was chosen to assess potential climate change impacts and prepare for worst-case scenarios.

Climate Data:

Data sources like Climate Atlas of Canada, ClimateData.ca, and Ontario Climate Data Portal were used to download historical and statistically downsampled future data based on outputs of multiple Global Climate Models. The climate data for each CCVAT assessment differ to represent the extent of the study area most closely.

Determination of Trends and Data Variability:

Linear regression tools in Excel were used to analyze trends in historical and future climate data for at least 30-year periods. Visual identification, statistical coefficients, and comparing average percent change with absolute values were used to help with trend interpretation. The trend analyses results were entered into the CCVAT tool for each one of the drinking water systems.

Climate Change Sensitivity

The subsequent stage entails assessing climate change sensitivity at both the study area assessment scale and the system and vicinity scale, considering various physical attributes. Sensitivity reflects the degree to which a system is affected by both climatic and non-climatic stressors. Parameters related to the area, such as the size of the assessment area, topography, geology, land use, system type (groundwater vs. surface water), the presence of storm and sanitary sewer infrastructure in the wellhead protection area or intake protection zone, flooding potential, and documented or anticipated water quality issues, were examined. The primary data sources for this task

were the datasets used to complete the assessment reports for the Halton Region Source Protection Area and the Hamilton Region Source Protection Area.

Following the completion of this phase, an uncertainty level was assigned. The assessment involved scrutinizing data quality, spatial distribution in terms of scale, accuracy, and the nature of data—whether anecdotal evidence or reported data were utilized. Uncertainty is then categorized as either 'low' or 'high' were assigned.

Climate Change Impact

Utilizing inputted data on exposure and area and system sensitivity, CCVAT automatically computes the initial impact score. All City of Hamilton systems have this step completed. The Halton Region system still require minor adjustments.

Adaptive Capacity and Vulnerability

Adaptive capacity refers to a system's ability to respond to climate change, mitigate potential impacts, and effectively handle extremes through measures like infrastructure updates and policy tools. The input data for this step is primarily provided by the municipalities as the system owner and operator. Using the climate change impact scores and adaptive capacity input data, CCVAT calculates an adaptive capacity score, leading to the assignment of a climate change vulnerability rating as "low," "medium," or "high." A "high" rating indicates anticipated adverse impacts on source water quality, possibly irreversible, necessitating a separate assessment. In such cases, implementing adaptation and mitigation measures is crucial. A "medium" rating suggests a moderate potential impact, emphasizing the importance of identifying and applying suitable measures. Conversely, a "low" rating implies minimal expected impacts, advising exploration of adaptation and mitigation options for planning purposes. All Hamilton systems have this step completed. The Halton Region system assessments still need to be finalized. The table below provides draft results of climate change vulnerability rating.

**Table 1 – Climate Change Impact Adaptive Capacity and Vulnerability Summary**

| SYSTEM | Impact Score | Impact Rating | Adaptive Capacity Score | Adaptive Capacity Rating | Vulnerability Score | Vulnerability Rating |
|---|---|---|---|---|---|---|
| **Burlington** | 64% | Medium | 56% | Medium | 38% | Medium |
| **Burloak** | 60% | Medium | 56% | Medium | 36% | Medium |
| **Oakville** | 67% | High | 56% | Medium | 40% | Medium |
| **Woodward** | 52% | Medium | 66% | Medium | 27% | Low |
| **Kelso** | 41% | Medium | 61% | Medium | 22% | Low |
| **Walkers Line** | 55% | Medium | 61% | Medium | 30% | Low |
| **Campbellville** | 65% | Medium | 48% | Medium | 45% | Medium |

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|---|---|---|---|---|---|---|
| **Carlisle** | 69% | High | 76% | High | 30% | Low |
| **Freelton** | 58% | Medium | 61% | Medium | 32% | Low |
| **Greensville** | 67% | High | 61% | Medium | 37% | Medium |

Climate Change and Water Quality Risk

The last element of the climate change vulnerability assessment is to combine the drinking water threat activities and the assigned climate change vulnerability ratings. This process categorizes each threat activity into Group I, II, or III. Threat activities in Group I require no supplementary measures to address climate change impacts. For threat activities in Group II, an evaluation should be conducted to ascertain the necessity of additional measures in response to climate change impacts. Threat activities falling into Group III warrant the development and implementation of appropriate measures to address the impacts of climate change. All HHSPR threat activities identified in the assessment reports were entered into system specific spreadsheets. The Hamilton system threat activities, which were removed based on field verification were also removed from the CCVAT assessments. Updates to Halton Region threat activity assessment is still outstanding.

The next step for staff is to make appropriate updates based on discussions with Halton Region, finalise the results of CCVAT assessments and prepare a summary report. Final results and any recommendations will be reported to the SPC at the next meeting in June 2024.

Signed & respectfully submitted:

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