Alloa Secondary Planning Area

Climate Adaptation Plan

Town of Caledon

Prepared for: Alloa Landowners Group

Project No.: PR-24-061

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Pratus Group

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Pratus

Document Revision History

Rev	Date	Description	Prepared By	Reviewed By	Approved By
1.0	2025/10/27	Draft for Internal Review	Lourette Swanepoel	Eric Dunford	Eric Dunford
1.1	2025/12/01	Final Draft	Lourette Swanepoel	Eric Dunford	Eric Dunford

Limitations

This report has been prepared by Pratus Group with the purpose of adhering to the Town of Caledon and Region of Peel requirements for completion of a Climate Adaptation Plan for Secondary Plan Areas. This report was prepared for the Alloa Landowners Group Inc. under the terms of our agreement. The material herein reflects Pratus Group's best judgement in light of the information available to it at the time of preparation. Any use that a third party makes regarding the information provided within this report including reliance on, or decisions to be made based on it, are the responsibility of such parties. Pratus Group accepts no responsibility for damages, if any, suffered by any party as a result of decisions made or actions taken based on this report.

Table of Contents

List of Appendices

List of Figures

List of Tables

1. Introduction

1.1. Purpose

The Region of Peel Official Plan approved on November 4th, 2022, introduced new requirements for secondary plan areas to complete a Climate Adaptation Plan. Under Section 5.6.20.14.17(e) of the Official Plan, secondary plan applications are required to address:

- The feasibility, planning and implementation requirements relating to the risk and vulnerability to property, infrastructure, public health, natural heritage and water resource systems due to changing climate conditions; and
- A strategy and policy direction to implement recommendations that reduce community and environmental vulnerability to changing climate conditions including severe weather, increasing temperature and climates shifts.

In alignment with the Official Plan requirements, the Town of Caledon implemented a Terms of Reference document in early 2023 outlining similar requirements for Secondary Plan Areas. An updated version of the Town's Terms of Reference was standardized and released in May 2024.

This Climate Action Plan (CAP) has been prepared to satisfy the requirements of the Region of Peel Official Plan and the Town of Caledon's Terms of Reference for the Alloa Secondary Plan Area. Within this document, the following topics are addressed:

- A summary of climate-related risks and vulnerabilities relevant to the Secondary Plan Area
- A summary of climate adaptation strategies and actions identified by the Region of Peel and the Town of Caledon as important considerations to promoting community resiliency to expected future changes that were considered for application within the Secondary Plan Area
- Specific climate adaptation considerations that were implemented within the Secondary Plan Area to reduce risk and vulnerability from expected changing climate conditions
- Identification of considerations that are recommended to be further explored and developed in future phases of the planning process for this Secondary Plan Area

1.2. Secondary Plan Area

The Alloa Secondary Plan Area is a new settlement area located in the southern portion of the Town of Caledon within the Regional Municipality of Peel. The planning area is comprised of multiple land parcels that encompass a total of 758 hectares (1,874 acres) of greenfield lands northwest of the City of Brampton, of which approximately 170 hectares includes existing and introduced natural heritage features. The Secondary Plan Area is bounded by Mayfield Road to the south, the proposed Greater Toronto Area West Transportation Corridor (Highway 413) to the north and west, and Chinguacousy Road to the east.

The lands consist primarily of existing agricultural uses with substantial farm fields and single detached rural residential dwellings. Natural heritage areas, including woodlots and watercourses are present, with a drainage feature (Alloa Municipal Drain) that runs east-west and services the existing agricultural land.

The majority of the lands are located within the Etobicoke Creek watershed, with flows generally eastward toward the Alloa Drain and other tributaries of Etobicoke Creek. The southeastern portion of the lands is located within the Credit River Watershed, draining southwards towards the tributaries of Huttonville Creek in the west and Fletcher's Creek in the east. The Plan Area is separated into two phases, with the first phase of development expected on the eastern half of the site primarily to the east of Creditview Road. As such, the lands fall within the jurisdiction of both Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC).

An Official Plan Amendment (POPA 2024-0004) has been filed on behalf of the Alloa Landowners Group for the Alloa Secondary Plan Area. The amendment would establish objectives and policies to direct land development within the Alloa Secondary Plan Area. The land use designations and policies proposed for the Alloa Secondary Plan include objectives and policies on growth management, community design, natural heritage system, cultural heritage, mobility, climate resilience, and infrastructure to support the projected population and employment growth to 2051.

The Alloa Secondary Plan prescribes several development objectives: support for climate change mitigation and adaptation; design of a stormwater management system that protects features and functions of the natural heritage system and water resource system; provide an inter-connected transportation network that includes road, pedestrian, cycling and transit infrastructure; and protect and enhance significant and sensitive natural heritage features within the Natural Environment System, among other objectives.

The Alloa Secondary Plan Area boundaries are shown in **Figure 1** below.

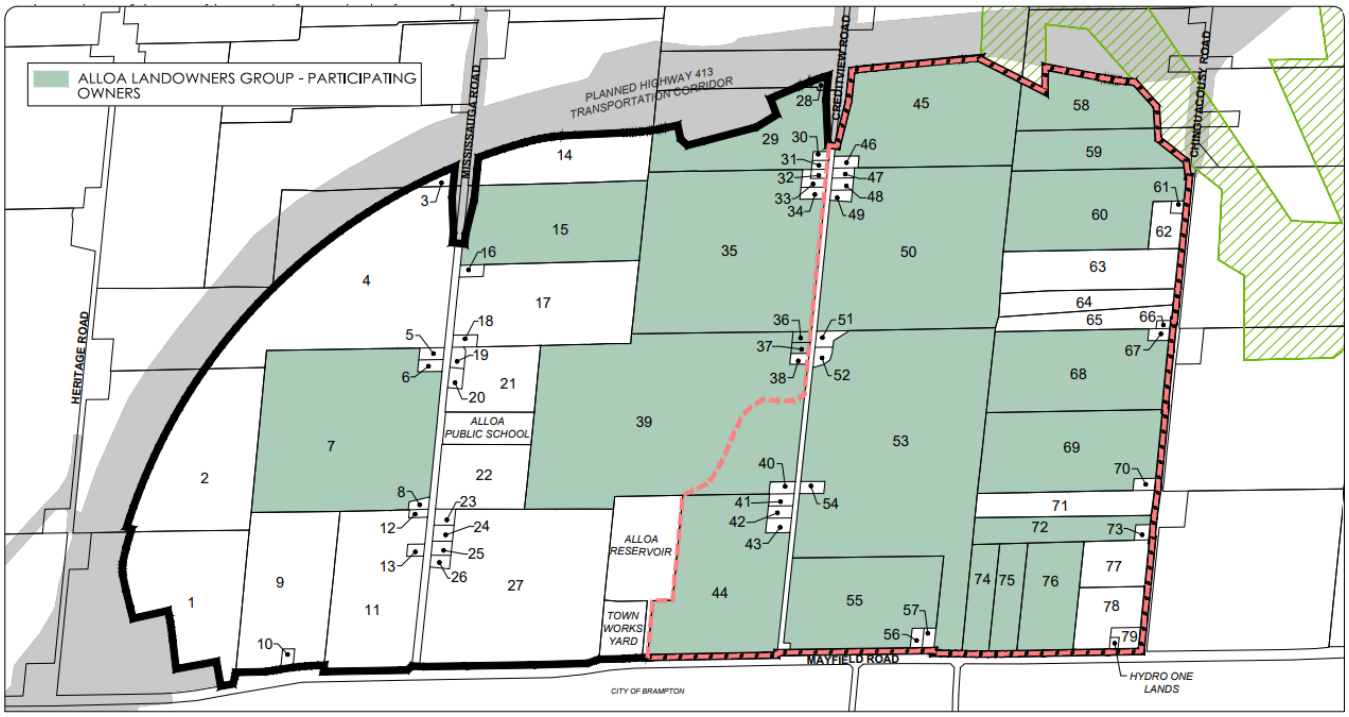

Figure 1: Alloa Planning Area Ownership Plan Demonstrating Phase 1 Boundary

(obtained from GSAI, May, 2025)

1.3. Background Context

The Region of Peel and the Town of Caledon have previously completed several climate-related studies and assessments that informed the development of the Alloa CAP. These studies include:

- Future Caledon Official Plan (March 2024)
- Future Climate Projections for the Town of Caledon (Amec Foster Wheeler; January 26, 2018)
- Community-Wide Risk and Vulnerability Assessment Project (ICLEI Canada; December 5, 2018)
- Resilient Caledon Community Climate Change Action Plan (Sustainability Solutions Group; 2021)
- 2021 Peel Climate Change Performance Measurement System Final Report (KPMG; November 2022)
- Town of Caledon Green Development Standard Guidebook (Sustainability Solutions Group; June 2024)
- Etobicoke Creek Watershed Plan (Toronto and Region Conservation Authority, 2024)
- Credit River Watershed Plan (Credit Valley Conservation Authority, 2021 – ongoing)

Additional details of the core studies that were referenced in the development of this CAP are described in **Appendix A.**

1.3.1. Climate Mitigation and Climate Adaptation

While this report focuses on climate adaptation, it is also acknowledged that there are significant co-benefits between emissions mitigation strategies and climate adaptation. This is reflected in the fact that several of the reports reviewed speak to both topics and the interrelated challenges and opportunities affecting both mitigation and adaptation strategies. It must be understood that climate adaptation strategies are influenced by the quantity of greenhouse gas emissions entering the atmosphere, and the need for adaptation will be influenced by future trends in global emissions.

1.4. Climate Adaptation in the Development Process

Climate adaptation is not a singular process that occurs at a point in time. Adaptation planning is instead a lens that must be overlaid with the land development process. Adaptation planning relies on access to accurate data and information to build capacity and knowledge to support implementation and monitoring of effective actions and strategies for reducing community vulnerability.

During early stages of planning, the primary objective is to review available information on expected climate impacts and potential risks and vulnerabilities. This information is used to establish opportunities to avoid or reduce prospective environmental, physical, or social harms, and to identify and define objectives, criteria, and strategies that must be further developed and implemented at later phases of planning and construction. Strategies that can increase the adaptive capacity and resiliency of the development area may only be fully defined and realized once the final concepts and designs of civil infrastructure, building lots, and individual buildings are known. The traditional climate adaptation planning process is outlined in **Figure 2** below.

Figure 2: Traditional Climate Adaptation Planning Process, Adapted from the City of Vancouver, 2018[1].

Each successive phase of the planning process specifies required technical documents that define the development parameters. The Region of Peel and the Town of Caledon have directed that the CAP is triggered and initiated as part of the first step in the development process, at the secondary planning stage, and is to guide activity throughout the planning process.

The CAP is necessarily collaborative in scope, and aspects of climate adaptation have therefore been integrated and completed concurrently into the other technical studies required for the submission of the Secondary Plan. These technical documents, and other future key documents that are anticipated to help drive climate action, are highlighted below in **Figure 3.**

The CAP is intended to capture the key considerations and act as reference in current and future stages to ensure that climate adaptation is embedded throughout the planning and development process. The CAP is supported by actions undertaken in the development of companion technical studies. These technical studies further develop principles and objectives summarized within the CAP at a greater level of detail. The CAP is intended to represent a summary of all actions undertaken to date while identifying critical components of the companion studies that report how climate adaptation considerations have been holistically embedded within the planning documentation.

Figure 3 summarizes the complete list of technical studies and reporting requirements that have and will be developed that are complementary to the Alloa CAP. The technical studies contain important context and information on the approach taken to implementing climate adaptation strategies into the Alloa Secondary Plan Area.

[1] City of Vancouver: https://council.vancouver.ca/ctyclerk/cclerk/20181205/documents/cfsc1.pdf

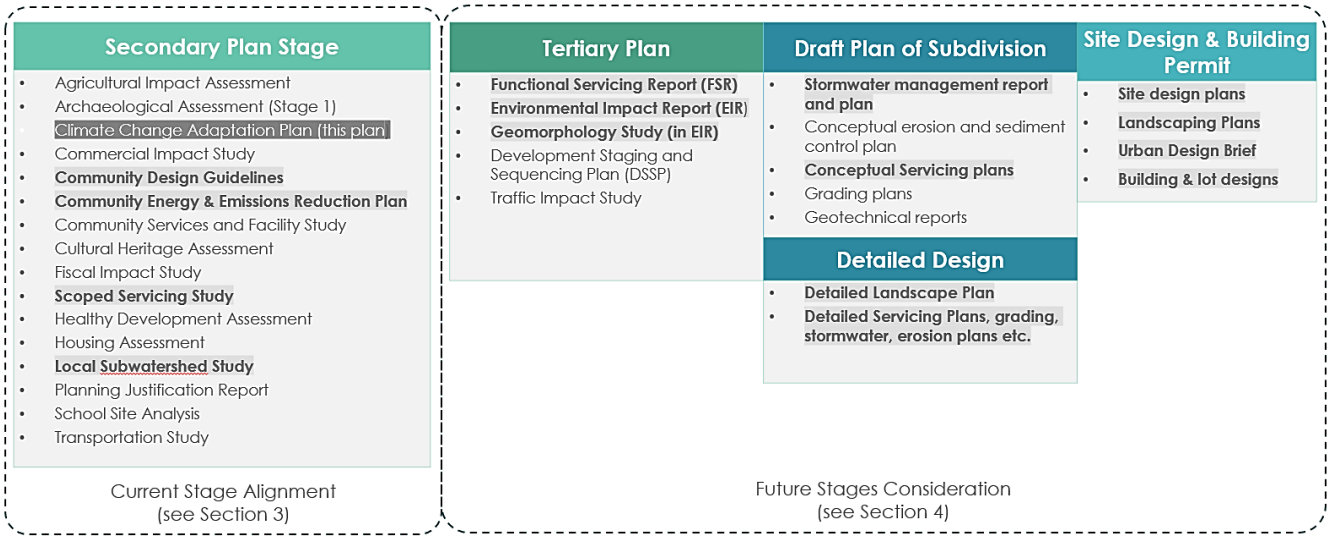

Figure 3: Key Technical Studies Incorporating Climate Adaptation Considerations and Guidance for the Alloa Secondary Plan Area

For the Alloa Secondary Plan Area, climate adaptation considerations were evaluated and embedded into the following technical studies:

Table 1: Technical Studies Reviewed for the Alloa Secondary Plan Area

Technical Study	Author	Date and Version
Secondary Plan / Official Plan Amendment	Glenn Schnarr and Associates	October 28, 2025 (Enacted)
Community Design Guidelines	NAK Design	July 2025 (2nd Submission)
Local Subwatershed Study	C.F. Crozier & Associates	August 2025 (2nd Submission)
Community Energy & Emissions Reduction Plan	Pratus Group Inc.	May 2025 (2nd Submission)
Functional Servicing Report	Urbantech Consulting	September 2024 (1st Submission)
Scoped Servicing Study	Urbantech Consulting	August 2025 (2nd Submission)
Environmental Impact Study	C.F. Crozier Inc.	December 2024 (1st Submission)

1.4.1. Policy Context

The Ontario government has recently implemented a suite of policies to fast-track land development. Through policies including Bill 185 (2024)[2], Bill 23 (2022)[3], and the Building Faster Fund[4] the provincial government has promoted an increase in the number of development applications and pace at which these applications are expected to move though the approvals process. The Alloa Secondary Plan Area is one of the plan areas subject to an expedited approvals process, as identified in zoning by-law amendments made by the Mayor of Caledon on March 26th, 2024 (identified as Zoning By-law A1)[5].

The Town of Caledon piloted a suite of sustainable planning and design measures through its Green Development Standard (GDS)[6] between July 2024 and July 2025. The GDS applied to Site Plan and Draft Plan of Subdivision applications for residential, commercial, and industrial developments across Caledon. The GDS included goals and metrics covering a range of sustainability and resiliency criteria organized under three themes: Community Design and Mobility, Green Infrastructure, and Buildings and Energy. The municipal-level goals and metrics generally exceed the requirements set forth by the Ontario Building Code.

In November 2025, the Legislative Assembly of Ontario passed Bill 60[7] into law. Bill 60 contains a range of technical amendments to various Acts, including the *Planning Act*, the *Development Charges Act*, the *Municipal Act*, and the *Construction Act*. In addition to the changes proposed, the Province of Ontario recently conducted consultation on Enhanced Development Standards at the lot level outside of the building envelope. These Standards are alternatively known as 'green development standards', such as the Town of Caledon GDS. The position of the Province is that municipal authorities are not empowered to impose environmental or green building standards that include requirements beyond the Ontario Building Code. The consultation focused on whether (and how) the Province would prohibit lot-level requirements imposed through the *Planning Act* approval process. The comment period closed on November 22nd, 2025, and the Province has not yet issued a summary of the consultation.

Considering the evolving state of the provincial legislation and the consultation conducted, it is not clear what aspects of the Town's GDS will be in force as the planning process for the Alloa Secondary Plan Area advances.

[2] Province of Ontario: https://www.ola.org/en/legislative-business/bills/parliament-43/session-1/bill-185
[3] Province of Ontario: https://www.ola.org/en/legislative-business/bills/parliament-43/session-1/bill-23
[4] Province of Ontario: https://news.ontario.ca/en/release/1003397/to-build-more-homes-ontario-launching-building-faster-fund-and-expanding-strong-mayor-powers
[5] Town of Caledon https://www.caledon.ca/en/government/resources/Mayoral-Decisions/Mayoral-Decision-2024-07.pdf
[6] Town of Caledon Green Development Standard: https://www.caledon.ca/en/town-services/green-development-standards.aspx
[7] Province of Ontario, Bill 60: https://www.ola.org/sites/default/files/node-files/bill/document/pdf/2025/2025-11/b060ra_e.pdf

1.5. Report Structure

Section 3 of the CAP describes efforts completed to date to align the documents and technical studies prepared as a part of the Secondary Plan application that complement and support the Region of Peel and Town of Caledon climate adaptation objectives. **Section 4** of the CAP identifies and summarizes climate adaptation considerations for subsequent stages of the development process. This section also includes a summary list of recommendations for actions that are to be implemented during future phases of development.

1.6. Limitations

Structural and temporal limitations exist that prevented the Alloa Secondary Plan Area project team from addressing some of the known climate risks for southwestern Ontario at the secondary plan stage. These limitations arose from:

- A lack of available data to inform technical analyses and modeling of the potential impacts of changing climate conditions on engineering and environmental criteria of interest. Specific limitations that affected the modeling work conducted as a part of the Local Subwatershed Study are summarized in Appendix E of the Urbantech Scoped Servicing Study, and in Table 61 of the Local Subwatershed Study.
- Limited guidance from local and provincial policymakers on how to apply Region-wide / Town-wide adaptation strategies and evolving best practices developed by local conservation authorities at the Secondary Plan level.
- The limited ability of the Alloa Landowners Group to directly influence current or future publicly owned lands located within the Plan Area.

These limitations are further described below to support continued discussion with the Town of Caledon, the Region of Peel, and the TRCA and CVC to continue to advance climate adaptation efforts as the planning and development process advances.

1.6.1. Availability of Relevant Data to Model Future Conditions

Per the Terms of Reference established with the Alloa Landowners Group, stormwater modeling standards and methodologies currently were not required to account for any potential changes from future climate conditions. The TRCA has developed a suite of four future scenarios to model the potential impacts of expected changes to climate conditions in the Etobicoke Creek watershed, and the TRCA continues to refine this scenario modeling approach for other watersheds. The four scenarios were provided at the watershed level in the *Etobicoke Creek Watershed Future Management Scenario Analysis Report*[8] to demonstrate potential areas of elevated risk and vulnerability from changes to precipitation patterns and projected water flows. At present, these scenarios are understood to be informational and do not supersede regulated requirements expressed in existing standards and models of record established by the conservation authority and the governing municipalities, including the Regional Storm used for flood

[8] Toronto and Region Conservation Authority: https://trcaca.s3.ca-central-1.amazonaws.com/app/uploads/2022/09/20171757/Final-ECWP-Scenario-Analysis-Report-July-2022.pdf

hazard mapping. TRCA has advised that no changes to the Regional Storm distribution are recommended in the Etobicoke Creek Watershed Future Management Scenario Analysis Report. The underlying methodology and data sources used by the TRCA was accessed by the project team to support the development of the Local Subwatershed Study

The project team participated in a workshop with representatives of the Town and the TRCA on April 23rd, 2025, to discuss data limitations and to propose an approach to integrating climate-related impacts into the analyses. Following the workshop, the project team proposed a methodology to evaluate potential climate-related impacts on design elements (refer to **Table 2**).

Table 2: Potential Climate Change Impacts to the Secondary Plan Area (Urbantech Consulting)

LSS Design Element	Potential Climate Impact	Potential Impact Rationale	Climate Data Source
Channel Block / Floodplain Hazard	No	An increase in the intensity and frequency of 100-year precipitation could lead to increased runoff to streams and rivers that impact people, property, and assets located in or near the rivers / streams. However, these impacts are not anticipated as the channel corridor and flood hazards are delineated based on the Regional storm conveyance, which were determined to be more conservative than the 100-year SSP5-8.5 climate scenario.	TRCA provided data for the 100-year climate period under SSP5-8.5.
Culvert Sizing	No		
Erosion	Yes	An increase in the intensity and frequency of precipitation could lead to increased flows and velocities in the creeks that cause erosion of creek embankments and damage to in-stream / near stream assets. The need for adaptation measures for erosion, such as sizing of stone protection, should be evaluated during the FSR / EIR / detailed design stage if climate-adjusted continuous precipitation and temperature data are available from the Town / TRCA. At this time a sensitivity analysis was conducted to evaluate 'low' baseline (based on the approved TRCA model), and 'high' runoff scenarios to evaluate flow differences.	Climate-adjusted and continuous precipitation and temperature data were unavailable at the time of the assessment.

LSS Design Element	Potential Climate Impact	Potential Impact Rationale	Climate Data Source
SWM Pond Block	No	Changes to the intensity and frequency of precipitation could lead to changes in runoff and extended detention, which could cause vegetation stress, longer drawdown times, and overland flooding impacts to nearby property and assets. However, no quantity control impacts are expected as the SWM pond capacity is based on the Regional storm conveyance, which was determined to be more conservative. The need for adaptation measures such as extended detention orifice controls should be evaluated during the FSR / Detailed Design stage if climate-adjusted continuous precipitation and temperature data are available from the Town / TRCA.	Climate Atlas of Canada, IDF_CC Tool for 2-year to 100-year storms.
Wetland Water Balance	Yes	Changes in precipitation and temperatures / evaporation could lead to more or less frequent inundation that impacts the water balance and wetland hydroperiods. In the absence of available climate-adjusted continuous precipitation and temperature data, the historical extreme (wet and dry) years from the period 1992 – 2007 were used as a basis for design impact assessment. The need for adaptation measures to ensure hydroperiods are maintained in future climate conditions should be evaluated during the Detailed Design stage if climate-adjusted continuous precipitation and temperature data are available from the Town / TRCA.	Climate-adjusted and continuous precipitation and temperature data were unavailable at the time of the assessment.
LID Features / Site Water Balance	Yes / No	Changes in precipitation and temperatures / evaporation could lead to more or less runoff, variable inundation, and vegetation stress. Under less rainfall conditions, there could potentially be insufficient recharge, while under more rainfall conditions the water balance will continue to be met. To be conservative Low-Impact Development (LID) capacity is not factored into pond calculations, allowing for greater contingency under future climate conditions. The need for adaptation measures for LID features should be evaluated during the FSR / Detailed Design stage if climate-adjusted continuous precipitation and temperature data are available from the Town / TRCA.	Climate-adjusted and continuous precipitation and temperature data were unavailable at the time of the assessment.

As reported, the absence of climate-adjusted and continuous precipitation and temperature data presented barriers to incorporating future climate scenarios into the analyses conducted. For some design elements, modeling indicated that the Regional storm values are expected to be greater than climate-adjusted 100-year storm data and were therefore considered conservative.

It is recognized that there is opportunity to further define and develop appropriate modeling methodologies at the secondary plan level as the planning process advances.

1.6.2. Limited Guidance at the Secondary Plan Scale

While future climate projections have been completed for the Region of Peel and the Town of Caledon, these projections have not yet been incorporated into Town of Caledon standards and guidelines for stormwater management. The stormwater modeling that was conducted for the Secondary Plan Area was based on existing standards and models of record obtained from the Town of Caledon and the Toronto and Region Conservation Authority. Prevailing Town of Caledon guidelines do not currently communicate any requirements for adjustment to reflect future climate conditions. It is understood that the Town is currently updating its IDF parameters to account for expected climate changes, but this information was not available to the project team. Should this information be made available during the development of the FSR and at Detailed Design, it will be utilized. Increases in IDF parameters would not be expected to impact block sizes, but it could affect storm sewer sizes and the number of catchbasins on the right of way.

1.6.3. Existing Restrictions on Use of Public Areas

The Alloa Landowners Group does not have direct control over areas of the Secondary Plan Area that will ultimately become public areas (e.g., parks and parkettes, right of ways, etc.). Noting that the Town of Caledon and the Region of Peel are broadly supportive of climate adaptation. the deployment of some mitigative strategies that would increase resilience to anticipated future climate conditions may not be possible to implement in these areas or may require changes to existing policies and standards. The CAP scope was therefore limited to the privately owned lands within the Secondary Plan Area. This restriction was most relevant to the placement of Low-Impact Development (LID) stormwater management features within public lands. Where relevant, recommendations have been made for the Town of Caledon's consideration for proposed public lands within the Secondary Plan Area, but it is understood that this is subject to the Town's acceptance and approval.

2. Climate Adaptation Goals for the Alloa Secondary Plan Area

2.1. Establishment of Climate Adaptation Goals

Future climate conditions and associated risks and vulnerabilities have been comprehensively studied in the Town of Caledon and the Region of Peel. In 2018, the Town completed the *Future Climate Projections for the Town of Caledon* as well as a community-wide *Risk and Vulnerability Assessment* (RVA) meant to assess the localized impacts of climate change and how such future changes could impact the built environment, natural systems, and other amenities and assets in the Town. These two documents were considered as foundational to the development of the CAP, representing the first two stages in the adaptation planning process.

The impacts identified through the Town of Caledon's RVA were prioritized based on their likelihood of occurrence and severity of impact. From there, community-wide goals and actions were defined in the 2021 *Resilient Caledon Community Climate Action Plan (CCCAP)* based on best practices from other municipalities and refined through public and stakeholder feedback. T

Goals for the Secondary Plan Area were selected based on the work previously completed in the studies referenced above. The following seven goals were taken from the CCCAP (**Figure 4**) to guide the development of the Alloa Secondary Plan Area Climate Action Plan. In some cases, the goal wording was slightly adjusted to solely focus on climate adaptation relevant aspects (vs. greenhouse gas emissions mitigation). In such cases, the original wording is shown in parenthesise for reference:

- **Goal 1:** Establish climate-friendly land-use policies (Establish climate-friendly land-use and building policies)
- **Goal 2:** Protect Communities from Flood Risks
- **Goal 5:** Improve Water Conservation (Reduce Community-wide Waste Generation and Improve Water Conservation)
- **Goal 11:** Restore and Enhance Natural Features on Public and Private Land
- **Goal 15:** Diversify Caledon's Energy Supply with Renewable and Resilient Energy Sources and Systems
- **Goal 16:** Enhance the Capacity of Town Roads and Bridges to Withstand Extreme Weather
- **Goal 17:** Upgrade Stormwater Plans and Practices to Reduce Risks from Extreme Weather Events

Note that other goals from the CCCAP were considered relevant to the Secondary Plan Area, but as they are outside of the control of the Landowners Group they were not addressed within this Plan. Specifically, **Goal 18:** Ensure Town Facilities are Carbon Neutral and Climate Resilient by 2040 will be influenced by the proposed development of additional Town facilities in the Secondary Plan Area, but the design and construction of these facilities will be at the Town's discretion. Several goals also address climate mitigation, which falls outside the scope of the CAP, but are addressed through other secondary plan studies.

The Alloa CAP is structured around each of the goals described above and further advances the related community-wide actions outlined in the *Resilient Caledon Community Climate Action Plan* in response to

potential community impacts and vulnerabilities identified in the RVA. **Section 3** describes the alignment of the Secondary Plan-level documents with these community goals and related CCCAP actions and actions completed to date to reduce climate vulnerability.

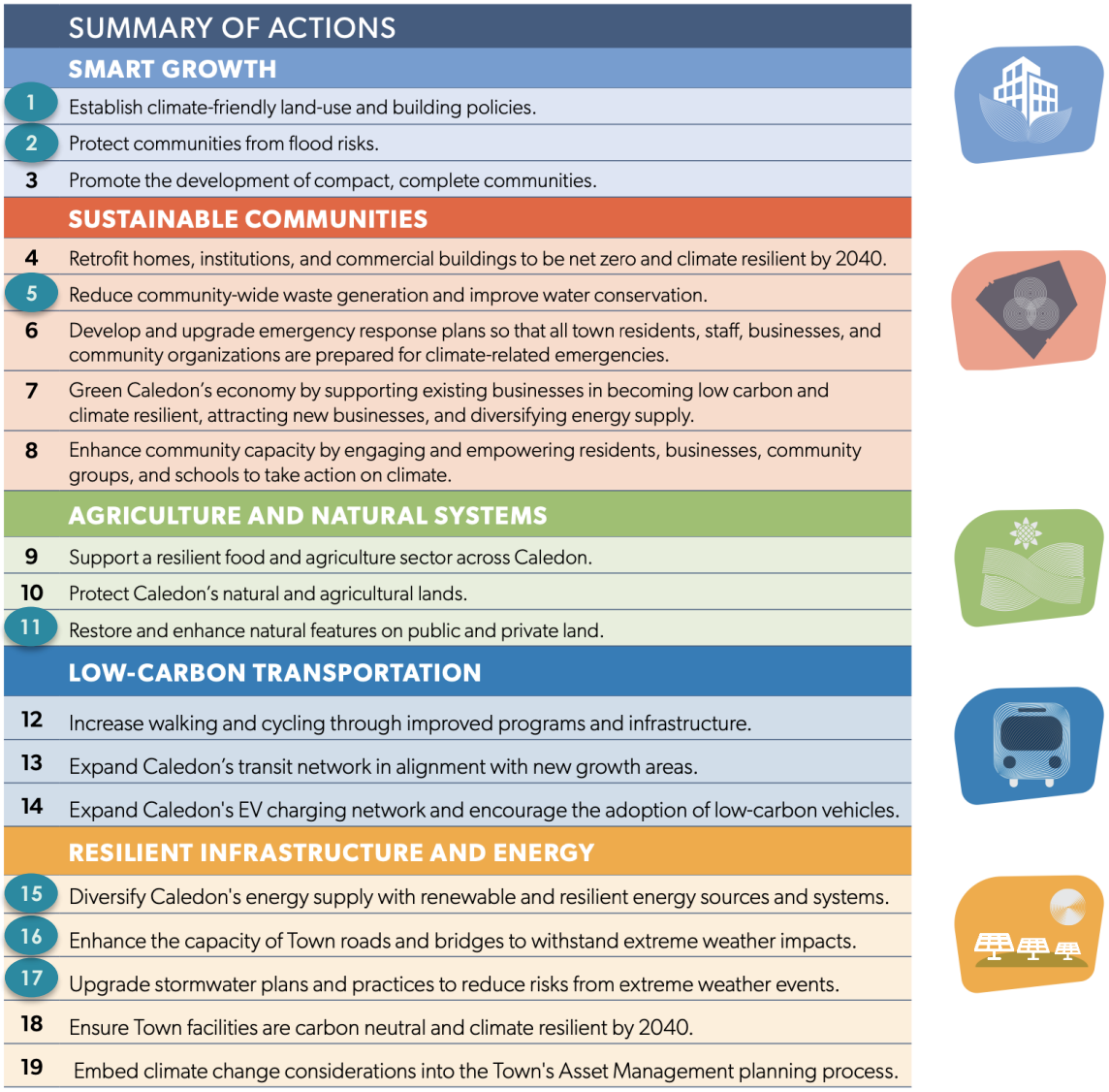

Figure 4: Summary of Resilient Caledon Climate Action Plan Actions

** Blue circles indicate relevant goals used to inform the development of the Alloa Secondary Plan CAP*

3. Secondary Plan Climate Adaptation Features

At the highest level, development in the Town of Caledon is guided by the Official Plan. The Secondary Plan stage focuses on a defined area of the Town where it is considered necessary to provide more detailed planning objectives and policies for development activities. These plans are an extension of the Official Plan, subject to the same administrative and public involvement processes. Secondary plans must demonstrate their alignment with the Official Plan and explore the development strategy for the area in the context of site conditions.

At this stage in the development process, details might not yet be determined but macro-level strategic decisions are made, including decisions on:

- Land use types and distribution, density, and community design concept;
- Transportation patterns;
- Environmental protection, enhancement and management requirements;
- Heritage/archaeological potential;
- Stormwater management concept;
- Site servicing strategy; and
- Development phasing.

At this stage, the general building blocks of the proposed development are established, but exact details and sizing requirements (e.g., for stormwater systems, road widths, parcel layout, etc.) are not determined. The focus for climate adaptation at this stage is firstly, to identify and avoid/limit development in vulnerable locations, and then secondly, to embed climate adaptation considerations into the core planning documents that will help shape subsequent detailed development stages.

The sections below provide an overview of how the proposed Alloa Secondary Plan area considers potential risks and vulnerabilities identified int he RVA and responds to the each of the individual resilience goals defined by the CCCAP.

3.1. Establish Climate-Friendly Land-Use Policies

3.1.1. Context

Goal 1 of the CCCAP calls for the establishment of climate-friendly land-use and building policies. Under this goal, the CCCAP identifies an action (Action 1.1), which directs for the integration of climate change into land-use planning policies and processes. The Official Plan is the primary avenue for implementing this action, but other bylaws and standards developed for the Secondary Plan Area must be aligned with the Official Plan requirements.

3.1.2. Secondary Plan Alignment

Secondary Plan

As an extension of the Official Plan, the Secondary Plan is subject to the same administrative and public involvement processes. The Alloa Secondary Plan[9] specifically incorporates policy language that embeds climate considerations into the process. Specific language used in the Alloa Secondary Plan requires that *New development in the Plan Area will be prepared for climate change through adaptation planning that reduces future impacts on public health, property, infrastructure and the natural environment* (Section 36.3.3.a).

The Secondary Plan text also references that *New development will make efforts to advance the recommendations outlined in the Alloa Climate Adaptation Plan to improve resilience at each development stage* (Section 36.3.3.b). Several other supporting policies that address specific climate vulnerability and resilience topics are included in the Secondary Plan. These requirements are identified and discussed under the related CCCAP goals described below.

3.2. Protect Communities from Flood Risks

3.2.1. Context

The RVA identified that the Town of Caledon is expected to experience an overall increase in average annual intensity and duration of precipitation. Seasonal changes are also expected, with drier summers and higher levels of precipitation occurring in winter and spring seasons. Changes to precipitation patterns could lead to vulnerabilities and risks related to more frequent inundation of floodplains, causing higher frequency of flooding in urban areas.

Goal 2 of the CCCAP calls for the protection of communities from flood risks. The CCCAP also identifies an action (Action 2.1) calling for the prohibition or restriction of new development in high-risk flood zones, maintenance of sufficient setbacks along water bodies, and enhancement of flood resiliency in urban areas through planning and zoning. Achieving these objectives will require collaboration with conservation authorities with jurisdiction to determine the most vulnerable watercourses and

[9] Town of Caledon, By-Law No. 2025-097, *A by-law to adopt Official Plan Amendment Number 5 to the Future Caledon Official Plan (Alloa Secondary Plan, File POPA 2024-0004)*

recommended management options. Reducing flood risk may also require restricting new basement construction in high-risk areas.

As the Alloa Drain is a central feature of the planned development and there are extensive Natural Heritage System features, consideration of flooding risk was highly relevant to the Secondary Plan Area.

3.2.2. Secondary Plan Alignment

Secondary Plan

The Alloa Secondary Plan directs new development in the plan area to implement measures *adapting storm drainage systems and using green infrastructure / Low Impact Development strategies where practical to manage an increase in annual precipitation and extreme precipitation* (Section 36.3.3.b.i). It also identifies that *minimum buffer widths will be provided from the limit of all natural heritage features and hazards as outlined in the approved Alloa Local Subwatershed Study (*Section 36.10.4.a*)*. Additionally, the Secondary Plan states that *the final buffer width and permitted uses within feature and hazard buffers, such as recreational trails, LIDs, or essential infrastructure, must be determined based on the recommendations of the Environmental Implementation Report established for each Phasing Plan Area* (Section 36.10.4.b).

Local Subwatershed Study

The Local Subwatershed Study (LSWS) recognizes the potential impact of climate variability on the hydrogeological system through the exaggeration of historical extremes in both wet and dry seasons. Data from the TRCA for the Etobicoke Creek Watershed was obtained reflecting historical and future RCP8.5 climate periods. This information was reported in the LSWS but was not used for the analysis conducted therein (Section 11.9, page 211).

Per the LSWS, *During wet seasons, the impact on the functioning of the system will be realized through increased groundwater discharge to wetlands and other surface water features but also increases in seasonal high groundwater levels. This will have the potential to increase wetland depths and increase the time of inundation as the periodic pooling will have a greater influence from groundwater. Similarly, the baseflow to watercourses could increase. In both scenarios, the potential threat of flooding could increase with the increase in water volume* (Section 11.9, page 217).

Flood hazards were established using the Regional Storm historic event. The project team analyzed the increase of intensity and frequency of the 100-year precipitation event. The results of this analysis demonstrated that the climate-adjusted values are expected to continue to be lower than the Regional Storm values (Section 11.9 Table 61, page 213). As such, the extent of existing or proposed flood hazards are not expected be affected by increased precipitation intensity, frequency and/or duration of storm events due to climate change.

The sizing of stormwater management pond blocks, culverts, and the NHS channel are based on the Regional storm event (for SWM), and existing return-period event flow targets for Etobicoke Creek. Two scenarios were considered to test the design's capacity to deal with wetter than average and drier than average conditions, termed the High Runoff and Low Runoff scenarios. TRCA recommended the use of

Buttonville Airport data that in their opinion captured a suitable period with climate variability. While this approach was in lieu of continuous data that would enable climate modeling, the Regional storm design components were considered conservatively sized (Appendix J).

Further mitigation of flood hazards could be achieved through the deployment of LIDs such as green roofs, infiltration measures, tree pits, etc. that can be used in the design to encourage groundwater recharge and reduce stormwater runoff (Section 11.9, page 216).

Scoped Servicing Study

The Scoped Servicing Study (SSS) analysis indicates that the Alloa Drain channel's enhanced conveyance capacity ensured that floodwaters can be transported more effectively, reducing the risk of backwater effects and localized flooding. The proposed changes to the channel design between Mississauga Road and Chinguacousy Road, while reducing riparian storage, are not expected to adversely impact downstream flows. The more efficient trapezoidal channel design improves flow conveyance, and the lost storage primarily comprises dead storage that does not significantly contribute to flow dynamics. The validation using 1D dynamic and 2D models confirms that peak flows downstream remain within acceptable limits, ensuring that the proposed conditions maintain effective floodplain management and minimize flood risks (Section 4.2.3).

Functional Servicing Report

Per current Town of Caledon design standards and IDF parameters, the minor system is designed to accommodate the 10-year storm event flows. Flows greater than the 10-year storm event will be conveyed overland to the stormwater management facilities. The use of the 10-year storm event in the design of the minor system is more conservative than that used in other southern Ontario municipalities, which generally use the 5-year storm event. The major storm system will use the internal road network with sufficient capacity to allow excess flows up to the 100-year design storm (Section 2.4.1, page 17, Section 8, page 62).

The Regional storm was used to establish flood hazards in the creeks, and as such the extent of existing or proposed flood hazards are not expected to be affected by increasing intensity, frequency, and duration of storm events due to climate change. Stormwater ponds over-control the regional event, and due to the use of the historical storm for sizing, the pond blocks are not anticipated to increase as a result of climate change (Section 8, page 62).

3.3. Improve Water Conservation

3.3.1. Context

The RVA indicates that the Town of Caledon will experience higher minimum, average, and monthly temperatures. There will be an increase in average summer temperatures and the number of days that exceed 30°C. Changes to the moisture holding capacity of the atmosphere could lead to vulnerabilities and risks related to increasing demand for water and water shortages, especially impacting rural areas that rely on wells.

Goal 5 of the CCCAP calls for the reduction of community-wide waste generation and improved water conservation. The CCCAP identifies also identifies an action (Action 5.2) directing for the support of water conservation and protection of water quality in the community, which includes protecting groundwater supply, particularly in anticipation of drought periods.

3.3.2. Secondary Plan Alignment

Secondary Plan

The Secondary Plan directs that *new development in the Plan Area will take steps to reduce potable water consumption through consideration of measures such as efficient water fixtures and rainwater harvesting and reuse* (Section 36.3.2.a). All new development in the Plan Area will *consider the installation of rainwater harvesting and recirculation/reuse systems on all new residential buildings for outdoor irrigation and outdoor water use* (Section 36.3.2.b1).

The Town of Caledon piloted Green Development Standards (GDS) for new development applications. Water conservation in new building construction is one of the core metrics contained within the GDS.

Local Subwatershed Study

While there are limited opportunities for water reuse due to prevailing regulatory requirements that limit the application of reused water, there could be opportunities in latter stages of planning and development for water reuse within the community parks. Parks that incorporate athletic amenities will likely require irrigation, which would be a suitable use for captured rain / stormwater. The Subwatershed Study directs that *in parks and site plan blocks, the potential for storing stormwater and utilizing it for irrigation should be explored in future studies to decrease reliance on municipal water during drought conditions. Increased irrigation demand due to potential drought should be considered in the final water distribution analysis* (Section 18.1.6, page 271).

Scoped Servicing Study

To establish water system demand for the plan area, the Scoped Servicing Study references the Peel Region design criteria and water supply standards to ensure uniformity across the regional system. Peel Region per capita water demand criteria were updated through the 2020 Water and Wastewater Master Plan[10], which forms the basis for the Alloa Secondary Plan Area water system capacity analysis (Section 6.3). In future however, water use demand could increase with due to drier conditions and increased demand for irrigation. To offset additional future demand, strategies that promote water conservation will contribute to greater resiliency.

[10] Peel Region Water and Wastewater Master Plan for the Lake-Based Systems: https://peelregion.ca/construction/environmental-assessments/2020-water-wastewater-master-plan-lake-based-systems

Community Design Guidelines

The Community Design Guidelines call for the prioritization of xeriscape planting techniques, the selection of drought-tolerant species to conserve water (Section 7.2.3) and the use of rainwater harvesting techniques to utilize stormwater resources for irrigation (Section 7.2.4).

3.4. Restore and Enhance Natural Features on Public and Private Land

3.4.1. Context

The RVA identified that an increase in average annual intensity and duration of precipitation could lead to high vulnerabilities and risks from damage to tree canopy, increasing the number of hazardous trees and branches. Projected increases in average annual temperatures and intensity duration of precipitation could also lead to increases in stream temperatures, decreasing dissolved oxygen levels, leading to loss of sensitive biota such as the Brook Trout.

Projected increases in average annual temperatures could lead to increased disturbance in natural ecosystems and decreased minimum winter temperatures, leading to increased survival and spread of invasive species such as Emerald Ash Borer. An increase in average annual hot days over 30 degrees Celsius could lead to a changed hydrologic regimen, causing drier wetland conditions, leading to loss of wetlands as well as an increase in the number of poor air quality days. Poor air quality could increase the frequency and severity of health issues for vulnerable populations and outdoor workers, particularly in areas impacted by the urban heat island effect and diminishing tree canopy.

Goal 11 of the CCCAP aims to restore and enhance natural features on public and private land. The CCCAP identifies an action (Action 11.2) calling for the expansion of restoration efforts on private lands (residential, commercial, rural, and agricultural). Restoration mechanisms include tree planting, wetland restoration, and stream rehabilitation. This includes developing guidelines on planting and caring for native and climate-resilient vegetation.

3.4.2. Secondary Plan Alignment

Secondary Plan

The Secondary Plan directs new development in the Plan Area to consider *maintaining and enhancing natural systems that are adapted to future climate conditions such as droughts and strong winds, in accordance with Town policies* (Section 36.3.3.iv). It identifies that *minimum buffer widths will be provided from the limit of all natural heritage features and hazards as outlined in the approved Alloa Local Subwatershed Study* (Section 36.10.4.a). Lands within the NHS will be *placed in a restrictive zone to protect it from development and remain primarily in a natural state and be restored and enhanced, in accordance with the recommendations of the approved Local Subwatershed Study* (Section 36.10.2.a).

The Secondary Plan acknowledges the co-benefits that come with natural infrastructure, including heat island effect and its impacts particularly on vulnerable populations. It directs that green infrastructure

strategies should be encouraged, and that to facilitate this the Town may consider green infrastructure to be located within required setbacks, buffers and/or parkland provided that the Town is satisfied that the proposed green infrastructure will be deployed in a manner that protects public safety and ensures no negative impact on the intended function of the required setback, buffer and/or parkland (Section 36.11.8). The plan also directs new development to consider *reducing the urban heat island effect and providing opportunities for respite during extreme heat events, particularly for vulnerable populations that might be disproportionately impacted* (Section 36.3.3.b.ii).

Local Subwatershed Study

No buffers currently exist for most natural heritage features within the existing lands because agricultural tilling and cropping is conducted right up to the feature boundary. The Subwatershed Study identifies that new buffers will be created and naturalized for natural heritage features, and an enhanced Natural Heritage System will *provide the opportunity for a 200% increase in natural cover within the Secondary Plan Area* (Section 10.4.2, page 152). Preliminary minimum buffers have been applied to all identified and field verified natural heritage features using a 10-metre buffer outside of dripline along woodland edges and 30 metres outside of all mapped wetland boundaries (Section 10.4.2, page 152).

Through field visits, seven wetland areas were identified in the Plan area. Wetlands provide ecosystem services that can offset the need for built infrastructure. Wetlands store and attenuate water, provide natural habitat, and provide water filtration benefits. Current water balance guidance from the TRCA[11] was followed in the preparation of the Subwatershed Study. This guidance generally directs new development to meet historical pre-development conditions. Of the seven wetlands, only Wetland 1 was modeled to have a deficit in runoff after development, with the remaining wetlands expected to gain inflow versus predevelopment conditions. The impact to Wetland 1 arises from the planned construction of Highway 413 and is not attributable to the proposed development. Mitigation strategies for Wetland 1 will however be considered for implementation (Section 11.2.4, page 186).

While guidance for integrating future climate conditions into water balance methodology was not available at the time of the Secondary Plan application, it is expected that warmer future temperatures could cause hydrological shifts that could threaten species that rely on wetland conditions to survive. Drier conditions could impact wetlands, reducing their capacity to provide services such as water attenuation and storage. The study references that climate change could affect the water balance for wetlands in future, and notes that utilizing stormwater to feed the wetlands could be an appropriate mitigation strategy (Section 11.9, page 217).

The proposed realignment of the Alloa Drain provides opportunity to restore and improve existing limited, impacted channels and headwater drainage features with naturalized watercourses and enhanced corridors. The realignment and naturalization of the Drain creates opportunities to improve riparian conditions benefiting sediment balance, floodplain storage, vegetation communities, aquatic and terrestrial habitat, water balance, fish passage, and water quality, among additional benefits (Section 10.5.1, page 154, Figures 23 – 26).

[11] TRCA Wetland Water Balance Risk Evaluation, 2017: https://trca.ca/app/uploads/2017/12/WetlandWaterBalanceRiskEvaluation_Nov2017.pdf

Thermal mitigation practices are recommended in the Subwatershed Study for the Huttonville and Fletcher's Creeks and in the Settlement Area Boundary Expansion Scoped Subwatershed Study. The target SWM facility discharge temperature for thermal mitigation is 24°C. Thermal mitigation can be achieved by implementing effective stormwater management facility measures (shading, orientation, outlet design, floating islands, etc.), including LIDs. Thermal mitigation options will be further reviewed at the Block Plan stage and refined through Draft Plans.

The Subwatershed Study also directs that the palette of plant species shall consider the wide range of climate scenarios that may affect sustainability and overall resilience. During detailed design further analysis will be conducted to fully consider soil moisture indices, sun/shade, wind, soil matrix, microclimate, and the use of ecologically correct plant assemblages, etc., to support a comprehensive restoration plan (Section 11.9, page 217).

Environmental Impact Study

The EIS provides further direction on the selection of native plant species. Within neighbourhood parks, *the implementation principles focus heavily on the inclusion of native species to foster an ecologically balanced and sustainable environment…Where possible, native trees and shrubs will be placed along interfaces, particularly where grading may encroach into buffer areas, to ensure the integrity of the ecosystem is maintained* (Section 10.1.2.2, page 126).

Planting within the SWM ponds must incorporate native species, as *by integrating native plants into pond design, the habitat becomes more conducive to local wildlife, promoting biodiversity and ecological resilience* (Section 10.1.2.5, page 127).

Overall, *the principle of net gain shall be achieved by increasing the net area for woodland, wetland, greenlands, and related habitat diversity enhancements and created linkages. The proposed enhanced NHS also provides an opportunity for a net increase in natural heritage areas by over 260% including habitat enhancements and linkages to key natural heritage features that will improve and encourage wildlife movement. The quality of the constructed wetland and restoration areas will generally be an improvement to the existing condition as these areas will be protected through buffers and natural heritage systems* (Section 10.1.4, page 128).

In recognition of the potential for climate change to affect the feature-based water balance for the wetlands present within the post-development Secondary Plan Area, the EIS notes that *wetlands will continue to be evaluated and have considered extreme conditions (wet / dry years). Mitigation could include utilizing stormwater to irrigate the wetlands and preparing monitoring plans for post-development to evaluate the health of the wetlands* (Section 10.1.5, page 128). Feedback from the TRCA advises that any irrigation of wetlands should not be conducted using water from the SWM pond to avoid introduction of salt, oil, grease, or suspended sediments. Only clean stormwater from rooftops or grassed areas is recommended.

Community Design Guidelines

The Community Design Guidelines directs that streetscapes located along the edge of the Greenbelt (referred to as the Natural Environmental System, or NES) shall be designed with careful consideration for natural areas and any sensitive features they may contain, including the planting of native street trees and buffer vegetation. It also calls for native plant species indigenous to the CVC and TRCA jurisdictions to be utilized in all restoration and buffer plantings, and throughout the EPA (Section 5.2). Street tree species selection shall be from the Town of Caledon's recommended list, with general preference given to native species, particularly those tolerant to pollution, salt, drought, and soil compaction (Section 6.5).

The Guidelines similarly identify the EIS requirements for a buffer threshold of 10 metres and 30 metres that is to be applied to the staked limits of tableland woodlots and wetlands (Section 5.2.1).

The Region of Peel and Town of Caledon have established a requirement to increase natural cover by 30% within the Secondary Plan Area. Net ecological gain is a core objective outlined in the Guidelines.

3.5. Diversify Caledon's Energy Supply with Renewable and Resilient Energy Sources and Systems

3.5.1. Context

The RVA identified that an increase in average annual intensity and duration of precipitation could lead to vulnerabilities and risks related to increased damage to power infrastructure leading to prolonged outages and disruptions to telecommunication lines.

Goal 15 of the CCCAP aims to diversify the Town of Caledon's energy supply with renewable and resilient energy sources and systems. The CCCAP also identifies two supporting actions:

- Action 15.5 calls for the development of energy storage as an emergency back-up power supply and energy demand management measure
- Action 18.4 calls for an increase in the availability of low carbon back-up power systems in Town facilities to serve as community hubs during emergencies

While the CCCAP goal has a strong focus on emissions mitigation (beyond the focus of this CAP), it also addresses an element of energy security. Ensuring power availability under increasingly extreme weather events.

3.5.2. Secondary Plan Alignment

Secondary Plan

The Secondary Plan directs that *where new public utility and telecommunications infrastructure is being introduced in the Plan Area, it will be located underground* (Section 36.9.3.c). This approach is expected to significantly reduce the exposure of utility services to extreme weather events such as strong winds, and the accumulation of snow and freezing rain. The Secondary Plan also directs new development to consider *improving low-carbon energy self-reliance during emergencies and power outages, especially for public amenities and services* (Section 36.3.3.b.vi).

With respect to energy generation, the Secondary Plan states that *the use of fossil-fuel based energy sources, such as natural gas, will be discouraged in the Plan Area and efforts made to minimize their use* (Section 36.3.1.a). *New development will make efforts to advance the recommendations outlined in the Alloa Community Energy and Emissions Reduction Plan to achieve a near net zero community design* (Section 36.3.1.b). Specific strategies referenced include heat pumps, energy recovery ventilators, low-carbon domestic hot water systems, solar PV, community-scale energy systems, and enhanced building efficiency strategies (Section 36.3.1.b).

New development will also be encouraged to use high-albedo roof materials and/or green roofs and be solar-ready (Section 36.3.1.c).

Community Energy and Emissions Reduction Plan

The Alloa Community Energy & Emissions Reduction Plan specifically addresses the CCCAP goal to study opportunities and the feasibility of low-carbon and renewable energy systems. The report identified that the primary opportunities for on-site renewable energy generation would arise from the deployment of geothermal heat pumps for heating, air-source heat pumps for domestic hot water, and rooftop-mounted photovoltaic systems. Deployment across the Secondary Plan Area would achieve substantial reductions in energy use intensity and greenhouse gas emissions (Table 15, page 28). District-level energy systems were also evaluated, which demonstrated that geothermal heat pumps could be viable (Section 4.5.1.1, page 36).

The capital cost of these systems however was evaluated as being substantially higher than the systems required by the building code. It was also noted that building-scale systems could deliver comparable performance and that there would be reduced complexity for implementation. Section 5 (page 45) of the report identifies a range of measures for exploration and deployment during future planning phases, focusing on building-scale energy efficiency and renewable energy generation and electric vehicle infrastructure.

Community Design Guidelines

Green roof technologies or reflective light-coloured roofs are encouraged for employment, office, institutional, and multi-storey residential buildings to reduce solar heat absorption and reduce building energy demand (Section 7.2.6). Similarly, the use of light-coloured surface materials such as concrete and unit pavers is encouraged to decrease heat absorption and ambient surface temperatures (Section 7.2.2).

3.6. Enhance the Capacity of Town Roads and Bridges to Withstand Extreme Weather

3.6.1. Context

The RVA identified that an increase in average winter temperatures and precipitation, combined with freeze-thaw cycles, could lead to vulnerabilities and risks related to damage to private (e.g. gas, dams, water pipes) and public (roads, sidewalks) infrastructure. The RVA also identified that temperatures near the freezing mark, could cause increased risk of freezing rain events, leading to a need for salting, damaging infrastructure. Increases in average annual intensity and duration of precipitation could create stress on municipal buildings, roads, culverts, and bridges leading to greater rates of infrastructure failure.

Goal 16 of the CCCAP aims to enhance the capacity of Town roads and bridges to withstand extreme weather. The CCCAP also identifies an action (Action 16.1) that calls for an update to municipal engineering codes and design standards for new and upgraded municipal and private infrastructure.

3.6.2. Secondary Plan Alignment

Secondary Plan

The Secondary Plan directs new development to *consider improving the durability of homes and public infrastructure to withstand more frequent or more severe climate change stressors, in particular flooding and high wind* (Section 36.3.3.b.vii).

Subwatershed Study

The Local Subwatershed Study identifies nine at-grade collector road crossings of the Natural Heritage System, and notes that additional at-grade and sub-surface corridors will be required to provide sub-surface road crossings to address fluvial considerations and accommodate conveyance and storage of regional storm flows and wildlife crossings. The study directs that *crossings will need to be designed according to the following design principles: road crossings will have flood-free access during the Regional Storm* (Section 10.4.2, page 153). Further detail is outlined in Section 18.1.6, where proposed roadways are stated to be designed to avoid excessive flooding and directs that roadway capacity be compared to the 100-year storm event (Section 18.1.6, page 271).

Stream channels within the Secondary Plan Area will remain naturalized, using bioengineered principles. *As there is the potential for increased frequency of flows in the creeks due to climate change, the impacts of these flows on erosion protection measures should be considered at Detailed Design. While this will not affect channel block sizes, it could impact the sizing of stone protection or other mitigation measures* (Section 18.1.6, page 270).

As stated in Section 17.3.5 on page 256, *it was identified that while accepted approaches exist to evaluate climate-related impacts to the IDF parameters (single event), these impacts do not affect the LSS / Secondary Plan scope of work or general block sizing. For example, IDF parameters may impact the sizing of storm sewers, number of catchbasins, and modelled return period flows for establishing the 2-*

year to 100-year flows and volumes in ponds, but the pond blocks, channel blocks, and other major infrastructure (road crossings) have been sized based on the conservative Regional storm criteria.

3.7. Upgrade Stormwater Plans and Practices to Reduce Risks from Extreme Weather Events

3.7.1. Context

The RVA identified that an increase in average annual intensity and duration of precipitation could lead to high vulnerabilities and risks related to stress on stormwater management infrastructure. This could lead to facility / system failure; an increase in instances of overland flooding, causing road closure that blocks access for emergency services; and more instances of overland flooding, causing evacuation of vulnerable populations and displacement of residents from homes. An increase in average winter temperatures and precipitation, combined with more frequent freeze-thaw cycles, could further lead to increased potential for rain on frozen ground events causing flooding and associated damage.

Goal 17 of the CCCAP calls for an upgrade to stormwater plans and practices to reduce risks from extreme weather events. The CCCAP identifies two actions:

- Action 17.3 calls for a review and creation of enhanced development guidelines for stormwater infrastructure in new developments
- Action 2.2 calls for an increase in the amount of green space and permeable surface incorporated into all new communities to provide green infrastructure, stormwater management, and recreation services.

3.7.2. Secondary Plan Alignment

Secondary Plan

The Secondary Plan explicitly addresses stormwater infrastructure as follows:

- Applicants are encouraged to use green infrastructure strategies, such as Low Impact Development measures, wherever feasible. To facilitate this, the Town may consider green infrastructure to be located within required setbacks, buffers and/or parkland provided that the Town is satisfied that the proposed green infrastructure will be deployed in a manner that protects public safety and ensures no negative impact on the intended function of the required setback, buffer and/or parkland (Section 36.11.8).
- At the Detailed Design stage, the Stormwater Management Report will incorporate a variety of stormwater management practices, including Low Impact Development (LID) techniques, to protect water quality, maintain baseflow and temperature, and support ecological integrity. Wherever possible, stormwater infrastructure required under the Consolidated Linear Infrastructure (CLI) Environmental Compliance Approval (ECA) requirements will be located on public lands to ensure access for maintenance. (Section 36.9.2.h).
- The stormwater management system should consider opportunities to be designed to adapt to climate change and have the ability to manage an increase in annual precipitation and

extreme precipitation events, in accordance with the approved Alloa Local Subwatershed Study, the Climate Adaptation Plan, Town Engineering Standards, and industry best management practices (Section 36.9.2.k).

- Best management practices, including low impact development techniques and measures, will be incorporated into the stormwater management system in accordance with the approved Alloa Local Subwatershed Study (Section 36.9.2.l.iv).
- New development in the Plan Area will consider…Adapting storm drainage systems and using green infrastructure / Low Impact Development strategies where practical to manage an increase in annual precipitation and extreme precipitation events based on guidance from the Town, TRCA, province, and industry best practices (Section 36.3.3.b.iii).

Subwatershed Study

The Subwatershed Study preliminary storm servicing plan for Alloa identifies eleven proposed stormwater management (SWM) pond facilities to achieve the SWM requirements for the proposed neighbourhood/residential areas. Two of the pond facilities are located in the Fletcher's Creek subwatershed, which will be designed to meet the SWM criteria from the Huttonville and Fletchers Creek Subwatershed Study. Nine of the SWM pond facilities are located in the Etobicoke Creek subwatershed, which will be designed to meet the SWM criteria as per the Etobicoke Creek Hydrology Update and Mayfield West EIS.

Conventional stormwater management facilities will be designed in compliance with the Town's Stormwater Management Design Guidelines, Town's Consolidated Linear Infrastructure Compliance Approval and applicable provincial and applicable Conservation Authority guidelines. While these guidance documents don't explicitly offer quantitative climate change guidance, all proposed stormwater management facilities have been *designed to control, and in the case of Etobicoke Creek facilities, over-control the Regional event. Due to the use of this historical storm in the sizing, the pond blocks are not anticipated to increase as a result of climate change* (Section 10.1.5, page 128). The storm systems are designed to convey the 10-year storm event in accordance with current Town of Caledon standards. This requirement is more conservative than other Greater Toronto Area municipalities which only require storm sewers be designed to convey the 5-year event. The major storm system will consist of internal road network designed with sufficient capacity to allow excess flows up to the 100-year design storm to be conveyed via overland flow within the proposed right-of-way limits (Section 10.1.5, page 128).

While end of pipe facilities provide the minimum required SWM controls, the use of LID stormwater management measures help reduce the amount of runoff by increasing on-site retention, infiltration, and evapotranspiration. LID capacity was not factored into the pond calculations, so the introduction of any LID facilities would provide greater contingency for future climate conditions. The need for adaptation measures for LID features requires further evaluation as climate-adjusted continuous data was not available (Section 11.9, page 215).

Scoped Servicing Study

The Scoped Servicing Study identifies LID placement in areas where groundwater is at least 2+ metres below proposed grade (page 17). During the next stage of planning the SWM Best Management Practices (BMPs) will be further evaluated.

Environmental Impact Study

The EIS proposes that where feasible based on soil / groundwater constraints, LIDs such as green roofs, infiltration measures, tree pits, etc. will be utilized in the design to mitigate expected climate impacts and to manage more frequent runoff events (Section 10.1.5, page 128). Considering the scenarios assessed, *during wet seasons, the impact on the functioning of the system will be realized through increased groundwater discharge to wetlands and other surface water features, but also increases in seasonal high groundwater levels. This will have the potential to increase wetland depths and increase the time of inundation as the periodic pooling will have a greater influence from groundwater. Similarly, the baseflow to watercourses could increase. In both scenarios, the potential threat of flooding could increase with the increase in water volume* (Section 8.1.3, page 110). During dry seasons, the impacts will work in reverse, depleting recharge. Deployment of LID techniques could counteract the long-term effects of climate change, including more frequent / more intense rainfall events.

Community Design Plan

The Community Design Plan includes several guidelines in support of LID, including (Sections 7.2.2 and 7.2.4):

- Select paving alternatives that allow for increased permeability and infiltration, while accommodating circulation and maintenance requirements;
- Paved areas used for snow storage are encouraged to integrate permeable paving to absorb snow melt on site;
- Preference shall be given to the selection of permeable or porous paving materials, such as open joint pavers, porous concrete or asphalt and/or precast turf-grid products;
- Implement roof downspout disconnection to prevent water from reaching the sewer system and allow it to be managed on site, whether through a storage device, permeable surfaces or an infiltration system;
- Implement the use of soakaway pits (roof downspout connected to an underground pit lined with gravel or coarse aggregate, temporarily storing the water until it is absorbed into the ground) or infiltration trenches (direct water to an at-grade trench filled with aggregate material, where it is held until it infiltrates into the ground);
- Where feasible, utilize rain barrels or similar container systems to manage roof runoff; and
- Where feasible, integrate bio-retention swales to manage stormwater within expansive areas of runoff.

4. Climate Adaptation Considerations for Future Planning Phases

As described in **Section 1.4**, climate adaptation will be an ongoing effort through the development process. While the Secondary Plan provides the foundation, subsequent development stages will continue to refine and implement adaptation measure. This section outlines several actions to be monitored by the Alloa Landowners Group and its development team in subsequent phases. Timelines are defined based on expected project phases, but it is understood that these phases may shift and evolve. Several action items will require close collaboration between the Town and the Landowners Group.

4.1. Tertiary Plan Stage

Based on the Secondary Plan development phasing, the **Tertiary Planning stage** is a detailed land use planning process for a specified area within the Secondary Plan area. The Tertiary Plan goes beyond the level of detail provided in the Secondary Plan and typically identifies the complete road network, stormwater management facilities, parks, schools, natural environment system, and the range or other land uses. The Tertiary Plan can happen prior or concurrent with the Draft Plan of Subdivision or Site Plan stage. During this stage of the development process, the key documents guiding and supporting implementation of the climate adaptation considerations include:

- Functional Servicing Report (FSR)
- Environmental Impact Study or Report (EIS/EIR)

The Tertiary Plan for Phase 1 of the Alloa Secondary Plan has already commenced. As referenced throughout **Section 3**, the FSR and EIS were referenced in the development of this document. **Section 4.4** identifies the actions for implementation in these documents during the subsequent stages of development planning.

4.2. Draft Plan of Subdivision

At the **Draft Plan of Subdivision stage**, the site is subdivided into lots, blocks, and rights-of-way for development by one or multiple developers. A registered plan of subdivision is a legal document that shows:

- the exact surveyed boundaries and dimensions of lots on which houses or buildings are to be built in future stages;
- the location and width of streets; and
- the exact sites and boundaries of any schools, public facilities, or parks.

The Draft Plan of Subdivision does not identify specific building locations or site design within each lot or block. During the Draft Plan of Subdivision stage of the development process, the key documents guiding and supporting implementation of the climate adaptation considerations include:

- Stormwater management report and plan
- Servicing plans, including grading, lighting, landscape, and underground servicing

- Hydrogeologic reports

The subsequent Site Plan or Building Permit stage will define the building and parking locations, landscaping, grading etc. Key documents guiding and supporting implementation of the climate adaptation considerations include:

- Landscape Plans

4.3. Site Plan & Permitting Stage

During the **Site Plan and Permitting stage** the climate adaptation measures will be guided by broader overarching regulatory documents such as the Zoning Bylaw and Building Code that sets requirements for parcel layout and design of related structures. At this stage, most of the climate adaptation measures should be in place to reduce the vulnerability and risks, and building / parcel scale requirements will depend on regulatory updates by the Town and others.

4.4. Actions to Monitor

Table 3 identifies the actions for implementation in these documents during the subsequent stages of development planning.

Table 3: Implementation Actions for Climate Adaptation into Future Development Stages

Actions in Future Stages	Responsibility	Implementation Mechanism
Tertiary Planning		
The storm sewers in the community are currently designed to convey the 10-year storm (above the typical 5-year event). To ensure stormwater sewers/downstream culverts are able to withstand the impacts of climate change during more frequent and/or intense events, the proposed sizes should be reevaluated at the detailed stage of the design when considering the potential for increased frequency, duration and intensity of storm events (once the Town has published **updated IDF parameters** / directives for incorporating climate change).	Development Team	Functional Servicing Report
Buffer sizes are proposed at 10-metre and 30-metre setbacks. Buffer sizes shall ultimately be defined scientifically in collaboration with the TRCA and CVC as a part of the completion of the EIS.	Development Team (Crozier / UrbanTech)	Environmental Impact Study
The Development Team will conduct a further a sensitivity review of climate change impacts on feature-based **water balance for the wetlands**. If required, mitigation could include utilizing clean stormwater (from rooftops or grassed areas) to irrigate the wetlands and preparing monitoring plans for post-development to evaluate the health of the wetlands.	Development Team	Environmental Impact Study

Actions in Future Stages	Responsibility	Implementation Mechanism
To accommodate for increased seasonal variability, it is recommended that **groundwater mitigation** strategies be designed for a greater range of extreme seasonal variability. This will require increased compensation for groundwater recharge and discharge scenarios. Essentially, designing for increased variability in line with recommended policies outlined by the Town, Region and Conservation Authorities will be followed.	Development Team (Crozier)	Functional Servicing Report; Environmental Impact Study
Draft Plan for Subdivision / Site Planning		
Where feasible, the Development Team should apply a range of stormwater management practices including **Low Impact Development** techniques to ensure water quality control, baseflow management, water temperature control (where required) and the protection of ecological integrity. Consolidated linear infrastructure (CLI) ECA requirements and low-impact developments ('LIDs') are proposed to be located within publicly accessible lands to ensure access for maintenance purposes. This requires confirmation from the Town of Caledon.	Development Team (Crozier) and Town of Caledon	Stormwater Management Report
At Detailed Design, the proposed **sizes of storm sewers** are to be reevaluated to consider potential for increased frequency, duration, and intensity of storm events. This will be reliant on the Town of Caledon providing the updated IDF parameters incorporating climate change.	Development Team (Urbantech) and Town of Caledon	Stormwater Management Report
The potential for **stormwater storage** for use in irrigation and for feeding the wetlands will be explored during Detailed Design. Irrigation feasibility will be considered in the final water distribution analysis.	Development Team (Crozier)	Stormwater Management Report
Potential for increased frequency of flows in the creeks due to climate change was established as a likely hazard for further evaluation. The impact of erosion is to be further discussed and evaluated as a part of Detailed Design to consider aspects such as sizing of stone protection or other mitigation measures. Available data to support **climate-adjusted assessment of erosion** to be discussed in collaboration with the Conservation Authorities.	Development Team (Urbantech)	Hydrogeology Report
Strategies for **hardening stormwater sump pumps** should be evaluated, including redundant power sources, power outage alarms, and similar measures.	Development Team (Urbantech)	Stormwater Management Report
Target minimum **green cover thresholds** as defined in the Town of Caledon Green Development Standard (GDS) Metric 2.1 when feasible. Green cover should be quantified using the Green Factor Tool.	Future Building Developers	GDS Green Factor Scoresheet; Landscape and Planting Plans; Arborist Reports

Actions in Future Stages	Responsibility	Implementation Mechanism
Target minimum **soil volume** requirements per the Green Development Standard (GDS) Metric 2.2 where feasible for newly planted trees or tree-specific soil volume indicated in municipal tree species guide. Structured soil cells or other appropriate technologies may be used.	Future Building Developers	GDS Green Factor Scoresheet; Landscape and Planting Plans; Arborist Reports
Per the Green Development Standard (GDS) Metric 2.3, consider minimum targets for **native plant species and select drought-tolerant species** from local climate zones where feasible. Refer to the Town's species list for public trees and Credit Valley Conservation (CVC) planting guidelines for landscaped areas. Where more climate-resilient species are proposed that are not included on these lists, consult with the Town and CVC to prioritize climate resilience, with careful attention during detailed design to fully consider moisture indexes, sun/shade, wind, soil matrix, microclimate, and the use of ecologically correct plant assemblages, etc., to support a comprehensive restoration plan.	Future Building Developers	Landscape Plans
Where feasible, implement **cool roofs** per the targets outlined in the Green Development Standard (GDS) Metric 2.4. Installation of solar PVs and/or green roof over minimum 50% of available roof area is encouraged.	Future Building Developers	GDS Green Factor Scoresheet; Letter of Commitment
At minimum, control the **infiltration deficit** per the criteria identified in the water balance assessment through stormwater retention low impact development (LID) practices; OR control, to the greatest extent possible, the 27 mm event using a hierarchical application of LID measures to achieve the target beginning with (1) retention, followed by (2) filtration, in accordance with site constraints outlined in the Green Development Standard (GDS) Metric 2.5. Consider the climate sensitivity analysis from earlier stages in consultation with Town staff.	Future Building Developers	GDS Green Factor Scoresheet; Stormwater Management Plans
Consider implementation of measures in line with the Green Development Standard (GDS) Metric 3.2 to increase **building resilience** for low-rise residential buildings. Where feasible, a resilience strategy for multi-unit residential buildings is encouraged to address climate risks, including flooding, high wind, extreme heat, and power outages to improve outcomes for residents in the context of climate change. The strategy should include a refuge area for residents with heating, cooling, lighting, potable water, and power available	Future Building Developers	GDS Green Factor Scoresheet; Building Resiliency Strategy
Consider the use of high-efficiency fixtures and non-potable watering systems to harvest rainwater for irrigation purpose and **reduce potable water** demand for irrigation where feasible, per the Green Development Standard (GDS) Metric 3.5.	Future Building Developers	GDS Green Factor Scoresheet; Letter of Commitment

Actions in Future Stages	Responsibility	Implementation Mechanism
Consider **durable construction materials** used for public infrastructure assets that are resilient to a changing climate, including hotter temperatures, stronger winds, heavier rains, and more frequent freeze-thaw cycles. If not in alignment with engineering standards, engage with the Town of Caledon to confirm approved tradeoffs.	Development Team & Town of Caledon	Site Plan
The Community Services and Facilities Study identified the potential for a new community centre in Phase 2 lands. The Town should consider facility programming as a **cooling centre** that offers respite during extreme heat events, particularly for vulnerable populations that might be disproportionately impacted.	Town of Caledon	Site Plan

5. Conclusion

The Region of Peel and the Town of Caledon have established policy objectives to promote integration of climate adaptation into secondary plans, objectives, and strategies into the planning process for Secondary Plan Areas within their jurisdiction. This CAP summarizes features of the proposed Alloa Secondary Plan that are intended to enhance the resilience of the future community, its residents and assets, and ultimately supporting greater resilience to expected climate change within the Town of Caledon.

Key climate adaptation themes identified for the Alloa Secondary Plan Area and discussed within this report include:

- Floodplain and Wetland Integrity
- Overland Flooding
- Operations and Maintenance
- Water and Power Availability
- Social Vulnerabilities
- Ecological Integrity

The Alloa Secondary Plan submitted to the Town of Caledon identifies the need to reference the CAP Objectives outlined in the CAP during ongoing future phases of development to enable opportunities to be identified and addressed at each stage of the development process. Proposed measures for implementation and tracking are shown in **Section 4.4** for ease of reference.

Collaboration and coordination with the Town of Caledon will continue to be required to address climate-related issues that are outside of the project development team's direct control, or where conflicts with Town policies and standards emerge.

Appendix A. Climate Adaptation Context in Town of Caledon

Future Caledon Official Plan

The Future Caledon Official Plan (OP) was adopted by Council in March 2024. The plan identifies the urgency to address climate change as one of the guiding principles of the plan: "*Mitigate and adapt to the impacts of a changing climate through policies and standards that support environmental protection, compact and resilient community design, and low carbon buildings, energy systems and transportation networks*" (Section 2.3.1).

The OP outlines several policies to support a transition to climate resilient communities, including policies that generally direct the Town to (paraphrased, ref to full OP Section 5.3 for full text):

- Enhance the adaptive capacity of its infrastructure assets
- Protect water resource systems in new urban areas
- Adequately assess the impacts of future extreme weather events in stormwater management planning
- Use low impact development and green infrastructure strategies for stormwater management
- Protect existing natural resources and heritage areas
- Utilize native and climate-adaptive plant species for public landscaping and require the use of such species in new development areas
- Protect and enhance the urban forest canopy to provide shade and reduce urban heat island effects
- Promote clean energy generation capacity
- Assess human health impacts of climate change

Peel Region Settlement Area Boundary Expansion Study

The Region's Settlement Area Boundary Expansion (SABE) study provided high-level guidance and recommendation for the growth areas in the SABE study area, which includes the Alloa Secondary Plan lands. Its relevance to climate adaptation is based on evaluation of hydrology and hydraulics. The report emphasizes the importance of maintaining both surface and groundwater quality and quantity through integrated stormwater management strategies.

The SABE recommends that:

- Climate change adaptation measures be considered in planning and development
- Green infrastructure solutions be promoted to support managing stormwater, reducing runoff, and improved urban resilience against extreme weather events.

Subwatersheds within the Alloa area have specific soil types and drainage patterns that require tailored planning and management approaches, which will continue to be developed during tertiary planning. The SABE report also suggests that municipal drains be upgraded to accommodate increased runoff from future development (such as that proposed for the Alloa lands) and designing road crossings to minimize impacts on stream morphology.

Future Climate Projections for the Town of Caledon

The Future Climate Projections for the Town of Caledon (2018), models future climate conditions through 2090 based on greenhouse gas emissions scenarios. This report compares baseline climate information between the years 1981 and 2010 to anticipated future climate conditions. The findings of this report indicate that the Town of Caledon can expect to see higher minimum, average, and maximum monthly temperatures, with an increase in the number of days that exceed 30°C and a decrease in the number of cold days. Expected precipitation changes are less certain, though it is likely that precipitation events will likely become more intense and will be more frequent in the winter and spring seasons.

Qualitative changes associated with projected climate conditions in the Town of Caledon are shown in **Table 4** below.

Table 4: Qualitative Climate Change Projections for the Town of Caledon, adapted from Future Climate Projections for the Town of Caledon (2018)

Climate Indices	Climate Projection Summary
Temperature	Warmer in every season
	More hot days, fewer cold days
Freeze-Thaw	Fewer cycles in spring and fall
Growing Season	Starting earlier, ending later
Precipitation	Winter and spring getting wetter
	Becoming more intense
Freezing Rain	No change / unable to model
Average Wind	No change / unable to model

Overall temperatures in the Town of Caledon are expected to increase by approximately 3°C under the IPCC RCP 4.5 scenario by 2100. Currently, the Town of Caledon experiences about four days per year that exceed 35°C. Caledon is projected to experience an additional 2 – 9 days of extreme heat by 2100. Comparatively, the number of days below freezing is expected to decrease from 49 days per year to 21 – 33 days per year in the same timeframe. Precipitation is expected to increase in all seasons except summer, with summers expected to experience longer periods without rain.

Town of Caledon Risk and Vulnerability Assessment

Refer to **Appendix B** for details

Resilient Caledon Community Climate Action Plan

The Resilient Caledon Community Climate Action Plan identifies how the Town of Caledon will address climate mitigation (actions to reduce greenhouse gas emissions and improve energy efficiency) and climate adaptation (actions to prepare and respond to climate change impacts like flooding) within the overall community.

The Community Climate Action Plan contains over 60 actions and supporting tasks developed to achieve the Plan's vision, long with five overarching goals:

- **Smart Growth:** Caledon's new communities and buildings are low carbon and resilient to climate impacts. They prioritize energy efficiency, walkability, effective stormwater management, and green space.
- **Sustainable Communities**: Caledon residents are prepared for climate impacts and have the capacity to reduce GHG emissions and build resilience in their own homes, businesses, and neighbourhoods.
- **Agriculture and Natural Systems**: Caledon's natural and agricultural systems are protected and enhanced to maximize carbon sequestration and resilience to climate impacts like flooding, invasive species, and pests.
- **Low-Carbon Transportation**: Caledon residents and businesses use low- or zero-carbon options for transportation. Cycling, walking, and transit mode shares are increased through the establishment and expansion of safe and efficient networks and infrastructure.
- **Resilient Infrastructure and Energy**: Caledon's energy infrastructure is diversified, low carbon and resilient, and core infrastructure assets are better able to withstand major weather events like storms, flooding, and freeze-thaw cycles.

As the Town of Caledon is expected to grow to a population of 300,000 people by 2050, new or expanded development areas such are expected to implement strategies consistent with the goals outlined above. Specific objectives for new development areas include:

- Compact urban form
- Provision of access to walking, cycling, transit, and alternative transportation modes
- Energy-efficient building design
- Use of green infrastructure
- Provision of green spaces

The complete summary of actions proposed within the Resilient Caledon plan are outlined in **Figure 5**.

SUMMARY OF ACTIONS	
SMART GROWTH	
1	Establish climate-friendly land-use and building policies.
2	Protect communities from flood risks.
3	Promote the development of compact, complete communities.
SUSTAINABLE COMMUNITIES	
4	Retrofit homes, institutions, and commercial buildings to be net zero and climate resilient by 2040.
5	Reduce community-wide waste generation and improve water conservation.
6	Develop and upgrade emergency response plans so that all town residents, staff, businesses, and community organizations are prepared for climate-related emergencies.
7	Green Caledon's economy by supporting existing businesses in becoming low carbon and climate resilient, attracting new businesses, and diversifying energy supply.
8	Enhance community capacity by engaging and empowering residents, businesses, community groups, and schools to take action on climate.
AGRICULTURE AND NATURAL SYSTEMS	
9	Support a resilient food and agriculture sector across Caledon.
10	Protect Caledon's natural and agricultural lands.
11	Restore and enhance natural features on public and private land.
LOW-CARBON TRANSPORTATION	
12	Increase walking and cycling through improved programs and infrastructure.
13	Expand Caledon's transit network in alignment with new growth areas.
14	Expand Caledon's EV charging network and encourage the adoption of low-carbon vehicles.
RESILIENT INFRASTRUCTURE AND ENERGY	
15	Diversify Caledon's energy supply with renewable and resilient energy sources and systems.
16	Enhance the capacity of Town roads and bridges to withstand extreme weather impacts.
17	Upgrade stormwater plans and practices to reduce risks from extreme weather events.
18	Ensure Town facilities are carbon neutral and climate resilient by 2040.
19	Embed climate change considerations into the Town's Asset Management planning process.

Figure 5: Summary of Resilient Caledon Climate Action Plan actions

Town of Caledon Green Development Standard Guidebook

In June 2024, the Town of Caledon introduced Green Development Standards (www.caledon.ca/gds) that will be used to assess development applications for new residential, commercial, industrial, and institutional buildings against specified sustainability criteria. The Green Development Standards are to be implemented through expanded development application requirements, which will include measures for climate change adaptation along with other climate mitigation measures. The Town of Caledon Green Development Standards are primarily focused on climate mitigation strategies, though considerations for measures that would provide climate adaptation benefits are also included.

The Green Development Standards as conceived contain 20 individual metrics organized under three thematic areas:

- Community Design and Mobility
- Green Infrastructure
- Buildings and Energy

The pilot process for the GDS was planned for July 2024 through July 2025. The current status of the GDS is unclear, though the expectation is that future development within the Alloa lands will aim to adhere to the GDS requirements to the extent practical.

Appendix B. Climate Adaptation Themes

Town of Caledon Risk and Vulnerability Assessment

The future climate projections informed the development of the Town of Caledon Risk and Vulnerability Assessment (2018). This assessment identified a suite of infrastructure, socioeconomic, and natural impacts associated with the projected change in climate conditions in the Town. In total, 57 consolidated climate-related impacts were identified. Following an assessment of both vulnerability and risk, 21 risks were identified (2 Medium-Low risks and 19 Medium to Medium-High risks). These risks are identified in **Table 5** on the following page.

Vulnerability levels were defined on a scale of 1 – 5 based on the perceived susceptibility of the community to harm arising from the specific climate impacts.

Climate Adaptation Themes Underlying the Secondary Plan

The Alloa project development team utilized the findings of the Risk and Vulnerability Assessment to inform the development of this CAP, starting with categorizing the identified priority impacts by themes as identified in **Table 5**.

Table 5: Highest Ranking Climate-Related Risks, adapted from Town of Caledon Risk and Vulnerability Assessment (2018)

Climate Threat	Impact Statement	Vulnerability Level	Risk Score	Theme
Increase in average annual intensity and duration of precipitation	Increased damage to power infrastructure leading to prolonged outages and disruptions to telecommunication lines.	V4	165	Water / Power Availability
Increase in average winter temperatures and precipitation, combined with freeze-thaw cycles	Damage to private (e.g., gas, dams, water pipes) and public (roads, sidewalks) infrastructure	V5	165	Asset Damage & O&M
Longer average annual Growing season	Farmers ploughing over (covering up) drainage swales leading to increased flood risk	V4	160	Overland Flooding & Wetland Integrity
Increase in average winter and spring temperature	Stress or failure of bridge and culvert infrastructure resulting from ice jams	V5	160	Infrastructure Damage
Increase in average annual intensity and duration of precipitation	Damage to tree canopy, increasing the number of hazardous trees and branches	V3	145	Asset Damage & O&M
Increase in average annual hot days over 30 degrees Celsius	Changed hydrologic regimen, causing drier wetland conditions, leading to loss of wetlands	V4	145	Floodplain / Riverine Flooding
Increase in average summer temperatures and moisture holding capacity of the atmosphere	Increasing demand for water and water shortages, especially impacting rural areas that rely on wells	V4	136	Water / Power Availability
Increase in average winter temperatures	Frequent winter freeze-thaw cycles, leading to ice conditions causing increased need for salting, leading to agricultural land, groundwater, and surface water contamination	V3	130	Asset Damage & O&M
Increase in average annual temperatures	Increased disturbance in natural ecosystems (due to changes in temperature and precipitation) and decreased minimum winter temperatures, leading to increased survival and spread of invasive species such as Emerald Ash Borer	V3	120	Ecological Integrity

Climate Threat	Impact Statement	Vulnerability Level	Risk Score	Theme
Increase in average annual temperature and intensity duration of precipitation	Increase in stream temperature can cause decrease in dissolved oxygen levels, leading to loss of sensitive biota such as the Brook Trout	V4	105	Ecological Integrity
Increase in average winter temperatures	Temperatures near the freezing mark, causing increased risk of freezing rain events, leading to a need for salting, damaging infrastructure	V4	155	Asset Damage & O&M
Increase in average winter temperatures and variability in winter freeze-thaw cycles	Unpredictable winter conditions, leading to difficulty planning for levels of service in the Town	V4	150	Asset Damage & O&M
Increase in average annual intensity and duration of precipitation	More frequent inundation of flood plains, causing higher frequency of flooding in urban areas	V4	144	Floodplain / Riverine Flooding
Increase in average annual intensity and duration of precipitation	Stress on municipal buildings, roads, culverts, and bridges leading to infrastructure failure	V4	144	Overland Flooding & Wetland Integrity
Increase in average winter temperatures and precipitation, combined with freeze-thaw cycles	Increased potential for rain on frozen ground events causing flooding and associated damage	V5	140	Overland Flooding & Wetland Integrity
Increase in average annual intensity and duration of precipitation	Ice storms causing damage of public and private infrastructure (i.e., building and transit network), and energy systems	V4	136	Asset Damage & O&M
Increase in average annual intensity and duration of precipitation	Stress on stormwater management infrastructure leading to facility / system failure	V5	132	Overland Flooding & Wetland Integrity
Increase in average annual intensity and duration of precipitation	Increase in instances of overland flooding, causing road closure that blocks access for emergency services	V4	125	Social Vulnerability
Increase in average annual intensity and duration of precipitation	More instances of overland flooding, causing evacuation of vulnerable populations and displacement of residents from homes	V4	140	Overland Flooding & Wetland Integrity; Social Vulnerability

Climate Threat	Impact Statement	Vulnerability Level	Risk Score	Theme
Increase in average annual hot days over 30 degrees Celsius	Increase in number of heat and poor air quality days resulting in health issues for vulnerable populations and outdoor workers	V3	130	Social Vulnerability
Increase in average winter temperature with increase in intensity and duration of precipitation	More rain during winter months, sometimes accumulating mixed with snow or as wet snow, making snow heavier and more challenging to remove	V4	124	Asset Damage & O&M

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