VERNON
Climate Action Plan

April 2021

CITY OF Vernon

Our vision: By 2050 Vernon is a leader in climate action, with no net greenhouse gas emissions, and resilient to the changing climate.

LETTER FROM THE MAYOR

Climate action is a priority for our community. Vernon's mission is to provide effective and efficient local government services that benefit our citizens, our businesses, our environment and our future. City Council is committed to reducing our greenhouse gas emissions and responding to the impacts of climate change by taking strategic, practical and sustainable actions.

To date, the City has signed the BC Climate Action Charter, joined the Federation of Canadian Municipalities: Partners for Climate Protection Program, established a Climate Action Revolving Fund, a Sustainability Grants Program, a Community Wildfire Protection Plan, and a Flood Hazard Mapping Study. We have retrofitted buildings with more efficient heating systems, purchased electric vehicles and electric assist bicycles, and installed electric vehicle charging stations. We support and promote active transportation, constructed several multi-use paths, and are currently reviewing waste diversion opportunities among many other climate action initiatives. We are focused on working with our natural assets as we plan and manage land use, development and growth.

Mayor Victor Cumming with the one of the City's electric fleet

While we have taken significant steps as a local government already, there is a lot more work to do. And we need you to be part of it, with us.

This plan is our collective guide for local climate action. It has been two years in the making and I want to thank everyone who has participated in its development. This includes our dedicated residents, businesses, environmental experts and staff members. Special thanks goes to the Climate Action Advisory Committee and Climate Ambassadors for their tireless volunteer efforts.

Thank you, in particular, to our youth volunteers. We, like you, are deeply concerned about the climate crisis; this plan is an essential first step in addressing concerns about our future and taking bold local action.

Through enacting this plan, we can reduce our greenhouse gas emissions, enhance our community, protect our infrastructure, and position ourselves to thrive during the changes to come. With the participation and activation of residents, businesses, and other organizations, we can work together towards the best possible future.

Our vision is to be a net-zero emission and climate resilient city in 2050. I hope that you will join us in our efforts to get there. We need you to.

Find out more about our climate change initiatives and learn how you can get involved by visiting vernon.ca/climate-action.

Sincerely,

Victor Cumming
Mayor

LETTER FROM THE CLIMATE ACTION ADVISORY COMMITTEE

Climate Action Advisory Committee Summer 2019

In 2018, in response to concerns about the ongoing increase in global greenhouse gas emissions that are contributing to more changeable weather and long term climate change both locally and globally, the City of Vernon created a Climate Action Advisory Committee. This committee consists of a diverse group of volunteer community members, whose role is to advise City Council on climate change issues.

The committee's primary activity has been to provide advice on the development of this Climate Action Plan by overseeing scientific studies and supporting an innovative community engagement process that involved recruiting and training over 30 climate ambassadors of all ages.

As the plan emerged through this comprehensive process, it became increasingly clear that it has great potential to make Vernon a more resilient, healthier, economically stronger and more diverse community, while simultaneously reducing our contribution to the climate change problem that is affecting our community and the entire world.

On behalf of the Climate Action Advisory Committee we are proud to have contributed to the growth and well-being of the community. We hope this plan will be embraced by all residents and organizations within the city, and that together we will create an even better Vernon in the years ahead.

Sincerely,

Bill Darnell, Brian Guy and Mary Stockdale
Climate Action Advisory Committee

WORDS TO KNOW

Climate Change
Climate change refers to significant changes in global temperature, precipitation, wind patterns and other measures of climate that occur over several decades or longer.

Greenhouse Gas (GHG)
The main greenhouse gases are water vapour (H2O), carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). The effects of human activity on the greenhouse gases is large and gases are increasing faster than they are removed from the atmosphere.

Net Zero Emissions
Net zero emissions are when human caused emissions of greenhouse gases to the atmosphere are balanced by human caused emission removals, such as storing or sequestering carbon.

Adaptation
The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to minimize or reduce harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate impacts.

Mitigation
A human intervention to reduce amount of greenhouse gases in our atmosphere.

Resilience
The ability of systems and communities to absorb the impacts of climate change and maintain an acceptable level of functionality and service.

TABLE OF CONTENTS

GUIDING PRINCIPLES

The CAAC collaborated with staff and stakeholders to create nine Guiding Principles for the planning process. The principles are based on the UN-Habitat "Guiding Principles for City Climate Action Planning", with customized changes to make them more relevant to the Vernon context.

Leadership

The plan will be based on a positive vision for the future and demonstrate the City's commitment to being a leader in climate action.

Inclusive

The plan will be developed in a collaborative manner with community stakeholders and Indigenous perspectives.

Fair

The plan will focus on developing equitable solutions to addressing the impacts of climate change, ensuring that the needs of the whole community are taken into consideration.

Equitable

Each objective and action in the plan must emphasize equity considerations, focusing particularly on populations at greatest risk to climate change impacts, including elderly, children, the poor, and the homeless.

Comprehensive & Integrated

Actions will be directed across various sectors, stakeholders, and citizens in the community and complement the Regional Growth Strategy. Municipal actions will be integrated into existing plans and policies.

Relevant & Adaptable

Actions will be appropriate to the local context and support the overall community's priorities. The plan will be designed to adapt to the changing community and regional context.

Realistic

While the goal is to be ambitious, actions will also be cost effective and within the ability of individuals, businesses and organizations to implement.

Evidence-based

The plan will be built using scientific knowledge, relevant studies and local and indigenous knowledge.

An assessment of vulnerability and emissions will inform decision-making.

Transparent & Accountable

The planning process will be open and transparent.

Goals and actions will be measured, reported and evaluated.

ACKNOWLEDGMENTS

The Climate Action Plan was developed by the City of Vernon in collaboration with the Community Energy Association, Flipside Sustainability and All One Sky Foundation. We would like to acknowledge the many individuals and organizations who participated in the development of this plan. We appreciate your time and commitment.

Residents

Without the commitment and actions of the community, it will be impossible to reach our goals. Residents have shown how they value practical solutions to reducing our emissions and getting ready for climate change. These include the community's passion for composting, involvement in emergency preparedness, volunteering to support vulnerable populations and adopting active transportation. The youth of the community are calling for and taking action where they can. Together we are tackling this big challenge!

Mayor and Council

Without the leadership of Mayor and Council, this project would not have been possible. Through the commitment of funding and staff resources, and creating and supporting the committee, Council has continued to show support for the development of the Climate Action Plan

Climate Action Advisory Committee

The volunteers on the Climate Action Advisory Committee have been instrumental in the development of this plan. The broad perspectives, community and technical expertise, patience and creativity of this group has created a plan that is grounded in the community, practical and easy to understand. The dedication of these volunteers to engage the community meaningfully, connect with business and community leaders and involve schools and teachers is inspiring. We look forward to their support in implementing the plan.

Climate Ambassador Volunteers

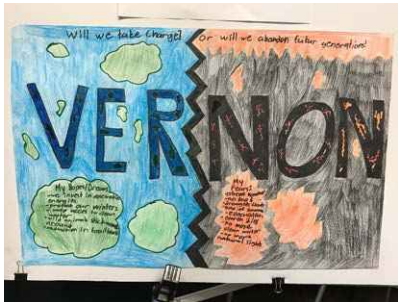
This dedicated team has committed to in-depth training on communicating about climate change and reaching out to their networks to have meaningful conversations about how to reduce greenhouse gas emissions and get ready for the impacts of climate change. The Climate Ambassadors have been a critical piece of the development of the Climate Action Plan.

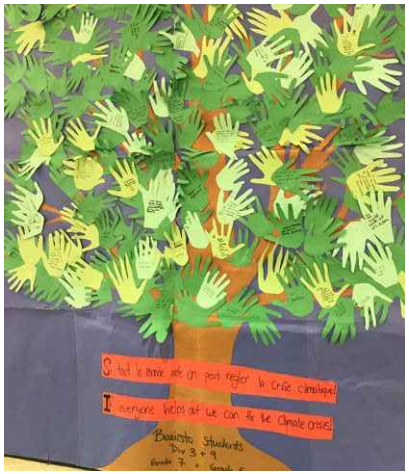
Local Organizations and Groups

Through workshops we learned a lot about the capacity of our community to adapt to the future. These sessions included a broad array of participants across all sectors of the community. At these sessions we worked together to map out actions that will move us towards a future where we are more resilient and have reduced our greenhouse gas emissions.

YOUTH ARE CLIMATE LEADERS

Vernon youth are passionately concerned about the impacts of climate change on their future. Youth in our community have taken part in marches, climate strikes, explored climate change at school and have written to the City in support of sustainability and climate action. They have also had a seat on the City's Climate Action Advisory Committee, which was shared by three youth. We know that by preparing our community to withstand the effects of climate change and taking action to reduce our greenhouse gas emissions, we are building a better community for Vernon's youth to stay and enjoy the lifestyle they love, for years to come.





This artwork was created by Vernon youth as part of the "Youth are Climate Leaders" project facilitated by the City with local schools.

1 INTRODUCTION

More than 41,000 people call Vernon home. Surrounded by Okanagan, Kalamalka and Swan Lakes, we live in a place of extraordinary natural beauty and four-season world class recreation opportunities at our doors. Our lifestyles are tied to the natural environment as we live, work and play in the North Okanagan. We are proud to live here and have an opportunity to help Vernon remain a place where community members enjoy our natural surroundings, quality of life and sense of community into the future, despite the challenge of a changing climate.

The good news is, we know what we need to do: getting ready for the impacts and working to reduce our emissions. And we need to start **now.**

This Climate Action Plan is our guide to strengthening and enhancing our community: to be more walkable, to build infrastructure that will last, to prepare community members to respond successfully to emergencies, and to value and work with natural systems. Over the years, as the plan is implemented, we will co-create a future where residents experience the benefit of a connected, healthy, and economically prosperous city, all while taking action on climate change and adapting to climate impacts. We are already taking action in many of these areas. This plan builds on that and gives a full picture of the path to a more resilient future.

It won't be easy, but we'll adapt and thrive together.

VERNON'S PROJECTED CLIMATE

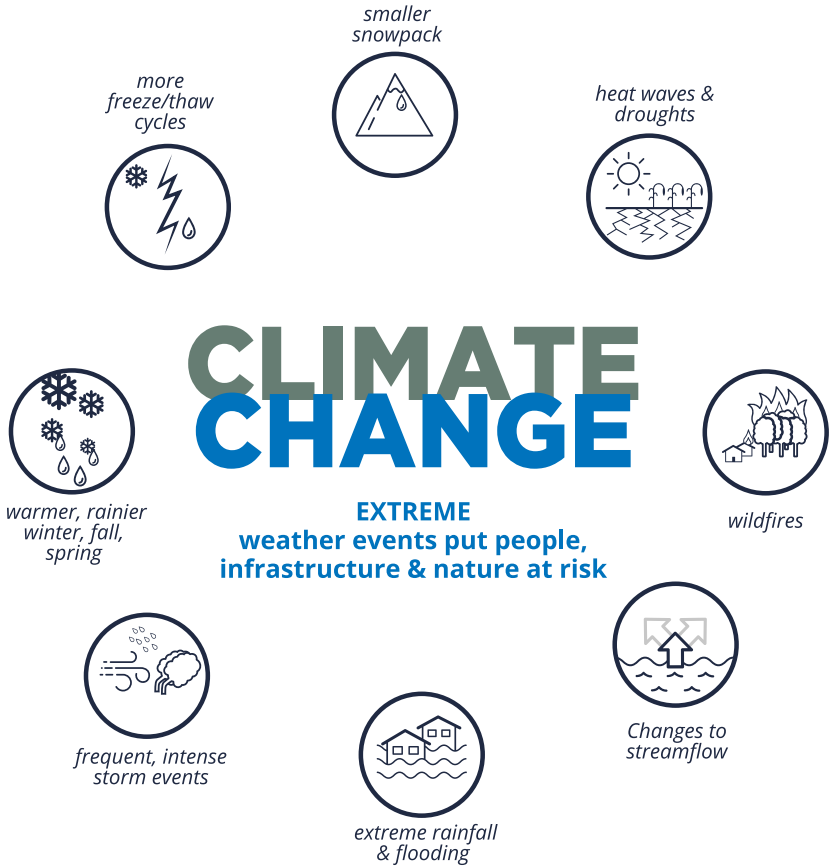
Sometimes the weather is talked about as if it proves or disproves that climate change is happening (for example, when there is a late snowstorm or a heat wave). It is important to remember the difference between weather and climate:

Weather is what is happening day-to-day.

Climate is the overall trend or average of the weather over the long term.

Communities around the world are taking climate action. Many were inspired to do so when, in October 2018, the UN's Intergovernmental Panel on Climate Change (IPCC) released a report that said we must reduce greenhouse gas emissions by 45% by 2030, and by 100% by 2050, if we want to keep global warming to only 1.5°C. We need to do this to avoid the worst impacts.

Our city and our region, like communities around the world, have to adapt to the changing climate. We are already experiencing some impacts and climate modelling for the North Okanagan by the Pacific Climate Impacts Consortium (PCIC)[1], indicates these impacts will continue.



The reality of these impacts and the scientific consensus that we must reduce our emissions guide this document. This is a practical plan and leverages our previous sustainability work to build a safe and healthy future for our residents.

[1]For more information about climate projections see PCIC's report "Climate Projections for the Okanagan Region".

A RESILIENT VERNON

The Climate Action Plan looks at how our community can adapt to climate change impacts and extreme weather (this is called *adaptation*) and how we can reduce our GHG emissions (this is called *mitigation*). With this approach we can create a pathway to community *resilience.*

In order to maximize benefits for the community, this plan looks at the individual actions we can take and the policies and plans that need to be in place to be successful. This integrated approach creates health and wellness benefits, long term savings in infrastructure repair and reduces costs for heating and cooling our buildings.

CLIMATE ACTION ADVISORY COMMITTEE (CAAC)

To ground the plan in our community the City established a Climate Action Advisory Committee (CAAC) to assist in its development. The mandate of the Committee was to provide recommendations to Council on policies and strategic initiatives, representing the diverse perspectives of our community members. The CAAC collaborated with staff and stakeholders to create nine Guiding Principles (see Appendix 6) for the planning process. The principles are based on the UN-Habitat “Guiding Principles for City Climate Action Planning”, with customized changes to make them more relevant to Vernon.

Adaptation is the process of changing our behaviour, infrastructure, and systems to plan for and manage the unavoidable impacts of climate change.

Mitigation is a process of reducing the amount of greenhouse gases (GHG) we produce. This needs to be done at an individual, community, provincial, national and global scale. We all have a role.

Resilience refers to the ability of a system to rebound from a shock or stress. Resilience is a future state where the balance between adaptation, mitigation and other municipal priorities is achieved.

USING THE CLIMATE ACTION PLAN

This plan combines climate adaptation and mitigation into a climate-ready approach for our city. It is Vernon’s first comprehensive climate plan. It sets long term targets and lays out a clear direction for the next five to ten years to address climate change issues.

The intent is for readers to review Sections 1 through 4 of this document to understand the plan. The appendices provide context and background information, including a summary of the process used to create the plan and full implementation details.

FOCUS AREAS

The core of the plan is the recommended *actions* that the City, residents and organizations can implement to begin creating a more resilient Vernon. We identified eight *focus areas*, each of which has its own *vision* and *goals*. It is important that the actions are relevant and focused.

The eight focus areas take into account climate action that is happening in other communities and across BC and Canada and they reflect the unique context of Vernon - our challenges, vulnerabilities, and opportunities.

The focus areas are:

- Health & Well-Being
- Core Services & Infrastructure
- Governance
- Land Use & Transportation
- Ecosystem Health & Biodiversity
- Buildings & Real Estate
- Economic Development
- Agriculture & Food Security

2 GUIDE TO SUCCESS

OUR VISION

By 2050 Vernon is a leader in climate action, with no net greenhouse gas emissions, and resilient to the changing climate.

The Climate Action Plan identifies and prioritizes future work and aligns with the vision and guiding principles outlined in the Official Community Plan. It sets out a path to this vision where the whole community works together to reduce emissions and prepare for the impacts of climate change. This collaborative effort sets the stage for Vernon to continue to be the place where we choose to live, work, play and thrive.

STRONG LEADERSHIP

The City continues to lead by example in prioritizing climate mitigation and adaptation.

The community continues to grow its climate action with support from the City.

RESILIENT STRUCTURES & SYSTEMS

Homes and businesses are better protected from fire and floods. Residents are prepared for emergencies.

City infrastructure and systems are continually evaluated and remain resilient to extreme weather events.

We see nature thriving all around us, including Okanagan lake, wetlands, our parks and urban forests.

Reducing emissions has improved our air quality and the health of our residents.

RELATIONSHIPS THAT BUILD WELL-BEING

Neighbours support each other during emergencies.

The strong partnerships between the City and community agencies lead to innovative climate action.

Residents share stories and successes to inspire each other to try new, climate-wise solutions.

REDUCED GHG EMISSIONS

Low carbon lifestyles are the norm; residents choose climate-wise options because City infrastructure and systems make them the best choice.

Residents notice the health and economic benefits of making low carbon choices, understanding how everyday choices, like what they buy, can decrease greenhouse gas emissions.

Low carbon choices are available to, and benefit all, community members.

COLLABORATION

Tackling climate action will require many hands working together. The strong and sustained commitment across the community - individual residents, business owners, corporations, industry, community groups - is critical. There is a role for each and every one of us as we move to our vision of the future.

ADAPTING TO IMPACTS OF CLIMATE CHANGE

Adaptation is about changing our behaviour, natural and built infrastructure and systems to prepare for the growing impacts of climate change. For example, if we know there are going to be more intense rain events, how can we build our storm water management system to be ready? If we know there will be more days of extreme heat, how do we prepare people for what to do, and what's the City's plan for supporting the community to respond to the impacts of extreme heat?

The effects of a warming climate are apparent in Vernon, and we have been challenged in recent years by climate-related events including flooding, landslides, and wildfires.

This challenge will only increase in coming years, with future climate projections[2] indicating:

- Increased temperatures year-round with less days in the winter below freezing and an almost doubling of summer and fall days over 30°C;
- Reduced winter snowpack with changes to the timing of high water bringing impacts to stream flow;
- More days of rainfall in every season except summer, and heavier, more intense rainfall on rainy days, which brings flooding risk and challenges for infrastructure;
- An increase in growing season length and reduction in frost days, which will drastically influence agriculture; and
- An increase in the frequency and severity of extreme weather events, wildfires, wildfire smoke events, and severe storms, all of which will be further complicated by the "layering" of climate impacts and are expected to become more difficult to respond to over time.

These impacts require the City of Vernon to be proactive in how it addresses and manages climate change.

Preparing for climate change impacts can improve our day to day lives **now** while ensuring we are resilient and will thrive in the long term.

WHAT CAN RESIDENTS AND ORGANIZATIONS DO TO PREPARE FOR IMPACTS AND REDUCE EMISSIONS?

Throughout the following sections we have highlighted individual and organization specific actions. When you see a call-out like those below, you'll find real actions you can take in your personal or professional life to be more climate-wise, often achieving co-benefits in the process like cost savings or improved health.

TAKE ACTION TO PREPARE FOR THE IMPACTS OF A CHANGING CLIMATE

- FireSmart your property
- Be prepared for emergencies, including having a 72 hour emergency kit ready to go
- Get to know your neighbours and connect with your community
- Know your evacuation routes
- Know your flood risk and prepare
- Protect your property from hazards like flooding*

***Understanding our risk of floods** We know we're vulnerable in Vernon to flooding. That's why the City is doing a study to make sure we're prepared with strategies to protect our community in the event of flooding. This project, and the actions we implement, will help us become more flood resilient.

[2] https://www.regionaldistrict.com/media/279459/OK_Climate_Projections_Report_Final.pdf

REDUCING GREENHOUSE GAS EMISSIONS

Our climate is changing due to increased levels of greenhouse gases in the atmosphere. These changes are felt at the community level. To reduce these impacts we must find ways to mitigate our emissions.

Mitigation is about acting to limit climate change by reducing the amount of greenhouse gases we produce. This needs to be done at an individual, community, provincial, national and global collective scale. We all have a role.

In order to map out our role in reducing emissions, we need to first understand what we emit today and what we can do to reduce emmissions going forward.

Local Government Influence

Local governments have varying degrees of influence over different sources of emissions within their boundaries. If the community of Vernon is to succeed, leadership and/or support from federal and provincial governments is required, as well as actions from our residents and organizations.

Did you know?

The actions in this plan are aligned with Federal and Provincial policies, including but not limited to:

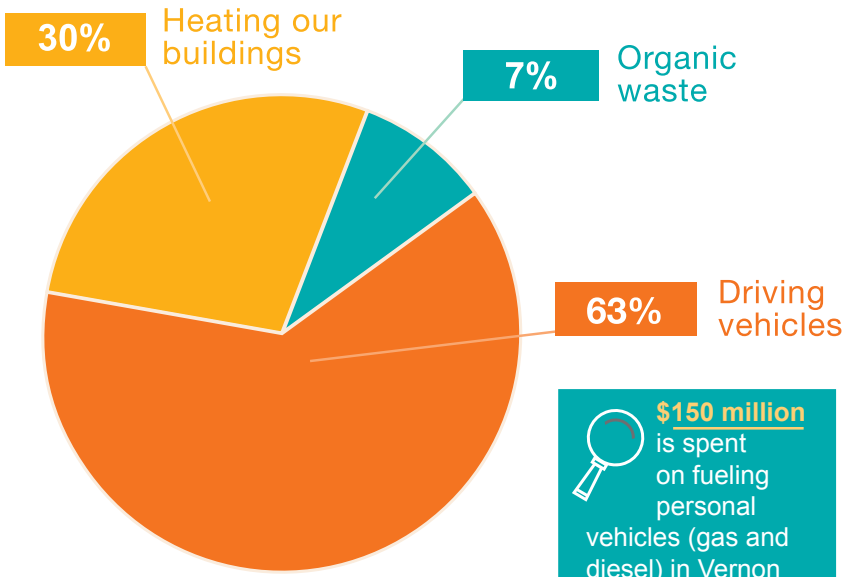
- Pan Canadian Framework on Climate Change
- CleanBC Plan (2018)
- BC's upcoming Climate Ready Plan
- BC Energy Step Code (2021)
- National Energy Code
- Provincial Building Retrofit Code (~2024 implementation)
- Provincial Clean Energy Vehicle (CEV) Mandate
  - 10% of all vehicles sold in the province by 2025 to be clean energy vehicles
  - 30% by 2030
  - 100% by 2040

Municipalities across Canada play an important role in lowering GHG emissions. They influence approximately 50% of emissions nationally.

Source: Quest Canada

Where We Are Today

Most of our emissions come from how we get around the community, heat our buildings and what we do with our organic waste (food, yard and garden). The pie chart below shows the sources of our GHG emissions in Vernon in 2017.



Vernon's GHG Emissions (2017)

$150 million is spent on fueling personal vehicles (gas and diesel) in Vernon each year.

ORGANIZATIONS

Implement a no-idling policy for fleet vehicles and prioritize use of the most efficient cars. This can save you money on fuel and reduces emissions.

INDIVIDUALS

Switch to an electric heating and hot water system in your home.

TARGETS FOR REDUCING OUR EMISSIONS

Community targets are to show the urgency of the challenge we are facing and the call to action to reduce our GHG emissions. Vernon's community targets are aligned with the IPCC recommendation* to reduce GHG emissions by 100% by 2050 to meet the maximum 1.5 degree Celsius target to keep impacts of climate change to a minimum. Our community's GHG emissions (residents and City of Vernon municipal operations) in 2017 were 309,407 tonnes CO2e. Our community targets are:

- 50% reduction in GHG emissions below 2017 levels by 2030
- 75% reduction in GHG emissions below 2017 levels by 2040
- 100% reduction in GHG emissions by 2050

We are also adopting a milestone of 23% reduction in GHG emissions below 2017 levels by 2026. The 2026 milestone reflects of the urgent need for action and sets the stage to reach the 2030 target. We know five years is a very short time to make these shifts and it is possible we will not reach our target, but we must inspire action and innovation **now**.

The actions in this plan are projected to achieve emission reductions of 202,250 tonnes CO2e. Remaining emission sources are discussed on the next page.

100% net reduction in emissions by 2050 means having each resident reduce their emissions by 3% each year.*

*Meeting International Targets

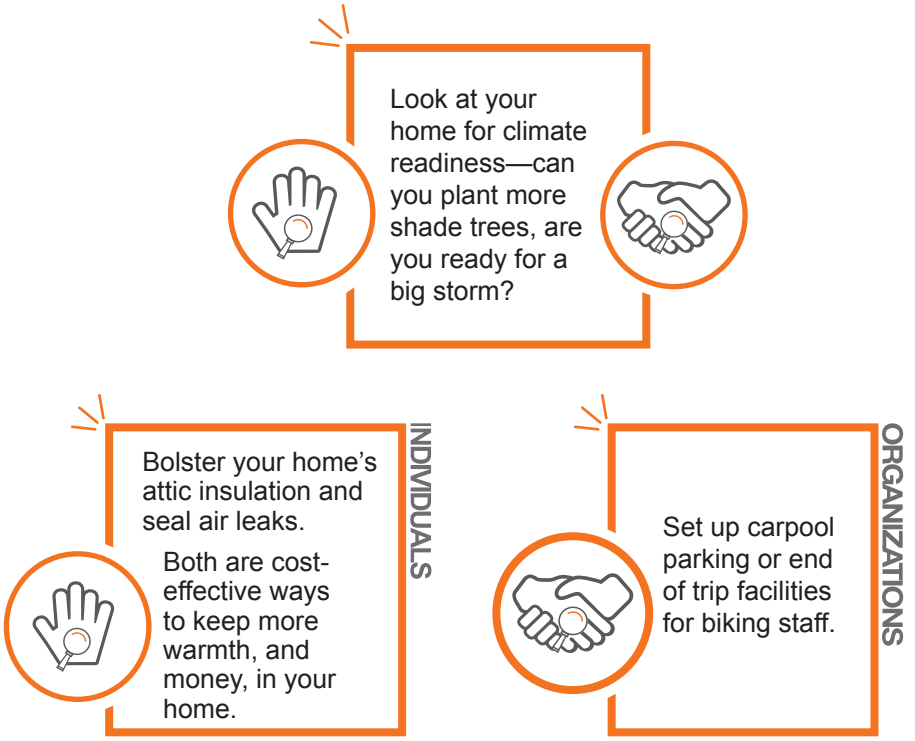
The City of Vernon is joining cities around the world committed to taking action on climate change. With the goal of becoming a net-zero emissions community by 2050, we are meeting the global target set out by the Intergovernmental Panel on Climate Change (IPCC). The IPCC is the United Nations body for assessing the science related to climate change. www.ipcc.ch

** Based on 2020 population numbers.*

This plan does not comprehensively address embodied carbon (the emissions associated with creating something), or life cycle emissions (how many GHGs are emitted over the lifetime of an energy source or object). This is outside of the scope of what municipalities can address, but is an important thing for everyone to think about when they are buying goods or services. How was your item created, how far did it travel, how is it packaged? These are all important questions to consider when shopping.

Changing how we live and act

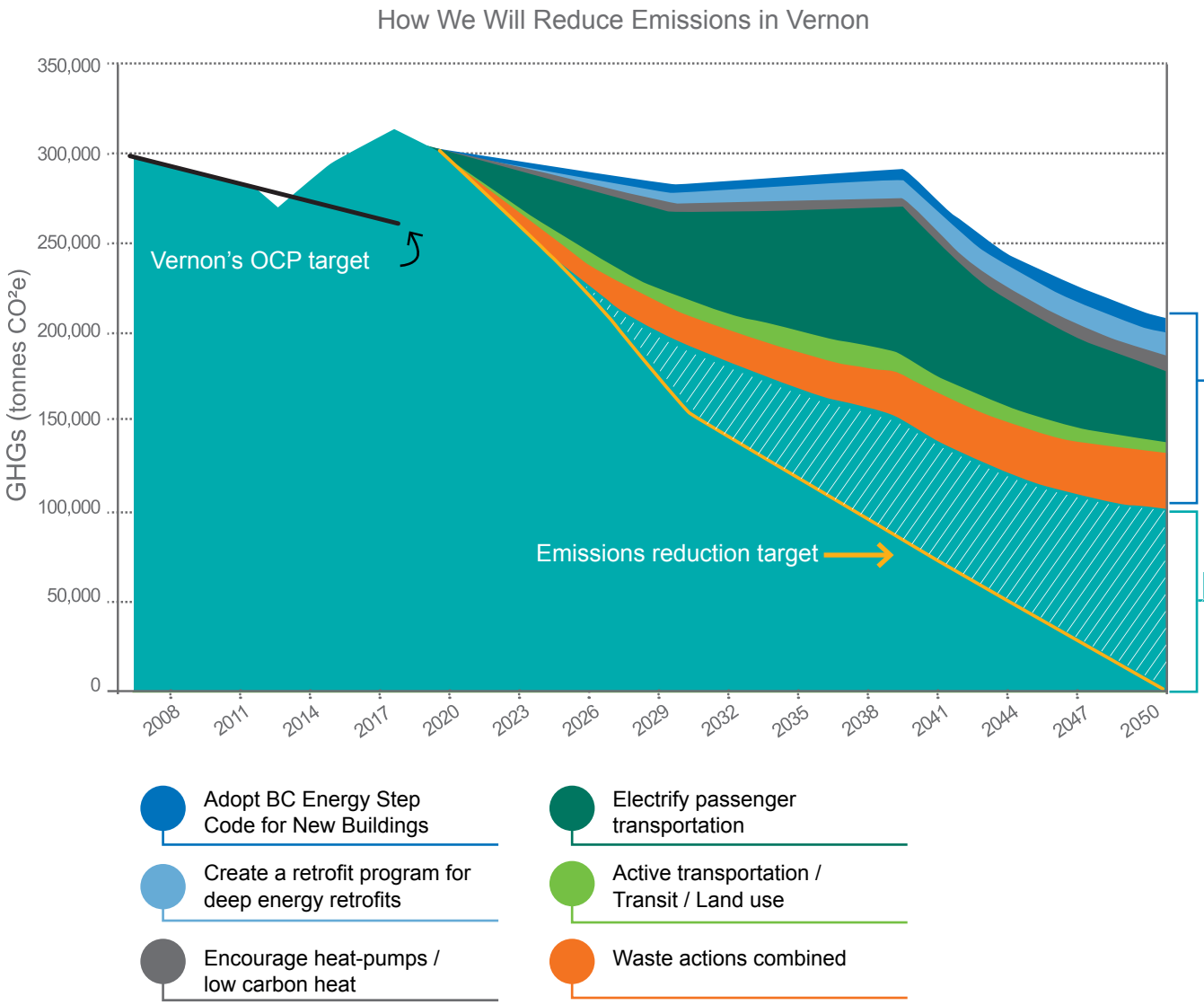
We know it will take some time for us to put in place policies, build infrastructure and shift how we get around. In reality it takes time to get started, then actions ramp up. The important thing is that we start **now**.



MEETING TARGETS

This graph shows where Vernon will eliminate emissions over time. The new emissions reduction target is more ambitious than our previous Official Community Plan target.

This target aligns with the IPCC. Addressing our emissions is an urgent priority that we must all focus on. It will require a lot of small changes and some very large ones.



Our intent is to revisit this plan every five years and adjust as needed to ensure the actions achieve the 2030 target and are on track for the 2040 and 2050 targets. This cycle of review and course adjustment is recommended every five years and is necessary to accommodate future technological advances and policy, knowledge and legislative changes.

Tracking our progress

Currently, our emissions are closely tied to our level of economic activity, as shown in the upper left part of the figure. The challenge is to continue to separate our economic success from our greenhouse gas emissions. The 6 colour-coded categories of actions included in this plan are projected to achieve significant emission reductions by 2050. These projected reductions are considered achievable with our current understanding of legislation, technology, costs, and adoption rates.

How do we address the remaining emissions?

The hatched area represents additional emission reductions that must be achieved beyond the steps described in this plan to meet our targets. Tackling these remaining emissions will require us to shift our actions as we gain experience in reducing emissions, as we adapt to federal and provincial leadership and new technologies, and as new incentives are developed to remove cost barriers to achieving deep emission reductions. We will also learn more about ways to capture and store carbon, which can help us achieve our targets.

BRINGING IT ALL TOGETHER

RESILIENCE = MITIGATION + ADAPTATION

Thriving in a changing climate is possible. We all have a role to play not only in reducing the amount of greenhouse gas emissions we each produce (mitigation), but also in ensuring we are prepared for extreme weather events (adaptation). Both mitigation and adaptation are needed. It is critically important for our plan to integrate both to ensure the best future for our community.

By viewing them as connected activities, we aim to foster and build our community's resilience. Doing so has the potential to focus resources and capacity, prevents contradictions, and identifies co-benefits for health, infrastructure, equity and other community priorities.

A RESILIENCE LENS

Merging adaptation and mitigation activities is called using a *resilience lens*. By considering both perspectives in decision-making and designing our municipal plans, we ensure we are building solutions that are good for our residents and our environment. A resilience lens guided the development of this plan and will continue to be applied throughout the implementation process, and in the monitoring and evaluation stages.

For example, stakeholders considered how adaptation actions like preparing infrastructure for extreme weather could incorporate ways to reduce GHG emissions while ensuring proposed actions didn't inadvertently increase emissions.

Similarly, we considered how proposed actions that focus on reducing emissions may or may not impact our ability to prepare for the impacts of climate change. Certain actions will be more mitigation or adaptation focused, however, using a resilience approach helps the actions in this plan create the greatest potential to build a healthy, prepared and equitable community.

WHAT IS AN EXAMPLE OF AN ACTION THAT USES A RESILIENCE LENS?

Building retrofits (renovating an existing building to maximize energy efficiency)

Mitigation benefits: Uses less energy, reduces emissions, saves money.

Adaptation benefits: Increases thermal comfort and air quality during extreme heat and wildfire events.

INDIVIDUALS

Retrofit your home to save money, increase comfort and reduce GHG emissions

INDIVIDUALS

Start a backyard composting bin. With just your organic waste like fruit and vegetable peels, coffee grounds and egg shells along with garden waste like leaves, you can create quality compost (“black gold”) for your garden.

ORGANIZATIONS

Arrange to have the organic waste from your office (like coffee grounds and filters, lunch scraps, etc) collected and composted. This can reduce how often your garbage needs to be collected.

3 VERNON'S PLAN

This Climate Action Plan sets out a path for the community to reduce its emissions that contribute to climate change and prepare for the changes to our climate that have already begun.

This plan focuses on eight key areas including both mitigation and adaptation. These focus areas provide logical groups of visions, goals and actions. The focus areas reflect Vernon's context including climate related challenges and initiatives affecting our community.

VERNON
Climate Action Plan

By 2050 Vernon is a leader in climate action, with no net greenhouse gas emissions, and resilient to the changing climate.

VERNON'S FOCUS & ACTION PLAN

The eight focus areas are associated with visions and goals. For each goal there are specific actions.

Health and Well-Being is the first focus area. It is really the outcome of the work in all the focus areas and the health and well-being of our community is the key indicator of success.

FOCUS AREA	VISION	GOALS
Health & Well-Being	Vernon is a healthy, equitable and resilient community.	» All members of the community, especially the most at risk and vulnerable, have equitable access to information, support, and resources related to preparing for climate readiness.
Infrastructure & Services	Vernon has infrastructure and services that are safe and resilient to a changing climate and employ low carbon options.	» Municipal infrastructure is upgraded or adapted to withstand the impacts of a changing climate. » Natural assets are protected, valued and assist with climate readiness and minimize the need for built infrastructure. » Emergency preparedness and response plans are updated for disaster prevention and address climate change hazards.
Governance	Vernon is a leader in tackling climate change.	» The climate change lens is used across all government activities including budgeting, procurement and asset management. » City Council, management and staff have the knowledge and capacity to ensure delivery of climate-ready municipal operations and services. » Vernon community members are aware of climate action plan strategies and have the capacity to use them.
Land-Use & Transportation	Vernon is made of compact, complete, climate-ready neighbourhoods connected to low carbon transportation networks.	» Residential uses are developed in close proximity to commercial services, employment, schools and recreational amenities. » Active transportation is the first choice to move around Vernon. » The community's transition to low greenhouse gas vehicles, such as electric, is supported.
Ecosystem Health & Biodiversity	Vernon has protected critical climate-sensitive ecosystems and species and is in turn protected by climate resilient natural infrastructure.	» Climate sensitive ecosystems and species are protected. » The urban is forest is prepared and protected from climate change impacts and the number of trees is increased. » There is ongoing responsiveness to invasive species in a changing climate.
Buildings & Real Estate	Vernon has transitioned to net-zero emissions buildings that are resilient to the impacts of climate change.	» All new buildings are efficient, use zero carbon energy systems, and are resilient to, and adapted for, projected climate impacts and hazards. » Existing buildings are retrofitted to be energy efficient, use zero carbon energy systems, and are resilient to climate change impacts.
Economic Development	Vernon has a diverse economy with businesses and industries that have embraced the opportunities of the low carbon economy and are resilient to the impacts of climate change.	» Local businesses are ready for the impacts and opportunities brought by climate change. » Diverse businesses, industry, entrepreneurs, and remote working professionals continue to thrive in Vernon.
Agriculture & Food Security	Vernon is food secure and has a resilient agriculture and economy.	» Residents are food secure and have opportunities for local food production.

FOCUS AREA ACTIONS

The goals and supporting actions in the following sections are detailed as follows:

TYPE

Actions are characterized as one of the following:

Plan: plans or strategies to either establish new direction, or embed climate readiness into existing plans or strategies

Assessment: analysis or research to gather additional information about potential climate changes, impacts or solutions

Policy: establishing or updating rules and regulations to provide direction for projects, initiatives, or programs, through a policy, guideline or standard

Procedure: develop and implement new operational procedures or adapt existing practices and procedures

Program: develop new programs to advance climate readiness

Project: implement projects to advance climate readiness ranging from operational upgrades to asset improvements, including green and hard infrastructure projects

Partnership: establish new or strengthen existing partnerships with key stakeholders (both internal and external)

Engagement: conduct outreach and engagement within the IAP2 Spectrum

Resourcing: establish new positions, hire new staff, and/or modify job descriptions or roles

CITY LEAD

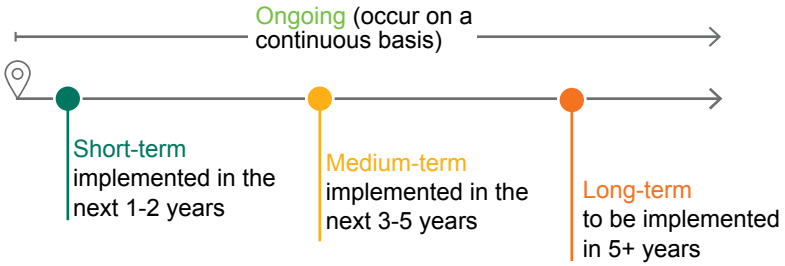
Identifies the City department responsible for action.

OTHER PARTNERS

The key partners to support implementation of the action both within the City of Vernon and external partners.

TIMELINE

The time by which the action will be initiated/implemented:



INVESTMENT

The estimated investment required to implement the action:

N/A	cost is either unknown, or is negligible and can be covered by existing staff capacity or operating budgets
$	Very Low ($0 - 10,000)
$$	Low ($10,000 - 25,000)
$$$	Medium ($25,000 - $100,000)
$$$$	High ($100,000+)

Funding to cover these investments will come from a variety of sources including City budgets, the Climate Action Revolving Fund and grants.

CO-BENEFITS

Many of the actions in the plan have co-benefits or additional positive outcomes. These co-benefits are additional ways that taking action on climate change betters our community. Types of co-benefits include:

- Improves biodiversity/ habitat creation
- Improves cost savings
- Enhances local autonomy
- Optimizes energy savings
- Creates jobs
- Reduces risk to property values
- Reduces waste; optimizes resources
- Improves human health and well-being
- Reduces congestion
- Improves water retention/ absorption
- Increases carbon storage/ sequestration
- Reduces burden on waste water infrastructure
- Improves air and/or water quality
- Reduces extreme temperatures
- Captures pollutants
- Improves equity/ improvements for vulnerable population
- Improves green space/recreation
- Supports clean energy transition
- Improves community livability/vitality
- Supports local food security initiatives
- Improves water and/or energy efficiency

INFLUENCE

The actions vary in their ability to influence GHG emissions and adaptation to impacts:

No influence

Little influence

Moderate influence

High influence

Additional information is provided in the Implementation Strategy included in the Appendices regarding each climate action. This section includes information about the co-benefits of each action, the lead organization or department responsible for implementing the action, a longer list of key partners to support implementation, how the City can monitor progress on the action, and how local organizations and individuals can support implementation of the action.

INDIVIDUALS

Make your second car work for you! If your family has two cars, one of them could be the efficient commuter/ around town car, saving you money and emissions!

INDIVIDUALS

Is your commute within cycling or walking distance? When you choose to walk or bike, you improve your health, save money and avoid emissions. Aim to replace 200km of driving with active methods.

Health & Well-Being

VISION

Vernon is a healthy, equitable and resilient community.

Goal 1: All members of the community, especially the most at risk and vulnerable, have equitable access to information, support and resources related to preparing for climate readiness

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Identify populations vulnerable to climate change and develop strategies to build their adaptive capacity.	Partnership	Short-term	$	Reducing healthcare costs, and increasing inclusiveness in society	» Donate funds, volunteer, and support organizations and programming for vulnerable populations to build your ability to prepare for and adapt to climate impacts	
							» Provide input on and identify resources for the inclusion of vulnerable populations in emergency planning
2	Develop a program to facilitate social connection, information sharing, climate awareness, and climate response activities amongst City residents at the neighborhood scale.	Program	Medium term	$$	Neighbourhood action will reduce and/or avoid costs for everyone	» Get to know your neighbours and who to call on in an emergency » Learn who might need help in your neighbourhood in an emergency	» Work with other like-minded organizations to learn together how to get ready for emergencies

Core Services & Infrastructure

VISION

Vernon has infrastructure and services that are safe and resilient to a changing climate and employ low carbon options.

Goal 1: Municipal infrastructure is upgraded or adapted to withstand the impacts of a changing climate

	Actions	Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Complete the Flood Hazard Mapping Study and update Flood Construction Level policies and amend bylaws to integrate both adaptation and mitigation considerations.	Assessment	Medium-term	$$$	Avoided damages and costs from flooding over time	» Implement flood mitigation strategies at your home (e.g. sump pumps, backflow prevention valves)	» Implement flood mitigation strategies (e.g. sump pumps, backflow prevention valves) » Update insurance to include flood/landslide risks where necessary
2	Update and implement the Community Wildfire Protection Plan in the context of expected future climate conditions.	Plan	Medium-term	$$$	Avoided damages and costs from wildfires over time	» Know your hazard level » If in a high hazard area, make new landscaping plans and plants FireSmart	
						» Learn about FireSmart and prepare your property » Consider using FireSmart materials if you do renovations	» Assess your property and landscaping for FireSmart » Consider using FireSmart materials when building
3	Incorporate climate considerations (emission reduction opportunities and adaptations for our future climate) into design, maintenance, and replacement of municipal infrastructure.	Procedure	Short-term	$	Avoided costs over time, including energy savings, fuel savings, operating costs	» Increase your home's energy efficiency » Look at your home for climate readiness – can you plant more shade trees, are you ready for a big storm? » Think about your next vehicle being an electric vehicle	» Increase building efficiency, adopt renewable energy, and electrify your fleets

Continued →

Core Services & Infrastructure

VISION

Vernon has infrastructure and services that are safe and resilient to a changing climate and employ low carbon options.

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
4	Review City waste management practices.	Program	Short-term	$$	Extends landfill lifespan, may find value opportunities for organics waste materials	» Compost at home or use a community bin » Take yard waste to the landfill » Recycle	» Set up composting and recycling for your business and support your staff to recycle and reduce waste
5	Update land use bylaws and share information on water conservation.	Partnership	Short-term	$	Extend lifespan of water assets and reduce pumping costs	» Conserve water by using low-flow technologies, rainwater harvesting, and planting low water use trees and plants	» Register to be a WaterSmart business/ organization » Conserve water by using low-flow technologies, rainwater harvesting, and planting low water use trees and plants

Goal 2: Natural assets are protected, valued and assist with climate readiness and minimize the need for built infrastructure

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Investigate a Natural Asset Management Inventory and Policy and consider for implementation	Assessment	Short-term	$$$	Natural assets can provide significant benefits at lower cost than built infrastructure	» Work with City to protect existing natural assets on your property (e.g. foreshores, wetlands, riparian areas) and use green infrastructure where possible (like a swale instead of a culvert)	» Work with City to protect existing natural assets on your property (e.g. foreshores, wetlands, riparian areas) and use green infrastructure where possible

Continued →

Core Services & Infrastructure

VISION

Vernon has infrastructure and services that are safe and resilient to a changing climate and employ low carbon options.

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
2	Implement policy and bylaw changes to increase natural assets, green infrastructure, and permeable areas	Plan	Medium-term	$	Natural assets can provide significant benefits at lower cost than built infrastructure	» Learn how to manage your property to reduce hazard risks (such as wildfire and flood) and save energy costs (e.g. tree shading) » Learn how to keep water on your property to reduce the impact of intense rainfall (increasing permeable surfaces and rain gardens for example)	» Learn how to manage your property to reduce flood risk and save energy costs

Goal 3: Emergency preparedness and response plans are updated for disaster prevention and address climate change hazards

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Develop an Extreme Heat and Clean Air Response Strategy, including designating and retrofitting emergency cooling and clean air facilities	Plan / Project	Medium-term / Long-term	$$ / $$$	Will reduce local healthcare cost	» Learn how to prepare your home for increased heat events and wildfire smoke days and/ or what to do and where to be during wildfire smoke events » Change your air filters regularly when it's smoky » Know when it's safe to be outside » Download and use the Vernon Connect app to stay up to date on important events » Know where you can refill your water bottle around town	» Prepare office/ facility ventilation systems for cooling during heat events and clean air during wildfire smoke days

Core Services & Infrastructure

VISION

Vernon has infrastructure and services that are safe and resilient to a changing climate and employ low carbon options.

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
2	Update Business Continuity plans for all City Divisions.	Procedure	Short-term	$	Will reduce unbudgeted costs for the City in the event of emergency disruptions	» Make sure you know what to do in an emergency » Educate yourself on response strategies, including emergency supplies, shelter facilities, and evacuation routes	» Work with City to create and mobilize awareness around emergency planning, response, and recovery » Share emergency information with your staff and networks

Governance

VISION

Vernon is a leader in tackling climate change.

Goal 1: The climate change lens is used across all government activities including budgeting, procurement and asset management

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Embed considerations from the Climate Action Plan into all existing and new policy and bylaws	Policy	Ongoing	$	Avoided costs over time, specifically the cost to react/ respond to climate-related events (e.g. wildfire, drought, flooding) and the year-over-year increase in costs associated with mitigating GHG emissions (e.g. an action that cost $1.00 in 2000 now costs $1.41 in 2020 due to inflation and will only continue to increase every year into the future)	» Continue to provide your ideas for climate action in Vernon via engagevernon.ca	» Bring your staff and/ or volunteers together to talk about what you can do! Share your ideas through engagevernon.ca
2	Initiate a 'project charter' program that integrates consideration of climate change in project budgets and objectives for project managers	Procedure	Short-term	$$	Avoided costs over time	» Research and understand your options for lower impact and more durable purchases	» Consider creating your own project charter to embed climate criteria into your business

Goal 2: City Council, management and staff have the knowledge and capacity to ensure delivery of climate-ready municipal operations and services

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Engage the Senior Management Team to ensure that each division has a mandate to implement its component(s) of the Climate Action Plan.	Resourcing	Ongoing	$	Avoided costs over time	Not Applicable	Not Applicable

Governance

VISION

Vernon is a leader in tackling climate change.

Goal 3: Vernon community members are aware of climate action plan strategies and have the capacity to use them

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Develop and fund a Climate-Ready Community Communications and Outreach Strategy.	Engagement	Short-term	$$	Avoided costs over time; long term investment in community action on climate change will save on property damage and local fuel spending	» Sign up for information and updates » Pledge to reduce your emissions » Get ready for emergencies	» Sign up for information and updates » Encourage your staff to participate in City and community climate action programs » Build on community events with staff events or pull a team together to challenge another business

Land-Use & Transportation

VISION

Vernon is made of compact, complete, climate-ready neighbourhoods connected to low carbon transportation networks.

Goal 1: Residential uses are developed in close proximity to commercial services, employment, schools and recreational amenities

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	During the review and update of the Official Community Plan beginning in 2022, integrate all climate risk and vulnerability analyses and emissions data, and objectives, actions and targets from this Climate Action Plan (CAP).	Plan/ Strategy	Short-term	$-$$	Considerable cost savings through reducing/avoiding infrastructure and transportation costs	» Contribute to the OCP review by participating in public engagement opportunities	» Participate in business engagement and community surveys around the OCP review » Share information with your employees and encourage their participation and attendance at OCP events

Goal 2: Active transportation is the first choice to move around Vernon

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Continue to implement the Master Transportation Plan, and update as needed, concurrently with the OCP to integrate and prioritize active transportation investments with the goals of the CAP.	Plan	Short-term	$$$	Transit and active transportation actions combined should save $2.5 million/year by 2025	» Participate proactively in the Master Transportation Plan update » Buy EVs, carpool, bike, and walk » Plant a tree near the front of your yard or sponsor a boulevard tree » Eliminate one trip by car a week » Bike to work	» Participate proactively in the planning process, and then install EV chargers, bike racks, and encourage employees and customers to carpool, bike, and walk » Set up carpool parking or end of trip facilities for biking staff » Support working from home » Develop an incentive program for carpooling

Land-Use & Transportation

VISION

Vernon is made of compact, complete, climate-ready neighbourhoods connected to low carbon transportation networks.

Goal 3: The community's transition to low greenhouse gas vehicles, such as electric, is supported

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Create and implement policies and programs that create a network of charging infrastructure to support the transition to electric vehicles.	Program / Project	Ongoing	$$$$	The use of EVs instead of fossil-fueled vehicles can lead to cost savings for the community. All of the EV actions combined are expected to save $13.5 million per year by 2025	» Purchase electric vehicles, and request public charging facilities	» Encourage public charging facilities at or near your business » Look at offering charging at your business » Evaluate if your employees need bike charging facilities
2	Enable and support the enhancement and expansion of the transit network and alternative mobility options.	Plan	Ongoing	$$	Transit and active transportation actions combined are expected to save $2.5 million per year by 2025	» Take the bus! » Review how you get to work or school – Is there a way to walk, bike or take a bus rather than a car?	» Provide end of trip facilities that support active transportation » Explore enabling flexible start and end times to allow staff to use transit

Ecosystem Health & Biodiversity

VISION

Vernon has protected critical climate-sensitive ecosystems and species and is in turn protected by climate resilient natural infrastructure.

Goal 1: Climate sensitive ecosystems and species are protected

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Ensure that the Sensitive Ecosystem Inventory identifies climate sensitive ecosystems, habitat, and species based on the latest climate projection data.	Plan	Medium-term	$$$	Natural assets can provide significant benefits to the community at lower cost than building infrastructure	» Learn about local species of importance (spadefoot toad, great blue heron, rattlesnake) » Learn about invasive species and how climate change will impact them	» Host a lunch and learn on a local species of importance (spadefoot toad, great blue heron, rattlesnake) or about invasive species and how climate change will impact them
2	Use the updated Sensitive Ecosystem inventory to strengthen policies to protect, enhance, restore and expand critical climate sensitive areas through the Environmental Management Areas Strategy update.	Policies	Medium-term	$$	Natural assets can provide significant benefits to the community at lower cost than building infrastructure	» Maintain or enhance unique habitats on your property and plant bee-friendly landscaping » When hiking or biking in a sensitive area, be sure to stay on the trail	» Restore, maintain, and expand natural areas, critical ecosystems and environmentally sensitive areas on your property
3	Continue to support public education and engagement opportunities for ecosystems and habitat protection and enhancement.	Engagement	Ongoing	$	Natural assets can provide significant benefits to the community at lower cost than building infrastructure	» Get involved in ecosystem rehabilitation projects	» Support an ecosystem protection project by creating a staff team to fundraiser or volunteer for a shoreline clean up or invasive species pull

Ecosystem Health & Biodiversity

VISION

Vernon has protected critical climate-sensitive ecosystems and species and is in turn protected by climate resilient natural infrastructure.

Goal 2: The urban forest is prepared and protected from climate change impacts and the number of trees is increased

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Protect and expand the urban forest by developing policies and increasing incentives to protect existing trees and plant new trees.	Policy	Short-term	$$	Natural assets can provide significant benefits to the community at lower cost than built infrastructure	» Access the City's Tree Voucher program to plant a shade tree in your yard (check the City of Vernon tree program) » Take care of existing trees in your yard	» Include shade trees in your landscaping plans

Goal 3: There is ongoing responsiveness to invasive species in a changing climate

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Partner with relevant organizations to collaborate on invasive species and pest vulnerability management.	Partnership	Short-term	$$	Pests can cause considerable economic damage (such as to the farming sector)	» Learn about invasive species and pests and do your part to detect, prevent and control invasive species and pests on your property, in the community and at nearby lakes and streams	

Buildings & Real Estate

VISION

Vernon has transitioned to net-zero emissions buildings that are resilient to the impacts of climate change.

Goal 1: All new buildings are efficient, use zero carbon energy systems, and are resilient to, and adapted for, projected climate change impacts and hazards

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Adopt the BC Energy Step Code and continue to engage and work with developers and the building industry to provide training and build capacity to implement the requirements of the Step Code.	Engagement/ Policy	Ongoing	$	New building actions are expected to save $1.7 million per year by 2025	» Ask for a home with increased energy efficiency and lower carbon emissions by requesting these items from your builder or realtor	» Builders can learn about the Energy Step Code and energy efficiency , then build to steps of the BC Energy Step Code and install low carbon energy systems
2	Implement a program for building energy labelling and benchmarking for energy, emissions, and resilience in accordance with the guidance in the BC Energy Step Code.	Policy	Ongoing	$	New building actions are expected to save $1.7 million per year by 2025	» When building a new home tell your builder that you want energy efficiency and to reduce carbon emissions » Ask for an energy label for your new home » Look into labeling your existing home	» Builders can promote themselves as a leader in building efficient homes » Share your experience with energy labelling » If you are building your business look into energy labelling

Goal 2: Existing buildings are retrofitted to be energy efficient, use zero-carbon energy systems, and are resilient to, and adapted for, projected climate change impacts and hazards

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Develop a building retrofit program to support residents to be more resilient to climate change, reduce energy investments over time, and reduce greenhouse gas emissions by improving building efficiency and installing low-carbon energy systems.	Program	Short-term	$$$$	Existing buildings actions are expected to save $2.8 million per year by 2025	» Sign up for the program, and retrofit your home	» Retrofit your business to save money, increase comfort and reduce GHG emissions

Economic Development

VISION

Vernon has a diverse economy with businesses and industries that have embraced the opportunities of the low carbon economy and are resilient to the impacts of climate change.

Goal 1: Local businesses are ready for climate change

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Establish a resource and information support program to help local businesses, including the tourism sector, get ready for climate change.	Program	Short-term	$$		» Be a local tourist: ◦ Plan a staycation ◦ Visit a local tourism business ◦ Take advantage of local or off-season rates at local tourism destinations ◦ Visit a restaurant	» Visit the City of Vernon website to access resources and information. Utilize the resources to enhance the climate readiness of your business: ◦ Develop a business continuity plan ◦ Know your risks ◦ Assess your air filtration ◦ Have a plan to keep you, your staff and customers safe ◦ Develop or update your corporate Emergency Management Plan
2	Advance a buy local campaign to build the capacity and networks of local businesses, industries and manufacturers.	Program	Short-term	$	Supporting local businesses	» Support local businesses and buy local » Participate in rebates and other buy local programming	» Participate in buy local campaign, including tracking and monitoring retail sales

Continued →

Economic Development

VISION

Vernon has a diverse economy with businesses and industries that have embraced the opportunities of the low carbon economy and are resilient to the impacts of climate change.

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
3	Integrate climate change considerations into economic development planning and decisions.	Plan	Short-term	$	Avoided damages and costs over time by helping local businesses respond to climate change	» Support local businesses	» Participate in development of Economic Development initiatives or strategies and co-develop climate-ready policies and practices » Communicate and implement outcomes of the Economic Development Strategy to your employees, clients and partners

Goal 2: Diverse businesses, industry, entrepreneurs, and remote working professionals continue to thrive in Vernon

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Develop a clean energy (e.g. renewable or net-zero emissions) and innovation network to support clean tech sector growth, facilitate business-to-business connections and identify top priorities for the sector, educational institutions and the City.	Partnership	Short-term	N/A	Ensuring Vernon has a thriving business sector in a low carbon future	» Seek out greener alternatives for your home » Get behind a new green technology business	» Participate in networking to identify business-to-business and innovation advancement opportunities through regional hubs and networks such as Accelerate Okanagan

Agriculture & Food Security

VISION

Vernon is food secure and has a resilient agriculture and economy.

Goal 1: Residents are food secure and have opportunities for local food production

Actions		Action Type	Timeline	Investment	Associated investment savings	Individual Action	Organization Action
1	Explore the role of the City of Vernon in supporting the food/agriculture system.	Plan	Medium term	$$	Keeping food dollars local	» Buy local food » Learn how local food and local food production contribute to personal health and well-being » Plant a garden/get backyard hens/ grow tomatoes on your patio » Go to the farmer's market » Do a farm stand tour » Subscribe to a Community Supported Agriculture box	» Buy local food or use caterers that do » Use and/or lease available space (including underutilized lands) to grow food

4 ENSURING SUCCESS

IMPLEMENTATION

Carrying out the actions of this plan will be the work of the whole community. At the City, the plan will be integrated into the Council Strategic Plan. The Senior Management Team will be responsible for ensuring that the actions are integrated into their team's workplanning. The Climate Action Advisory Committee will continue to provide advice and recommendations to Council. Outreach to the community will be a key piece of the implementation.

COMMUNITY PARTICIPATION

Implementation of this Climate Action Plan will take the participation of everyone in Vernon; individuals, businesses, institutions and government organizations, including:

- Residents and homeowners
- Elected officials
- City staff
- Local businesses
- Industry
- Community groups
- Builders/Developers
- Youth
- Indigenous residents and community members
- School District No. 22
- Academic institutions
- Other levels of government
- Regional organizations (such as RDNO) and neighbouring communities
- Visitors

RENEWAL

We will review and update this plan every five years.The review process will include:

- Integration of new climate science and risks
- Alignment with other City policy and guidance documents (i.e. OCP and other master plans)
- Course adjustment depending on progress to date
- New technologies
- New federal and provincial legislation

MEASURING PROGRESS

Monitoring and evaluating the implementation of this plan is critical to its success. Indicators enable the community to measure the outcomes of a plan's implementation. When these indicators are monitored regularly, communities can determine how to best allocate resources to support implementation, and what success different actions are having. A monitoring strategy will be developed to select the indicators and frequency of monitoring.

Key items for reporting:

- Community action
- Integration of climate action into municipal activities
- Greenhouse gas emissions
- Infrastructure for active transportation

COSTS AND BENEFITS OF CLIMATE ACTION

Addressing climate change at a community level is a complex process. There will be costs incurred with the actions, however in many cases the cost of inaction is much higher. Examples of this are wildfire interface fuel management or flood mapping. As well, actions that reduce greenhouse gas emissions often will reduce long term fuel costs, such as for heating or getting around.

All the actions in the climate action plan all require more investigation, costing and sourcing of funds. The Climate Action Plan will support funding applications that the City or community partners make as it aligns with many funders requirements. Many of the actions align with current activities the City is undertaking, others will need to be budgeted for through the City budget process. In addition the City's Climate Action Revolving Fund will be able to support actions and leverage additional funding opportunities.


PEDEGO
PEDEGO

VERNON
Climate Action Plan

APPENDICES

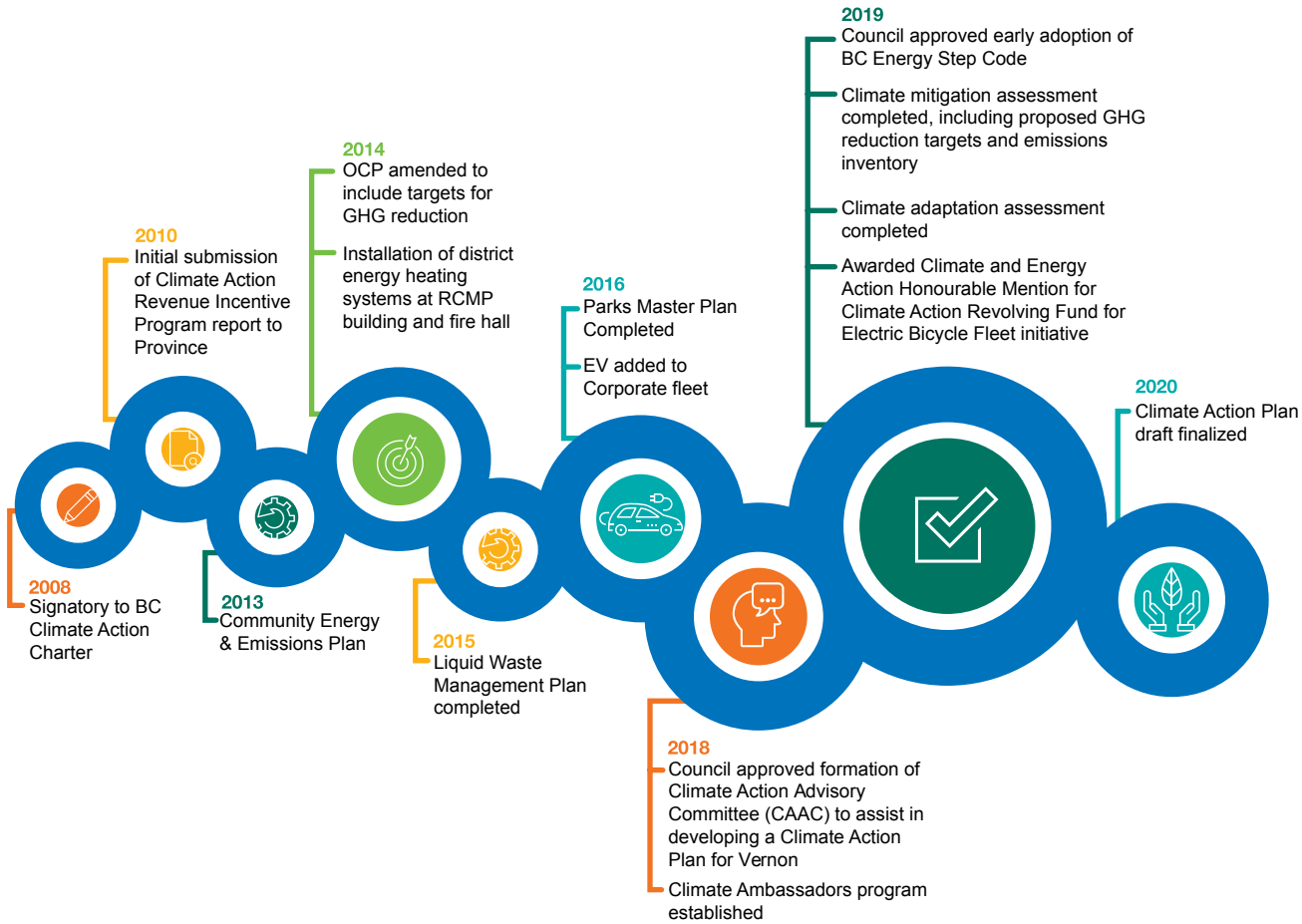
CITY OF Vernon

Appendix 1
Development Process

TIMELINE

In the Fall of 2018, the City of Vernon started to develop a plan to tackle climate change through the combination of mitigation and adaptation actions. The planning process began with technical studies including mitigation and adaptation assessments, understanding existing supporting initiatives, and in-depth action planning workshops with key stakeholders from across the community and from City departments.

Timeline of Vernon's Climate Action



The following sections detail the Vernon context and methodology employed to develop Vernon's Climate Action Plan:

- Overview
- What is Vernon's Climate Action Plan?
- Community engagement on this plan
- Incorporating co-benefits into the plan
- Climate action at all levels
- Summary of past climate action in Vernon
- Vernon's community and government operations GHG emissions profiles
- Adaptation assessment
- Mitigation assessment
- Glossary

OVERVIEW

This plan is a result of an in-depth, systematic process. It included a technical review of current conditions, gap analysis to identify information needs, visioning on progress over the next 30+ years, and creating an outcome-oriented action plan for City of Vernon for the next five to ten years.

This plan recognizes the need to act quickly and with purpose. The next two sections outline the scope of the plan, and the key steps we took to create and finalize it.

The figure below provides a high-level summary of the process.

Climate Action Plan Process

Project Start-up

- Document review
- Communications strategy
- Climate Action Advisory Committee creation

Inventory & Analysis

- Corporate GHG emissions inventory
- Assess existing initiatives and mitigation/adaptation recommendations

Engagement & Development

- Draft potential actions
- Workshops and community outreach
- Host public survey
- Final Climate Action Advisory Committee review

Deliver Final Plan

- Refine draft plan following feedback from staff and Climate Action Advisory Committee
- Present draft plan to Council
- Community review and final presentation to Council

WHAT IS VERNON'S CLIMATE ACTION PLAN?

This Climate Action Plan is both a guide and an operational document that provides recommendations on policies and actions that will make a more climate-resilient Vernon. The plan describes community targets and identifies both corporate and community-wide actions that will reduce emissions (mitigation outcomes), prepare us for climate change impacts (adaptation outcomes) or both (low-carbon resilience actions that achieve both adaptation and mitigation outcomes). The plan also includes budget, timing considerations and identifies key partners and stakeholders.

SCOPE

This plan is a result of an in-depth, systematic process which included a technical review of current conditions, a gap analysis that identified information needs and visioning what progress could look like over the next 30+ years. All this led to creating an outcome-oriented action plan for the City of Vernon that is rooted in science and data. This plan recognizes the need to act quickly and with purpose over the next five to ten years.

This plan focuses on community emissions only (the sum of the corporation and residents) and addresses both mitigation and adaptation areas.

One underlying assumption of this document is that City of Vernon will continue to have access to ample low-carbon electricity. If this situation changes, because BC's electricity grid begins to draw from sources with a higher carbon footprint or there are electricity shortages, then many of the actions in this document will have to be re-evaluated.

The plan does not comprehensively address issues related to embodied carbon (the emissions associated with creating something) or life cycle emissions (how many GHGs are emitted over the lifetime of an energy source or object). Further adjustments, modifications and prioritizations may need to occur to fully consider life cycle assessments.

All projections and calculations have been made using a 100-year global warming potential value (i.e., estimating the amount of warming that will occur over the next 100 years as a result of GHG emissions).

COMMUNITY ENGAGEMENT ON THIS PLAN

Community engagement was a key piece of the development of the Climate Action Plan. Every different step of the plan involved seeking input from the community. In fall of 2018, the City created the Climate Action Advisory Committee (CAAC). This committee consists of community members representing Business and Commercial Services, Science, Technology, Environmental Services, Community Stewardship, Educators and Educational Institutions, Youth, School District 22, Utilities, Health and Social Services, the Community at Large and Council. The CAAC was instrumental in guiding the planning process and developing the Climate Action Plan.

The community was engaged in the planning process in a number of ways, including through the Climate Ambassador Program, community events like Sunshine Festival, youth events, a display at the mall, a community survey, workshops with community stakeholders and presentations at Council. The Climate Ambassador program was developed to train community volunteers to talk to their peers and networks about climate change and the process that the City was going through to develop a climate action plan. The Ambassadors reached more than a thousand community members through these interactive presentations.

Three sets of community workshops brought together a variety of community members together with City staff and experts to talk about where Vernon was going to be impacted by climate change and where we are vulnerable to these impacts. The workshops also looked at how to reduce our community greenhouse gas emissions. The strength of these workshops was the wide representation of our community coming together to share their ideas.

City staff were involved in all of these workshops as well as focused internal sessions, bringing perspectives from Finance, Infrastructure, Development, Transportation, Operations, Planning, Economic Development, Tourism and more. This supports the plan being grounded in what is possible for the City to achieve and builds on the work that is already complete or underway.

In the spring of 2020, just as the community workshops were wrapping up, COVID-19 halted the community engagement process. A series of community conversations had just launched and the last two were cancelled, as were the in person open houses and pop ups. In its place the City launched a survey that attracted approximately 700 responses from residents of Vernon. The results reflect both support for the plan, and some concern with addressing climate change, with most people wanting to take action.

The plan was brought to Council in late fall of 2020 to obtain approval to run the final round of virtual open houses.

INCORPORATING CO-BENEFITS INTO THE PLAN

Integrating adaptation and mitigation actions (resilience) can result in key opportunities that provide benefits in areas other than the main intent of the action. These are called co-benefits and can range from the creation of jobs and increased property values to cost savings.

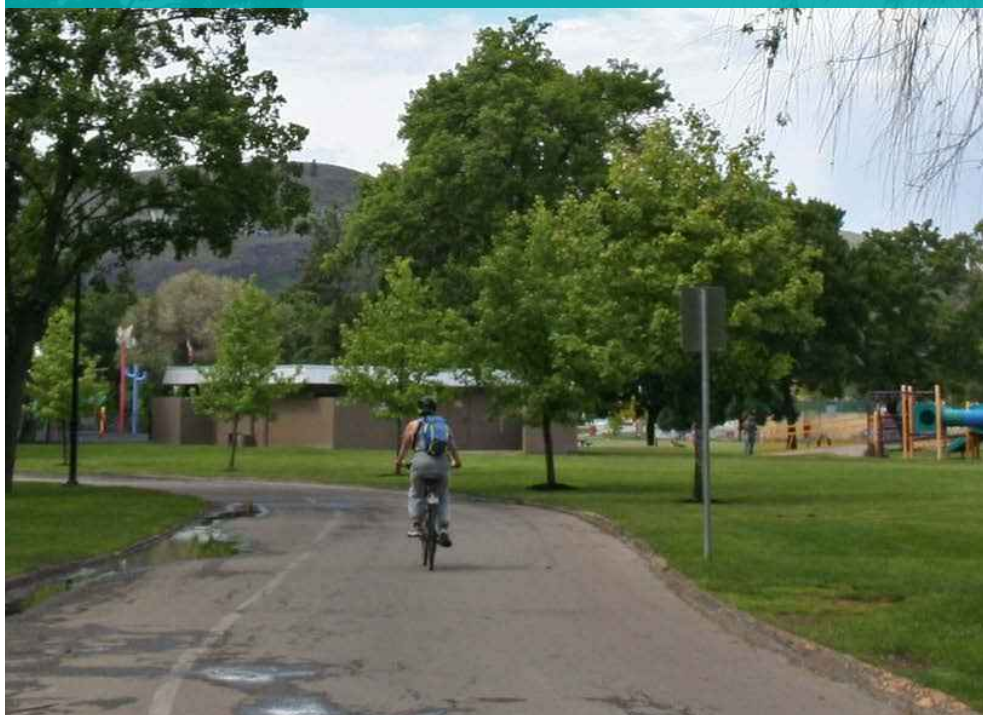
WHAT IS AN EXAMPLE OF AN ACTION THAT ACHIEVES CO-BENEFITS?

Low carbon transportation:

Incentivizing electric vehicle adoption, be it through infrastructure or policy, can significantly reduce GHG emissions while improving air quality.

Active transportation:

Creating safe, connected walking/biking paths reduces emissions, increases access for vulnerable populations, reduces congestion, reduces pollution, and increases air quality and health.

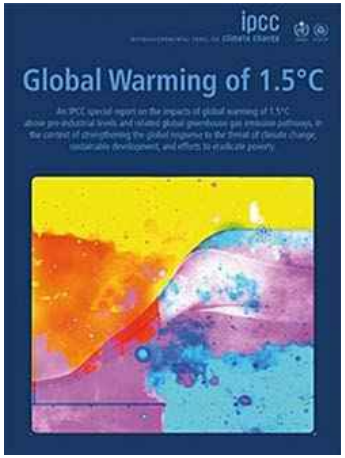


CLIMATE ACTION AT ALL LEVELS

Our community is one of many across Canada and around the world committing to climate action. The following is a summary of what's happening globally, nationally and provincially.

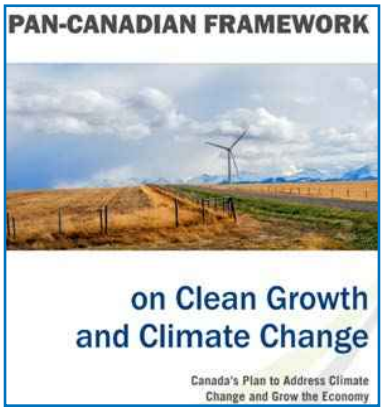
Global Action

When Canada signed the 2015 Paris Agreement, we joined a global commitment to keep global warming below 2°C, and as close to 1.5°C as possible. In October 2018, the United Nations Intergovernmental Panel on Climate Change (IPCC) released a major report that emphasized the dramatic difference in consequences between a 1.5°C and 2°C increase. Warming beyond a 1.5°C threshold will lead to increased impacts of extreme weather, more wildfires and floods, increases in sea-level rise, and severe threats to human health and well-being. By limiting these impacts, we do our part to have a healthy environment, economy and society for ourselves and future generations.



National Action

In 2016, the Government of Canada released its Pan-Canadian Framework on Clean Growth and Climate Change. The framework sets out the Federal government's strategy to meet its commitment under the Paris Agreement to reduce national greenhouse gas emissions 30% below 2005 levels by the year 2030. In 2017, the most recent emissions inventory year, Canada's emissions were 716 megatonnes of CO2 equivalent (CO2e)[1], which is a 2% decrease from 2005 levels. This means that in order for Canada to meet its emissions reduction target, we need a decrease of 28% from 2005 levels in just ten years. More recently, the Government of Canada has established a target of net-zero emissions by 2050, requiring an acceleration of action by all levels of government.

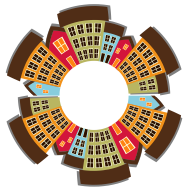


Climate Action Across Levels of Government

The federal government uses national standards and funding in climate action because provinces have constitutional jurisdiction over both energy and local governments.

Local governments are the front lines of climate action because communities are where the buildings, vehicles & infrastructure are.

	Plans	Authority	Actions/Levers
Federal	Pan-Canadian Framework on Clean Growth and Climate Change	• National standards • Funding • International commitments • Taxation	• Vehicle fuel efficiency standards • Infrastructure funding • Model national building codes • Energy ratings & tools (e.g., EnerGuide) • Green infrastructure bank • National carbon price • CCS (Carbon Capture & Sequestration) • Information sharing
Provincial	CleanBC (*mitigation*) Adaptation Strategy coming in 2020	• Constitutional authority for Energy and for Municipalities • Taxation	• Codes ie Building code (including Step Code) • Data (e.g., Community Energy & Emissions Inventory) • Green infrastructure (e.g., EV charging) • Provincial roads & transit funding • Direction to BCUC on BC Hydro, FortisBC, ICBC • Municipal regulation & authority • Carbon neutral government operations • Carbon tax • RNG (Renewable Natural Gas) • ZEV (Zero Emissions Vehicle Mandate)
Local	> 120 Community Energy & Emissions Plans > Multiple Adaptation Plans	• Land-use / community form • Local infrastructure • Local engagement • Waste management	• New / adjusted community infrastructure • Restricting land use in key areas • Sidewalks/bike & scooter lanes • Complete compact walkable communities • Transit • EV Strategy • BC Energy Step Code • Local engagement • Energy retrofit programs • Organics diversion • Natural assets • Water management • Extreme climatic event / disaster preparation



Governments set the stage, but it is residents and businesses who reduce their emissions and adapt to climate change through individual choices:

- where you locate/live/work
- heating / cooling
- vehicle & travel choices
- extreme climatic event / disaster preparedness
- landscaping choices
- water management

Source: Community Energy Association

[1]Carbon dioxide equivalent, or CO2e is the standard unit for measuring greenhouse gas emissions. It works by converting all greenhouse gases into an equivalent amount of CO2. For example, Methane (CH4) is a more potent greenhouse gas than CO2, and has a CO2e of 25 over a 100-year time frame. For this report a 100-year time frame is used for CO2e.

Source: cleanbc.gov.bc.ca

Provincial Action

In December 2018, the Province of British Columbia released its CleanBC Climate Plan. The plan reaffirmed the Province's previous target to reduce emissions 80% below 2007 levels by the year 2050, and established a new interim target to reduce emissions 40% by 2030. In 2017, BC's provincial emissions were 0.5% below 2007 levels, which means that in order for BC to meet its emissions reduction target, we need a decrease of 40% from 2007 levels in just ten years.

CleanBC outlines a path to meeting the 2030 targets, outlining a range of actions to meet 75% of the target. These actions include sourcing clean and renewable electricity, incremental increases in building-energy performance in the BC Building Code, tailpipe emissions standards, and measures to reduce emissions from industry. The Province is currently identifying the actions to achieve the remaining 25% of emissions reductions.

CleanBC builds on a history of provincial climate action: The provincial government has enacted laws and regulations to reduce emissions and transition to a low-carbon economy. These include the Climate Change Accountability Act, Carbon Tax Act, Greenhouse Gas Industrial Reporting and Control Act, and Clean Energy Act.

As shown in Figure 6, senior levels of government have recognized the need for strong climate action (particularly on mitigation) and to provide support to local governments.

Local Action - Local Government

More than 120 British Columbia local governments have enacted community climate action plans or Community Energy and Emissions Plans (CEEPs), which outline actions they can take, or are taking, to reduce greenhouse gas emissions. Local governments have varying degrees of influence over different sources of emissions within their boundaries, as shown below.

If local governments are to succeed, they will need leadership and/or support from other levels of government, and commitments from residents and businesses. Further, the outputs of this plan and the targets/actions prioritized for implementation will need to be embedded into relevant policy, operational, budgetary and asset management plans or strategies. Communities and regional districts play an important role in climate mitigation and adaptation. Almost every BC local government has committed to some degree of action under the BC Climate Action Charter.

Across Canada, local and regional governments directly and indirectly influence approximately 60% of the nation's overall energy use and 50% of its GHG emissions. Local governments have three main categories of tools that influence the choices of residents and businesses through changes in land use, transportation, buildings, and solid waste:

Enable choice through **infrastructure** decisions

Shape choice through **policy and regulation**

Support choice through **engagement and outreach**

Local Government Relative Influence over GHG Emissions

High ⟵ ⟶ Low

• Municipal infrastructure, buildings and fleet.	• Transportation network • Land use patterns • Solid waste • Building efficiency standards	• Transportation mode share • Residential and business energy efficiency • Food security	• Air travel • Industrial energy efficiency • Vehicle standards • Energy utilities

Source: BC Climate Leaders Playbook

Local Action - Local Residents

Residents and businesses also have an important role in climate action. Individual choices on where to live and work, how to heat or cool, how to travel, and how to handle household waste all have significant implications for greenhouse gas emissions.

Businesses' decisions regarding operations and future plans (as well as acting as leaders and innovators) also impact community-based emissions. Residential and business decisions are shaped by all levels of government, which is how governments can influence those decisions in a way that addresses environmental issues and climate action.

This plan will necessarily depend on sustained feedback to help residents, businesses and the City of Vernon sort through what their choices are, and how those choices impact the direction of the community and the world.

What we purchase makes a big difference. The emissions associated with creating something and how many greenhouse gases are emitted over the lifetime of an object are important. All our choices add up.

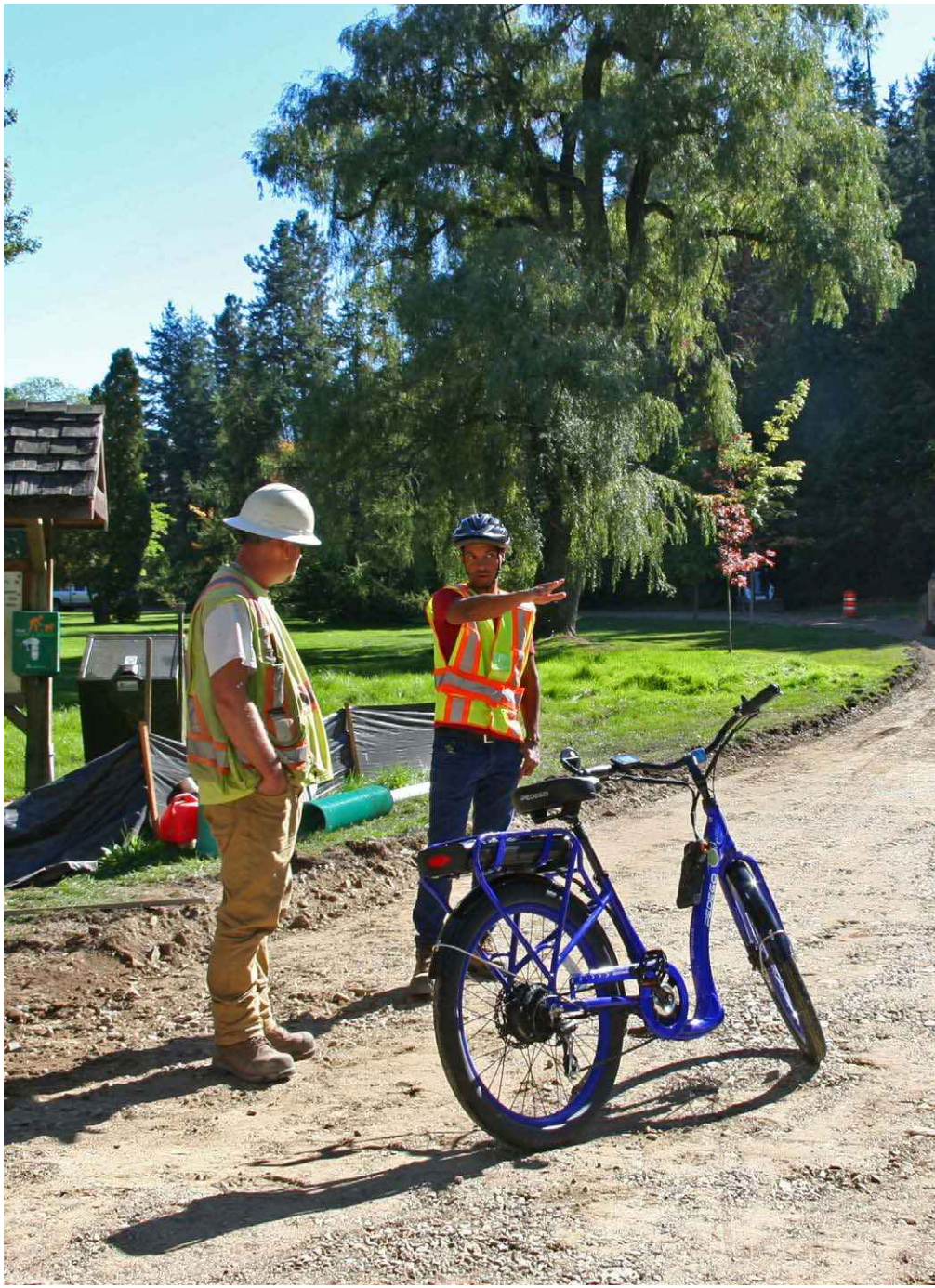
SUMMARY OF PAST CLIMATE ACTION IN VERNON

The City of Vernon has been taking action on climate change for many years. The City has a history and culture of addressing sustainability and climate action. These include creating and using the Climate Action Revolving Fund, the City e-bike fleet, participating in the Climate Action Rebate Incentive Program, the sustainable growth strategy of the OCP, the Environmental Management Areas Strategy, asset management and many other initiatives. This plan builds on all this previous work.

Past Climate Action Initiatives

The City of Vernon has been addressing climate change in many ways. Some examples of this work include:

- BC Climate Action Charter
- Drainage Infrastructure Prioritization Study
- Carbon Tax Revolving Fund
- Flood Hazard Mapping Study
- Official Community Plan
- Environmental Management Areas Strategy
- Parks Master Plan
- Sustainability Grants Program
- Emergency Management Plan
- Attainable Housing Strategy
- Community Wildfire Protection Plan
- Beginning to transition to electric vehicles and bikes
- Creating the Polson Greenway
- Expanding the walking and biking trails
- Transportation Master Plan



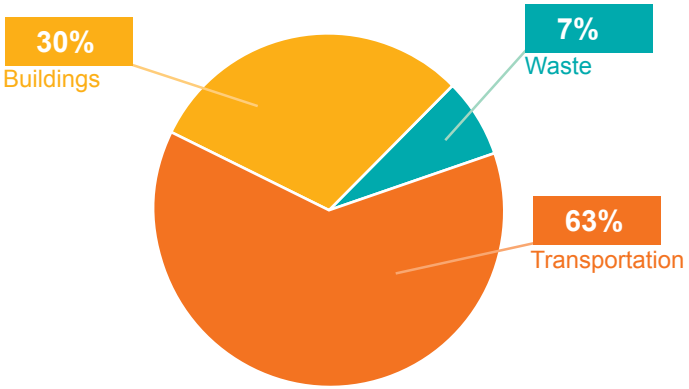
VERNON'S COMMUNITY AND GOVERNMENT OPERATIONS GHG EMISSIONS PROFILES

This section provides an overview of GHG emissions in Vernon. This includes emissions for the community, including government operations (community emissions) and emissions related exclusively to City of Vernon municipal government operations (corporate emissions). Full summaries of each of our GHG emissions profiles are included in Appendix 2 and 3.

Community Profile

Community inventory data was collected for the City of Vernon from 2007 to 2018, but the most recent inventory year that is complete is 2017, so it is the year used to describe Vernon's current energy consumption and greenhouse gas emissions. It is the baseline for modelling and projected emission reduction impacts out to 2050. The community inventory includes emissions from residents, businesses, industry, and emissions from the Corporation of the City of Vernon.

Community Greenhouse Gas Emissions Profile (2017)



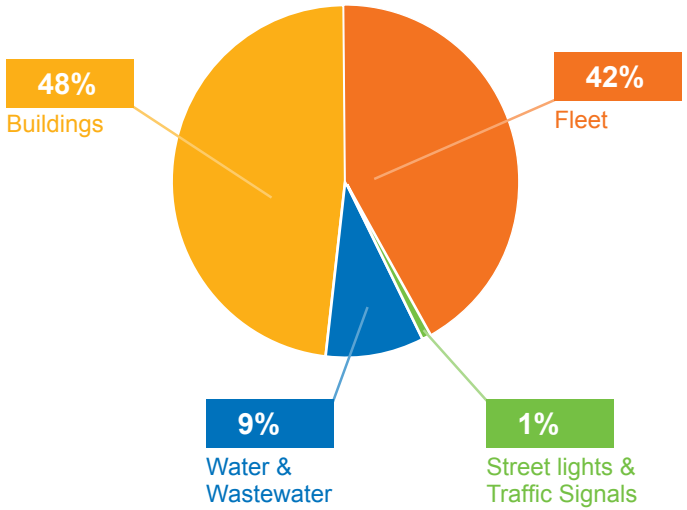
The community inventory includes emissions from residents, businesses, industry, and emissions from the Corporation of the City of Vernon.

Total GHG emissions for the community are 309,407 tonnes of CO2e. The majority of GHG emissions in Vernon come from transportation.

City of Vernon Municipal Government Operations Profile

The five main GHG sources for City of Vernon operations include municipal buildings, corporate fleet, waste and wastewater facilities, and street lights and traffic signals. Total GHG emissions for the corporation are 3,354 tonnes of CO2e. Municipality-owned and operated buildings account for a large portion of GHG emissions, with fleet operations a close second.

City of Vernon Corporate Greenhouse Gas Emissions Profile (2017)



MITIGATION ASSESSMENT

The City engaged the Community Energy Association (CEA) in the spring of 2019 to do a climate mitigation assessment for Vernon. CEA's scope of work included the community's most recent complete GHG emissions inventory (2017), identifying targets for greenhouse gas emission reduction that are informed by the Intergovernmental Panel on Climate Change (IPCC) recommendation to limit warming to 1.5°C, and modelling the impacts of potential high-level actions to reduce greenhouse gas emissions and meet these targets.

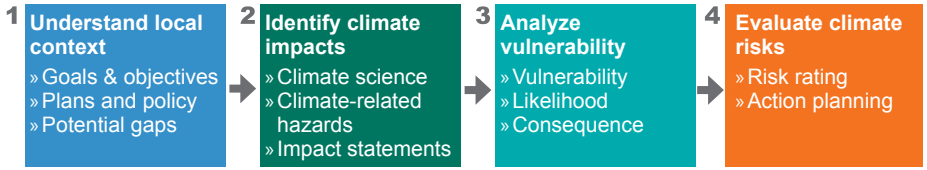
CEA conducted this work throughout the summer and fall of 2019. A final report summarizing the current inventory, targets and actions/impacts is provided in Appendix 3. Developing the targets and actions/impacts included meetings and workshops with City of Vernon staff and the Climate Action Advisory Committee.

On July 7, 2019 staff and the Climate Action Advisory Committee (CAAC) participated in initial meetings to establish a baseline of knowledge including a review of the community's current emissions inventory, and discussions on possible mitigation actions and community targets. A 1.5°C target was presented to Council. In addition, a summary of existing mitigation initiatives was already underway.

A 'backcasting' exercise was conducted to help envision steps to reach the plan's vision and target of net-zero emissions. Outcomes of the backcasting exercise included a summary of mitigation actions supported by attendees for inclusion in the Climate Action Plan.

ADAPTATION ASSESSMENT

Integral Group was contracted to conduct an adaptation assessment with the City of Vernon. The Adaptation Action Planning Report (Appendix 5) shows the process that was used for the assessment:



Step 1 was completed by the consultant team, while impacts, vulnerabilities, and risks to the City and broader community, and preliminary actions to address these risks (Steps 2 through 4), were identified through two workshops with key stakeholders. Workshop participants included City of Vernon staff, the CAAC, representatives from other levels of government and partner organizations. Workshop outcomes were further refined with follow-up input from participants.

Step 2 was completed during Workshop 1, held with City staff, the CAAC, and other key stakeholders. The workshop focused on building awareness of climate projections specific to Vernon and identifying a range of potential impacts to the community from these anticipated changes. Over 100 climate impacts specific to our community were generated, including both challenges, like impacts to winter tourism, and opportunities, like lower heating bills. Following the workshop, these were refined by the project team to reduce redundancy and overlap.

In Step 3, impact statements were prioritized to focus limited adaptation resources on the most effective areas for action. This was done using a vulnerability assessment carried out in Workshop 1.

The first component of Step 4, risk rating, was completed in Workshop 2. Based on the results of the vulnerability assessment, participants assessed those impacts with higher vulnerability for overall risk.

The second component of Step 4, action planning, was also started in Workshop 2. The outcomes were preliminary actions and required further refinement through the development of the Climate Action Plan. During the workshop, the results of the risk assessment were reviewed, discussed and "ground-truthed".

Full details on the methodology and outcomes of Integral's adaptation assessment is provided in Appendix 5.

GLOSSARY

Adaptation
The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to minimize or reduce harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate impacts.

Carbon
Carbon is a naturally abundant, nonmetallic element that occurs in all organic compounds and can be found in all known forms of life. It combines with hydrogen to become a hydrocarbon one of the main components of petroleum and natural gas. When these break down the carbon combines with oxygen to for Carbon Dioxide one of the primary greenhouse gases.

Climate
The prevailing weather conditions including temperature, precipitation, and wind patterns in an area over a long period of time.

Climate Change
Climate change refers to significant changes in global temperature, precipitation, wind patterns and other measures of climate that occur over several decades or longer.

Co-benefit
Co-benefits are generated when an action has benefits beyond the main intent of the action. For example when we walk or ride a bike instead of driving, it reduces our greenhouse gas emissions and also improves air quality and our health.

Community
Inclusive of the individuals, businesses, and industry residing within the municipal boundaries of the City of Vernon.

Extreme Weather
Extreme weather events refer to meteorological conditions that are rare for a particular place and/or time, such as an intense storm or heat wave and are beyond the normal range of activity. They can be the result of sudden and drastic changes in temperature, precipitation or sea-level or they may be the result of a more gradual, but prolonged, shift in temperature or precipitation that is beyond the normal range.

Greenhouse Gas (GHG)
The main greenhouse gases are water vapour (H2O), carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). The effects of human activity on the greenhouse gases is large and gases are increasing faster than they are removed from the atmosphere.

IPCC
The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.

Low-Carbon
Products, solutions, methods encompassing zero to very little GHG contributing sources.

Mitigation
A human intervention to reduce amount of greenhouse gases in our atmosphere.

Net Zero Emissions
Net zero emissions are when human caused emissions of greenhouse gases to the atmosphere are balanced by human caused emission removals, such as storing or sequestering carbon.

Resilience
The ability of systems and communities to absorb the impacts of climate change and maintain an acceptable level of functionality and service.

Appendix 2
Implementation Strategy

City of Vernon
Climate Action Plan
Implementation Strategy

Table of Contents

Focus Area Actions - Explained

The goals and supporting actions detailed in the following sections are detailed as follows:

Type

Actions are characterized as one of the following:

- **Plan**: plans or strategies to either establish new direction, or embed climate readiness into existing plans or strategies
- **Assessment**: analysis or research to gather additional information about potential climate changes, impacts or solutions
- **Policy**: establishing or updating rules and regulations to provide direction for projects, initiatives, or programs, through a policy, guideline or standard
- **Procedure**: develop and implement new operational procedures or adapt existing practices and procedures
- **Program**: develop new programs to advance climate readiness
- **Project**: implement projects to advance climate readiness ranging from operational upgrades to asset improvements, including green and hard infrastructure projects

- **Partnership:** establish new, or strengthen existing partnerships with key stakeholders (both internal and external)
- **Engagement**: conduct public outreach and engagement or improve climate action communications
- **Resourcing**: establish new positions, hire new staff, and/or modify job descriptions or roles

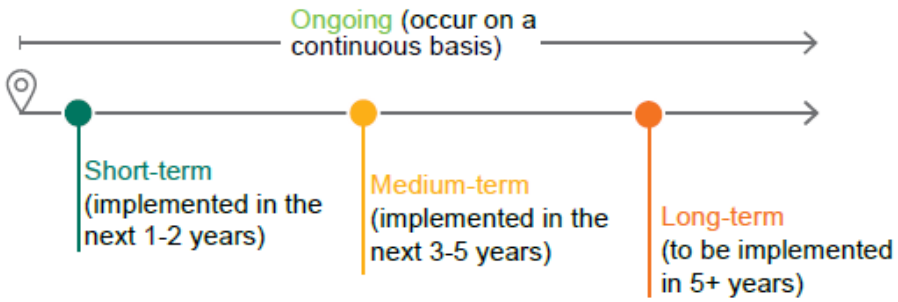
City Lead

Identifies the City department accountable for action.

Other Partners

The key partners to support implementation of the action both within the City of Vernon and external partners.

Timeline
The time by which the action will be initiated/implemented:



Investment
The estimated investment required to implement the action:

- N/A: cost is either unknown, or is negligible and can be covered by existing staff capacity or operating budgets
- **$** - Very Low ($0 -$10,000)
- **$$** - Low ($10,000 – $25,000)
- **$$$** - Medium ($25,000 - $100,000)
- **$$$$** - High ($100,000+)

Funding to cover these investments will come from a variety of sources including City budgets, the Climate Action Revolving Fund and external grants.

Co-Benefits: Many of the actions in the plan have co-benefits or additional positive outcomes. These co-benefits are additional ways that taking action on climate change benefits our community. Types of co-benefits are outlined in the table to the right.
Table Credit: ACT, SFU 2019.

Improves biodiversity/ habitat creation	Improves cost savings	Enhances local autonomy
Optimizes energy savings	Creates jobs	Reduces risk to property values
Reduces waste; optimizes resources	Improves human health & well-being	Reduces congestion
Improves water retention/absorption	Increases carbon storage/sequestration	Reduces burden on grey infrastructure
Improves air and/ or water quality	Reduces extreme temperatures	Captures pollutants
Improves equity /improvements for vulnerable populations	Improves green space/ recreation	Supports clean energy transition
Improves community livability/vitality	Supports local food security initiatives	Improves water and/or energy efficiency

Influence

The actions vary in their variability in their ability to influence GHG emission and adaptation to impacts:

Health & Well-Being

Vision: Vernon is a healthy, equitable and resilient community

Goal 1. All members of the community, especially the most at risk and vulnerable, have equitable access to information, support and resources related to preparing for climate readiness.

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Identify populations vulnerable to climate change and develop strategies to build their adaptive capacity.	Partnership	Short-term	Ongoing	$		Long Range Planning and Sustainability	BC Housing; Ministry for Children and Families; Interior Health (BC Healthy Communities); Social Planning Council of North Okanagan; Okanagan Indian Band, Indigenous Organizations; Community

Details: Using best available climate change projections and impacts (e.g. heat, flood, wildfire and other extreme events), and based on learnings from the COVID-19 pandemic experience, the City will aim to better understand how climate impacts will disproportionately affect vulnerable populations within our city. Gaining better data and understanding about the City's vulnerable populations (e.g. seniors, indigenous, health-compromised, poor, homeless) will help build collaboration to develop needs-based strategies and a coordinated approach to build adaptive capacity to projected climate events over time (e.g. meet the needs of those with mobility challenges during extreme weather events or the homeless during wildfire events).

How will this action influence…		Investment savings	Funding
…GHG emissions? Little influence 	…Adaptation? Moderate influence 	Reducing healthcare costs, and increasing inclusiveness in society	Community Resilience Fund (Public Safety Canada)

What are the co-benefits?

- Improves equity / improvements for vulnerable populations – directly through this action
- Improves community livability / vitality – for more vulnerable sectors of the community
- Improves human health & well-being – for more vulnerable sectors of the community

What can individuals do?

- Donate funds, volunteer, and support organizations and programming for vulnerable populations to build your ability to prepare for and adapt to climate impacts

What can organizations do?

- Financially support, volunteer, and support organizations and programming for vulnerable populations to build your ability to prepare for and adapt to climate impacts
- Provide input on and identify resources for the inclusion of vulnerable populations in emergency planning

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 2: Develop a program to facilitate social connection, information sharing, climate awareness, and climate response activities amongst City residents at the neighborhood scale.	Program	Medium term	Ongoing	$$	Emergency Management	Communications, Long Range Planning and Sustainability	Interior Health (BC Healthy Communities); Social Planning Council of North Okanagan; community groups; neighborhood associations and stratas; School District No. 22

Details: A critical approach to adapting to the impacts of climate change is building coherent and consistent messaging, promoting and supporting social networks, partnering with organizations that support the social infrastructure of our community, and identify the key strategies that help our community transition toward low to zero carbon solutions. The City will partner with organizations and residents to develop programming that helps build awareness (e.g. Climate Ambassadors), encourages and supports social connection, and connect to resources for organizations and residents to transition to low to zero carbon energy and mobility solutions. Working together will help build the overall resilience of Vernon.

Supporting action 1: Utilize the City's communications channels to provide climate and emergency related information (for example, heat response, clean air locations, and food supply)

How will this action influence…		Investment savings	Funding
…GHG emissions? 	…Adaptation? 	Neighbourhood action will reduce and/or avoid costs for everyone	To be determined

What are the co-benefits?

- Improves community livability / vitality – for all residents in the community by helping them become climate ready
- Reduces risk to property values – by helping residents make their properties climate ready
- Improves cost savings – by helping residents transition to low / zero carbon building energy and mobility solutions

What can individuals do?

- Get to know your neighbours and who to call on in an emergency
- Learn who might need help in your neighbourhood in an emergency

What can organizations do?

- Work with other like-minded businesses to learn together how to get ready for emergencies

Infrastructure & Services

Vision: Vernon has infrastructure and services that are safe and resilient to a changing climate and employ low carbon options

Goal 1. Municipal infrastructure is upgraded or adapted to withstand the impacts of a changing climate

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Complete the Flood Hazard Mapping Study and update Flood Construction Level policies and amend bylaws to integrate both adaptation and mitigation considerations.	Assessment	Medium-term	Long-term	$$$	Infrastructure, Long Range Planning and Sustainability	Emergency Management	Province; RDNO; OBWB

Details: The City will continue to work to complete the flood mapping for the City, identifying key flood and landslide risks and risk reduction strategies, that will feed into Vernon's policies, land use planning, and bylaw changes. Updated floodplain construction levels and amending bylaws will help to avoid future damage and development in high-risk flood and landslide areas. This work will also help to identify critical natural assets - foreshores, riparian, wetland areas -that help to retain and absorb water, helping with stormwater management and flood prevention strategies.

How will this action influence…		Investment savings	Funding
…GHG emissions? Little influence 	…Adaptation? High influence 	Avoided damages and costs from flooding over time	Provincial flood mapping and planning funds, administered through UBCM's 2020 Flood Risk Program and similar mechanisms

What are the co-benefits?

- Improves cost savings – by reducing the likelihood of damage to property
- Reduces risk to property values – by decreasing likelihood of impacts
- Improves community livability/vitality – by helping the community withstand climatic extremes

What can individuals do?

- Implement flood mitigation strategies at your home (e.g. sump pumps, backflow prevention valves)

What can organizations do?

- Implement flood mitigation strategies (e.g. sump pumps, backflow prevention valves)
- Update insurance to include flood/landslide risks where necessary

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 2: Update and implement the Community Wildfire Protection Plan in the context of expected future climate conditions.	Plan	Medium-term	Medium-term	$$$	Fire Rescue Services	Building and Licensing; Long Range Planning and Sustainability	PCICS; RDNO; GVWU

Details: The City will update the 2014 Wildfire Protection Plan to include best available wildfire projections under climate scenarios, risk management approaches, and standards that inform land use decisions, policies, and bylaws to prevent and/or reduce future damages and costs incurred. Consider dovetailing active infrastructure pathways and trails with the placement of wildfire corridors or other solutions that safeguard the community.

Supporting action 1: Update the Community Wildfire Protection Plan (CWPP).
Supporting action 2: Continue to work with neighborhood groups and community members to implement the CWPP recommendations at the individual, neighborhood and community scale.
Supporting action 3: Implement FireSmart principles for City-owned infrastructure, parks, properties and work with regional organizations to mobilize these principles more broadly.

How will this action influence…		Investment savings	Funding
…GHG emissions? 	…Adaptation? 	Avoided damages and costs from wildfires over time	UBCM Community Resiliency Investment

What are the co-benefits?

- Improves cost savings – by reducing the likelihood of damage to property
- Reduces risk to property values – by decreasing the likelihood of impacts
- Improves community livability/vitality – by helping the community withstand extreme weathers

What can individuals do?

- Know your hazard level
- Learn about FireSmart and prepare your property
- Consider using FireSmart materials if you do renovations
- If in a high hazard area, make new landscaping plans and plants FireSmart

What can organizations do?

- Know your hazard level
- Assess your property and landscaping for FireSmart
- Consider using FireSmart materials when building
- If in a high hazard area, make new landscaping plans and plants FireSmart

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners
Action 3: Incorporate climate considerations (emission reduction opportunities and adaptations for our future climate) into design, maintenance, and replacement of municipal infrastructure.	Procedure	Short-term	Ongoing	$	Infrastructure Management	Operations; Building Services

Details: The City leads by incorporating resilient, low carbon climate change considerations into all projects. The guidelines will establish that all new infrastructure (e.g. any municipal asset, including buildings and vehicle fleet) must consider opportunities to be resilient to climate impacts over time, including heat, floods, and extreme events, and either meet or exceed BC Energy Step Code standards.

Supporting action 1: Establish a City corporate fleet policy transitioning all vehicle and equipment purchases to low or zero emissions.
Supporting action 2: Measure and improve the energy efficiency of City-owned buildings and facilities.
Supporting action 3: Develop a policy that all new municipal buildings be constructed to net zero readiness and be resilient to impacts of a changing climate.
Supporting action 4: Reduce water inflow to the Vernon Water Reclamation Facility as described in the Liquid Waste Management Plan.
Supporting action 5: Establish guidelines for backup power including investigating the use of renewable energy and storage at critical municipal facilities (e.g. Fire Hall, EOC, City Hall and other municipal buildings).

How will this action influence…		Investment savings	Funding
…GHG emissions? High influence 	…Adaptation? Moderate influence 	Avoided costs over time, including energy savings, fuel savings, operating costs	Infrastructure Canada; Municipal Asset Management Program (MAMP), Disaster Mitigation & Adaptation Fund (DMAF), Municipalities for Climate Innovation Program (MCIP), Smart Cities Challenge (SCC)

What are the co-benefits?

- Improves cost savings – by reducing the likelihood of damage to property, municipal infrastructure, and reducing operating costs
- Reduces risk to property values – by reducing climate risks by helping municipal infrastructure cope with extremes
- Improves community livability/vitality – by helping the community withstand climate challenges

What can individuals do?

- Increase your home's energy efficiency
- Look at your home for climate readiness – can you plant more shade trees, are you ready for a big storm?
- Think about your next vehicle being an electric vehicle

What can organizations do?

- Increase building efficiency, adopt renewable energy, and electrify your fleets

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 4: Review City waste management practices.	Program	Short-term	2022	$$	Long Range Planning and Sustainability; Operations	Procurement	RDNO

Details: The City will review waste management practices to identify key areas where the City can improve, including organics diversion, recycling and waste management.

Supporting action 1: Conduct a review of the City's waste management processes and assess the feasibility of organics diversion at a household level.
Supporting action 2: Share messaging and education opportunities with the RDNO as they work to implement new policies to reduce emissions at the landfill.

How will this action influence…		Investment savings	Funding
…GHG emissions? Moderate influence 	…Adaptation? Little influence 	Extends landfill lifespan, may find value opportunities for organics waste materials	Provincial Waste Management Grants

What are the co-benefits?

- Reduces waste; optimizes resources
- Improves cost savings – by extending the lifespan of the landfill and other assets
- Captures pollutants – by composting organic materials

What can individuals do?

- Compost at home or use a community bin
- Take yard waste to the landfill
- Recycle

What can organizations do?

- Set up composting and recycling for your business and support your staff to recycle and reduce waste

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 5: Update land use bylaws and share information on water conservation.	Partnership	Short-term	Ongoing	$	Long Range Planning and Sustainability	Current Planning Development Services	RDNO

Details: The City will update land use bylaws and share the Regional District's materials to create awareness around water use in preparation for longer, drier summers. This will aim to reduce seasonal pressures on the drinking water supply, reduce the likelihood of late-summer water shortages, while also minimizing the burden on stormwater infrastructure.

Supporting action 1: Update City bylaws (e.g. zoning, subdivision service and landscaping bylaw) to encourage on-site rainwater harvesting, xeriscaping, and green infrastructure (to retain and absorb rainfall on their properties) (e.g. efforts such as water conservation education at the development stage, and promoting on-site storm water management and xeriscaping, or plants that require less watering).
Supporting action 2: Share water conservation materials developed by the RDNO as they implement measures to enhance water conservation.

How will this action influence…		Investment savings	Funding
…GHG emissions? Little influence 	…Adaptation? Moderate influence 	Extend lifespan of water assets and reduce pumping costs	EcoAction Community Funding Program

What are the co-benefits?

- Improves water/energy efficiency – water is saved directly through this action, and pumping and treatment costs are reduced
- Reduces waste; optimizes resources – by conserving water
- Improves cost savings – by reducing pumping and treatment costs, and extending the lifespan of existing assets

What can individuals do?

- Conserve water by using low-flow technologies, rainwater harvesting, and planting low water use trees and plants

What can organizations do?

- Register to be a WaterSmart business/organization
- Conserve water by using low-flow technologies, rainwater harvesting, and planting low water use trees and plants

Goal 2. Natural assets are protected, valued and assist with climate readiness and minimize the need for built infrastructure

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Investigate a Natural Asset Management Inventory and Policy and consider for implementation.	Assessment	Short-term		$$$	Infrastructure Management	Long Range Planning and Sustainability	N/A

Details: The City will take stock of natural assets (such as streams and aquifers, urban forests, wetlands, riparian areas) in Vernon and explore opportunities to protect our existing natural assets and identify opportunities to expand to meet changing demographic and climate demands. Protecting and expanding natural assets is currently best practice for minimizing flood risks and projected heat impacts, while also sequestering carbon and improving community green space. Explore the Municipal Natural Assets Initiative (www.mnai.ca) and ACT (https://act-adapt.org/icabbci) to better understand how to inventory and value the ecological services nature is already providing to Vernon for free (e.g. flood mitigation, infiltration, groundwater regeneration, and carbon sequestration).

How will this action influence…		Investment savings	Funding
…GHG emissions? Little influence 	…Adaptation? Moderate influence 	Natural assets can provide significant benefits at lower cost than built infrastructure.	Disaster Mitigation and Adaptation Fund; Infrastructure Canada/Federation of Canadian Municipalities

What are the co-benefits?

- Improves cost savings - by addressing municipal needs through natural assets which can be much more cost effective than built infrastructure
- Improves health & well-being/safety – by addressing municipal needs (e.g. for flooding mitigation)
- Improves biodiversity – by increasing the number of natural assets

What can individuals do?

- Work with City to protect existing natural assets on your property (e.g. foreshores, wetlands, riparian areas) and use green infrastructure where possible (like a swale instead of a culvert)

What can organizations do?

- Work with City to protect existing natural assets on your property (e.g. foreshores, wetlands, riparian areas) and use green infrastructure where possible

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 2: Implement policy and bylaw changes to increase natural assets, green infrastructure, and permeable areas.	Plan	Medium-term		$	Long Range Planning and Sustainability; Infrastructure Management	Current Planning; Operations	Development Applicants

Details: The protection of natural assets and the advancement of engineered green infrastructure (bioswales, raingardens, urban trees, asphalt alternatives) help minimize flood and heat risks, helping with stormwater and heat management projected to increase into the future. Using best available climate change projections, the City will identify areas projected to be at high risk of urban flooding. This information will be used in stormwater analysis and design, helping to identify key options for reduced flooding and natural asset protection and enhancement. It is important to consider green infrastructure in policies and bylaws that minimize flood impacts, protect against future heat events (via shading of buildings and active transportation corridors) and expand biodiversity. It will be increasingly important to include drought resistant plantings, and consider wildfire and biodiversity effects, appropriate for a changing climate over the coming century.

Supporting action 1: Update asset management protocols to account for climate change risks, identifying ways to include natural assets in order to minimize flood and heat risks, minimize burden on existing stormwater infrastructure, and reduce/avoid costs and emissions of hard infrastructure construction over time (see Asset Management BC).
Supporting action 2: Implement the recommendations from the Drainage Infrastructure Prioritization Study and PIEVC Climate Vulnerability Assessment, including identifying and protecting overland flow routes, and amend bylaws to reflect required changes.
Supporting action 3: Conduct a review of the feasibility of carbon sequestration in Vernon to assist in achieving Climate Action Plan goals.
Supporting action 4: Review and update bylaws that regulate impermeable surfaces in new development.

How will this action influence…		Investment savings	Funding
…GHG emissions? Moderate influence 	…Adaptation? High influence 	Natural assets can provide significant benefits at lower cost than built infrastructure	Infrastructure Canada – Investing in Canada plan programs Municipal Natural Assets Initiative

What are the co-benefits?

- Improves cost savings - by addressing municipal needs through natural assets which can be much more cost effective
- Improves health & well-being/safety – by meeting municipal needs e.g. for flooding mitigation
- Improves biodiversity – by increasing the number of natural assets

What can individuals do?

- Learn how to manage your property to reduce hazard risks (such as wildfire and flood) and save energy costs (e.g. tree shading)
- Learn how to keep water on your property to reduce the impact of intense rainfall (increasing permeable surfaces and rain gardens for example)

What can organizations do?

- Learn how to manage your property to reduce flood risk and save energy costs

Goal 3. Emergency preparedness and response plans are updated for disaster prevention and address climate change hazards

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Develop an Extreme Heat and Clean Air Response Strategy, including designating and retrofitting emergency cooling and clean air facilities.	Plan / Project	Medium-term / Long-term		$$ / $$$	Emergency Management	Long Range Planning and Sustainability; Operations; Building and Licensing	Interior Health; Community groups Social Planning Council of the North Okanagan

Details: The City will proactively respond to the projected impacts of climate change for the community. This includes developing an Extreme Heat and Clean Air Response Strategy that minimizes the negative impacts of extreme heat and wildfire smoke on the community. It will identify and promote public awareness about where and how to access emergency facilities, and in particular ensure supports are available for the most vulnerable neighbourhoods and populations (e.g. elderly, poor, health compromised).

How will this action influence…		Investment savings	Funding
…GHG emissions? Little influence 	…Adaptation? Moderate influence 	Will reduce local healthcare costs	To be determined.

What are the co-benefits?

- Improves human health & well-being/safety – by providing places that are cool and have clean air during times of extremes
- Improves equity/improvements for vulnerable populations – by providing these facilities for all members of the public
- Improves cost savings – by reducing healthcare costs or other strains on society

What can individuals do?

- Learn how to prepare your home for increased heat events and wildfire smoke days and/or what to do and where to be during wildfire smoke events
- Change your air filters regularly when it's smoky
- Know when it's safe to be outside
- Download and use the Vernon Connect app to stay up to date on important events
- Know where you can refill your water bottle around town

What can organizations do?

- Prepare office/facility ventilation systems for cooling during heat events and clean air during wildfire smoke days

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners
Action 2: Update Business Continuity plans for all City Divisions.	Procedure	Short-term	Short-term	$	Emergency Management	All City Divisions

Details: The City will use key insights from the COVID-19 pandemic in order to, where possible, update the Business Continuity Plan. This will minimize impacts on operations and management of critical services, ensuring that water, wastewater and other primary services and facilities are prepared for future emergency disruptions.

How will this action influence…		Investment savings	Funding
…GHG emissions? Little influence 	…Adaptation? Moderate influence 	Will reduce unbudgeted costs for the City in the event of emergency disruptions	Operating budget

What are the co-benefits?

- Improves human health & well-being – by ensuring the City can provide continuity of services in the face of disruptions
- Reduces risk to property values – by preparing for the risks presented by climate change
- Improves cost savings – by preparing for the risks presented by climate change, and reducing the likelihood of infrastructure and properties being damaged

What can individuals do?

- Make sure you know what to do in an emergency
- Educate yourself on response strategies, including emergency supplies, shelter facilities, and evacuation routes

What can organizations do?

- Work with City to create and mobilize awareness around emergency planning, response, and recovery
- Share emergency information with your staff and networks

Governance

Vision: Vernon is a leader in tackling climate change

Goal 1: The climate change lens is used across all government activities including budgeting, procurement, investment and asset management

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Embed considerations from the Climate Action Plan into all existing and new policy and bylaws.	Policy	Ongoing	Ongoing	$	Senior Management Team	All City divisions	RDNO

Details: The City will proactively identify opportunities to integrate actions from the Climate Action Plan and embed them into all decision-making. This helps to reduce community risk and vulnerability to current and projected climate impacts and emissions over time. Doing so, while also aligning climate action with other community priorities, such as health, equity, economy, and biodiversity, will ensure Vernon is a leader in developing comprehensive and coherent municipal strategy, policy, planning and investment decisions that build future-oriented resilience and sustainability.

Supporting action 1: Embed the Visions from each focus area of the Climate Action Plan into the Council Strategic Plan, including reviewing progress annually and updating every five years.
Supporting action 2: Develop a policy and decision-making framework to incorporate greenhouse gas emission reduction and preparing for climate change in municipal decision-making.
Supporting action 3: Update City procurement policy to ensure contractors and suppliers are specifically required to consider incorporating climate change and greenhouse gas emissions in the delivery of products and services.
Supporting action 4: Update the Council report template to integrate consideration and evaluation of the impact of recommendations on Climate Action Plan objectives.
Supporting action 5: Integrate Climate Action Plan objectives into new and existing policies and bylaws where it makes sense.

How will this action influence…		Investment savings	Funding
…GHG emissions? 	…Adaptation? 	Avoided costs over time, specifically the cost to react/respond to climate-related events (e.g. wildfire, drought, flooding) and the year-over-year increase in costs associated with mitigating GHG emissions (e.g. an action that cost $1.00 in 2000 now costs $1.41 in 2020 due to inflation and will only continue to increase every year into the future).	City of Vernon operating budget.

What are the co-benefits?

- Improves community livability/vitality – by ensuring the community is ready for a low carbon future and the future climate.
- Improves cost savings – by realizing savings through reducing energy consumption, and by reducing risks from the future climate.
- Enhances local autonomy – by reducing dependence on outside energy sources, and outside levels of government.

What can individuals do?

- Continue to provide your ideas for climate action in Vernon via engagevernon.ca.

What can organizations do?

- Bring your staff and/or volunteers together to talk about what you can do! Share your ideas through engagevernon.ca.

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners
Action 2: Initiate a 'project charter' program that integrates consideration of climate change in project budgets and objectives for project managers.	Procedure	Short-term	Ongoing	$$	Long Range Planning and Sustainability	All City divisions

Details: The City will initiate a project charter program (or business prioritization framework) that includes evaluation criteria, integrating consideration pf reducing vulnerability to projected impacts and reducing emissions over time alongside other key criteria such as cost and feasibility. Assessing ways to solve other priorities such as community health, economy, equity, and biodiversity should also be considered in the evaluation of decision and budget options and priorities.

Supporting action 1: Integrate climate change considerations into design guidelines for capital projects.

How will this action influence…		Investment savings	Funding
…GHG emissions? High influence 	…Adaptation? High influence 	Avoided costs over time	City of Vernon operations budget

What are the co-benefits?

- Improves cost saving over time – for municipal services by increasing energy efficiency and reducing sensitivity to climate impacts.
- Improves energy savings – for municipal services.
- Reduces burden on wastewater infrastructure – by reducing climate impacts.

What can individuals do?

- Research and understand your options for lower impact and more durable purchases.

What can organizations do?

- Consider creating your own project charter to embed climate criteria into your business.

Goal 2: City Council, management and staff have the knowledge and capacity to ensure delivery of climate-ready municipal operations and services

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners
Action 1: Engage the Senior Management Team to ensure that each division has a mandate to implement its component(s) of the Climate Action Plan.	Resourcing	Ongoing	Ongoing	$	Senior management Team	All City Divisions

Details: The City will harness the momentum from the Climate Action Plan and continue to nurture cross-departmental collaboration and partnership. The Senior Management Team will work together to develop the key features related to successful implementation.

Supporting action 1: Develop an organization-wide climate-ready staff training, communication and awareness program.
Supporting action 2: Develop an internal incentive and accountability program to measure, acknowledge and inspire progress towards the visions and goals of the Climate Action Plan.
Supporting action 3: Improve the uptake of the Climate Action Revolving Fund by reviewing performance and implementing changes.
Supporting action 4: Explore the availability of funding mechanisms such as municipal reserve funds, gas tax funds, and grant fund opportunities in order to implement the Climate Action Plan.
Supporting action 5: Explore the role of technology and innovation in supporting climate action across City operations and the community.

How will this action influence…		Investment savings	Funding
…GHG emissions? 	…Adaptation? 	Avoided costs over time	Operating budget

What are the co-benefits?

- Improves cost savings – by avoiding damages and costs over time, and increasing energy cost savings
- Supports clean energy transition – by ensuring implementation of the Climate Action Plan

What can individuals do? Not applicable

What can organizations do? Not applicable

Goal 3: Vernon community members are aware of climate action plan strategies and have the capacity to use them

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Develop and fund a Climate-Ready Community Communications and Outreach Strategy.	Engagement	Short-term	Ongoing	$$	Long Range Planning and Sustainability	Communications	Emergency Management; Infrastructure Management; Operations

Details: The City will fund and support the development of a communications and outreach strategy to ensure that residents and businesses understand the need to integrate climate considerations and how they can get started. The strategy will focus on community engagement, collaborating and building partnerships for strategic actions, and connecting residents and businesses with information about climate goals and actions that will help the City fulfill its climate Visions.

Supporting action 1: Develop a communications and outreach strategy; host engagement and education events; develop tool for community engagement.
Supporting action 2: Update and enhance the website and engagevernon.ca with relevant climate-related materials for residents and businesses.
Supporting action 3: Define the implementation role of the Climate Ambassadors Program and provide ongoing administrative and programming supports.
Supporting action 4: Continue to work with local teachers and schools on local based curriculum on climate change.
Supporting action 5: Encourage and support neighbourhood based actions.

How will this action influence…		Investment savings	Funding
…GHG emissions? 	…Adaptation? 	Avoided costs over time; long term investment in community action on climate change will save on property damage and local fuel spending	City of Vernon operating budget; Grant Funding

What are the co-benefits?

- Improves community livability/vitality – by helping to ensure that the community is climate-ready
- Improves human health & well-being – by encouraging healthy lifestyles (such as active transportation), and reducing climate impacts
- Reduces risk to property values – by preparing the community for climatic changes

What can individuals do?

- Sign up for information and updates
- Pledge to reduce your emissions
- Get ready for emergencies

What can organizations do?

- Sign up for information and updates
- Encourage your staff to participate in City and community climate action programs
- Build on community events with staff events or pull a team together to challenge another business

Land Use & Transportation

Vision: Vernon is made of compact, complete, climate-ready neighbourhoods connected to low carbon transportation networks

Goal 1. Residential uses are developed in close proximity to commercial services, employment, schools and recreational amenities

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: During the review and update of the Official Community Plan beginning in 2022, integrate all climate risk and vulnerability analyses and emissions data, and objectives, actions and targets from this Climate Action Plan (CAP).	Plan/ Strategy	Short-term	Short-term	$-$$	Long Range Planning & Sustainability	Infrastructure Management; Development Services; Current Planning; Financial Services	RDNO and surrounding municipalities; residents

Details: The City will integrate the Climate Action Plan into the OCP to provide strategic direction for future planning and development. The City will build on the work already being done and our commitment to promote a compact, complete and walkable community. This includes updated policies related to land use and transportation, buildings, ecosystem health, agricultural land protection, food security, updating bylaws and adding new Development Permit Areas for wildfire protection and flooding. The City will continue to work towards the creation of neighbourhood centres, where each neighbourhood is climate-ready, low carbon and resilient to projected impacts, with walking access to as many amenities as possible (for example. groceries, schools, daycares, cafes, parks, playgrounds).

Supporting action 1: Explore additional tools to encourage density and infill redevelopment within existing neighborhood centres. Evaluate and improve existing tools where needed (e.g. reduced Development Cost Charges, Revitalization Tax Exemption bylaws).
Supporting action 2: Investigate reducing parking requirements for transit-friendly developments or implementing parking maximums in the Zoning Bylaw in designated neighbourhood centres.
Supporting action 3: Ensure that metrics are incorporated into the OCP and are quantifiable and reflect the objectives of the Climate Action Plan.

How will this action influence…		Investment savings	Funding
…GHG emissions? High influence 	…Adaptation? High influence 	Considerable cost savings through reducing/avoiding infrastructure and transportation costs	BC Hydro Community Plan Funding

What are the co-benefits?

- Improves community livability / vitality – through creating a more complete, compact community
- Improves human health & well-being – through increasing transportation options

What can individuals do?

- Contribute to the OCP review by participating in public engagement opportunities

What can organizations do?

- Participate in business engagement and community surveys around the OCP review
- Share information with your employees and encourage their participation and attendance at OCP events

Goal 2. Active transportation infrastructure is the first choice to move around Vernon

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Continue to implement the Master Transportation Plan, and update as needed, concurrently with the OCP to integrate and prioritize active transportation investments with the goals of the CAP.	Plan	Short-term	Short-term	$$$	Transportation	Long Range Planning and Sustainability; Infrastructure Management; Operations	RDNO, surrounding municipalities, residents

Details: Since 2009, significant work has been done to shift transportation in Vernon to active transportation and transit. The City has developed the Master Transportation Plan that sets the stage to reduce or eliminate GHG emissions associated with mobility in Vernon. Work is already taking place on active transportation, public transit, and electric vehicle policy. Continuing to implement and update the plan as needed will increase the impact of the Climate Action Plan. Active transportation corridors and networks continue to be built until they are continuous, protected, and pleasant, with all new infrastructure is designed to be climate-ready.

Supporting action 1: Update the Pedestrian and Bicycle Master Plan to align with the visions and targets in the Climate Action Plan, including a monitoring system to measure, evaluate and refine the Active Transportation Network.
Supporting action 2: Accelerate the construction of active transportation infrastructure by increasing the annual investment in projects by a minimum of 25% over current levels.
Supporting action 3: Revise zoning requirements to require and support the development of end of trip active transportation facilities (e.g. showers, bike lockers, storage, charging stations).
Supporting action 4: Continue to conduct public education campaigns to increase awareness and uptake of active transportation and alternative transportation options.
Supporting action 5: Develop design standards for active transportation networks in the Official Community Plan that ensure the experience of active transportation is pleasant and comfortable (e.g. shade trees, benches, bike charging facilities).

How will this action influence…		Investment savings	Funding
…GHG emissions? 	…Adaptation? 	Transit and active transportation actions combined should save $2.5 million/year by 2025	For the active transportation plan – BC Active Transportation Infrastructure Grants Program

What are the co-benefits?

- Improves community livability / vitality – through offering transportation options away from travelling in a vehicle alone
- Reduces congestion – through smart transportation choices that maximise space efficiency
- Improves air and/or water quality – through reduced emissions from vehicles

What can individuals do?

- Participate proactively in the Master Transportation Plan update
- Buy EVs, carpool, bike, and walk
- Plant a tree near the front of your yard or sponsor a boulevard tree
- Eliminate one trip by car a week
- Bike to work

What can organizations do?

- Participate proactively in the planning process, and then install EV chargers, bike racks, and encourage employees and customers to carpool, bike, and walk
- Set up carpool parking or end of trip facilities for biking staff
- Support working from home
- Develop an incentive program for carpooling

Goal 3. The community's transition to low greenhouse gas vehicles, such as electric, is supported

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Create and implement policies and programs that create a network of charging infrastructure to support the transition to electric vehicles.	Program /Project	Ongoing	Continuous	$$$$	Transportation	Long Range Planning and Sustainability Operations	Ministry of Transportation; BC Hydro; BC Transit; Downtown Vernon Association/ Chamber of Commerce; Local businesses

Details: The City will create a phasing plan for EV charging in public areas, looking at partners to work with and external funding sources that could be leveraged**.** Bylaws will be reviewed and updated to require commercial and multi-family buildings to be electric charging ready**.**

Supporting action 1: Increase the use of the public vehicle charging network by installing chargers at municipal facilities and on municipal land.
Supporting action 2: Enable and support the development of private sector charging facilities by preparing easy to follow guidelines and policies for both residential and commercial developments.
Supporting action 3: Update the Zoning Bylaw to require all new commercial and residential buildings to have 100% of parking spaces to be EV ready and review ways to include other e-mobility solutions.

How will this action influence…		Investment savings	Funding
…GHG emissions? 	…Adaptation? 	The use of EVs instead of fossil-fueled vehicles can lead to cost savings for the community. All of the EV actions combined are expected to save $13.5 million per year by 2025	City of Vernon operating budget

What are the co-benefits?

- Supports clean energy transition – by reducing consumption of fossil fuels, and increasing supply of renewables
- Improves cost savings – electric vehicles have lower operating and maintenance costs as compared to fossil-fueled vehicles (for example electricity is less costly than gasoline)
- Improves air and/or water quality – through reduced emissions from vehicles

What can individuals do?

- Purchase electric vehicles, and request public charging facilities

What can organizations do?

- Encourage public charging facilities at or near your business
- Look at offering charging at your business
- Evaluate if your employees need bike charging facilities

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 2: Enable and support the enhancement and expansion of the transit network and alternative mobility options.	Plan	Ongoing	Ongoing	$$	Transportation	Long Range Planning and Sustainability	BC Transit; Local Transit Provider; SD 22; Schools; Residents; transit users

Details: Transit is a key element in reducing vehicle emissions – providing additional routes and more frequent service is key to improving ridership and rider experience. It is important to partner with BC Transit to significantly improve ridership. Improvements for public transit service are a priority. The City will develop and expand innovative mobility initiatives that emerge from the update to the Master Transportation Plan.

Supporting action 1: Work with BC Transit and the local transit provider to expand ridership, address routing concerns, and accelerate electrification of the fleet to meet emission reduction targets.
Supporting action 2: Continue to work to promote bike/scooter/car-sharing/co-op programs in the community.
Supporting action 3: Seek to apply innovative low carbon mobility strategies (active transportation, public transit, car sharing) in the upcoming Mater Transportation Plan update.
Supporting action 4: Partner with School District 22 to engage in School Travel Planning, incorporating safe and active transportation, including exploring the potential to share bussing with BC Transit.

How will this action influence…		Investment savings	Funding
…GHG emissions? 	…Adaptation? 	Transit and active transportation actions combined are expected to save $2.5 million per year by 2025	BC Active Transportation Infrastructure Grants Program

What are the co-benefits?

- Improves equity / improvements for vulnerable populations – by offering lower cost alternatives to solo personal vehicle travel
- Reduces congestion – by reducing need for solo personal vehicle travel, which is space inefficient (i.e. creates traffic congestion)
- Improves community livability / vitality – by offering active alternatives to solo personal vehicle travel

What can individuals do?

- Take the bus!
- Review how you get to work or school – Is there a way to walk, bike or take a bus rather than a car?

What can organizations do?

- Provide end of trip facilities that support active transportation
- Explore enabling flexible start and end times to allow staff to use transit

Ecosystem Health & Biodiversity

Vision: Vernon has protected critical climate-sensitive ecosystems and species and is in return protected by climate resilient nature infrastructure

Goal 1. Climate sensitive ecosystems and species are protected

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Ensure that the Sensitive Ecosystem Inventory identifies climate sensitive ecosystems, habitat, and species based on the latest climate projection data.	Plan	Med-term	Long-term	$$$	Long Range Planning and Sustainability	Infrastructure Management; Parks; Operations	RDNO; Local environmental organizations; Okanagan Collaborative Conservation Program Province

Details: The City will ensure that climate projections are used to identify sensitive ecosystems, habitat and species and optimize ways to protect environmentally sensitive areas over time. This will be done through an inventory of critical ecosystem areas and resilient species that will support the development of natural asset and green infrastructure strategies.

How will this action influence…		Investment savings	Funding
…GHG emissions? 	…Adaptation? 	Natural assets can provide significant benefits to the community at lower cost than wastewater infrastructure	Canada Nature Fund

What are the co-benefits?

- Improves biodiversity/habitat creation –assisting the protection of ecosystems will improve biodiversity, ensuring that ecosystems and species have the ability to cope and adapt under changing climate conditions
- Improves water retention/absorption –protecting and enhancing ecosystems and their services contributes to a community's ability to deal with increased rainfall and heat events, helping to replenish groundwater, sequester carbon, and avoid carbon from land use changes
- Increases carbon sequestration – thriving ecosystems are capable of storing carbon unlike artificial surfaces

What can individuals do?

- Learn about local species of importance (spadefoot toad, great blue heron, rattlesnake)
- Learn about invasive species and how climate change will impact them

What can organizations do?

- Host a lunch and learn on a local species of importance (spadefoot toad, great blue heron, rattlesnake) or about invasive species and how climate change will impact them

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 2: Use the updated Sensitive Ecosystem inventory to strengthen policies to protect, enhance, restore and expand critical climate sensitive areas through the Environmental Management Areas Strategy update.	Policies	Med-term	Long-term	$$	Long Range Planning and Sustainability	Infrastructure Management	RDNO; Local environmental organizations; Okanagan Collaborative Conservation Program

Details: Based on results of the 2013 Environmental Management Areas (EMA) Strategy, the City sets priorities and establishes objectives related to the protection of natural areas, critical ecosystems and environmentally sensitive areas, as well as for air, water and soil quality. The City will ensure that the inventory data from Action 1 informs and is implemented into the EMA and Official Community Plan updates. This will promote zoning and bylaw changes that encourage the protection, rehabilitation and, where possible, expansion of critical climate sensitive areas in Vernon.

How will this action influence…		Investment savings	Funding
…GHG emissions? Little influence 	…Adaptation? Moderate influence 	Natural assets can provide significant benefits to the community at lower cost than built infrastructure	Canada Nature Fund

What are the co-benefits?

- Improves biodiversity/habitat creation – by helping value and thus protect habitats
- Improves water retention/absorption – through conservation of natural assets
- Increases carbon sequestration – through conservation of natural assets

What can individuals do?

- Maintain or enhance unique habitats on your property and plant bee-friendly landscaping
- When hiking or biking in a sensitive area, be sure to stay on the trail

What can organizations do?

- Restore, maintain, and expand natural areas, critical ecosystems and environmentally sensitive areas on your property

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 3: Continue to support public education and engagement opportunities for ecosystems and habitat protection and enhancement.	Engagement	Ongoing	Ongoing	$	Long Range Planning and Sustainability	RDNO School District No. 22	Community groups; residents; schools; neighbourhood associations; teachers

Details: The City will continue to work with partners to build local awareness and opportunities to protect and enhance Vernon's critical ecosystems. The City will build awareness around small grants, incentives, educational resources, and/or outreach activities to local organizations to help support terrestrial and aquatic ecosystem restoration and enhancement projects on both public and private property (for instance, linking relevant projects to the Sustainability Granting program for projects focused on ecosystem and ecological conservation).

How will this action influence…		Investment savings	Funding
…GHG emissions? Little influence 	…Adaptation? Moderate influence 	Natural assets can provide significant benefits to the community at lower cost than built infrastructure	Sustainability Grants

What are the co-benefits?

- Increases biodiversity and habitat creation – by helping value and protect habitats
- Improves community livability/vitality –natural assets help increase a sense of livability/vitality
- Increase health and well-being –natural assets are shown to support mental health

What can individuals do?

- Get involved in ecosystem rehabilitation projects

What can organizations do?

- Support an ecosystem protection project by creating a staff team to fundraise or volunteer for a shoreline clean up or invasive species pull

Goal 2. The urban forest is prepared and protected from climate change impacts and the number of trees is increased

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Protect and expand the urban forest by developing policies and increasing incentives to protect existing trees and plant new trees.	Policy	Short-term	Medium-term	$$	Parks; Operations; Long Range Planning and Sustainability		Residents; homeowners; businesses

Details: The City will update tree management policies and bylaws to ensure that suitable tree species are planted, shade trees are strategically placed, and the overall urban tree canopy is expanded on public and private lands.

Supporting action 1: Update the City's tree protection bylaw and landscaping policies to better protect existing shade trees.
Supporting action 2: Develop boulevard planting standards to expand the network of street trees resilient to the future climate.
Supporting action 3: Expand education around the Tree Voucher Program including information about suitable trees.
Supporting action 4: Update the tree inventory.

How will this action influence…		Investment savings	Funding
…GHG emissions? Moderate influence 	…Adaptation? Moderate influence 	Natural assets can provide significant benefits to the community at lower cost than built infrastructure	Canada Nature Fund; Tree Canada

What are the co-benefits?

- Improves costs savings –planting climate resilient tree species will reduce tree maintenance and management costs by reducing tree damage from extreme weather and tree mortality from pests, diseases and drought
- Improves community livability/vitality –through beautification and reducing extreme temperatures
- Reduces greenhouse gases in the atmosphere - by capturing carbon through tree uptake

What can individuals do?

- Access the City's Tree Voucher program to plant a shade tree in your yard (check the www.vernon.ca/neighbourhood-tree-program)
- Take care of existing trees in your yard

What can organizations do?

- Include shade trees in your landscaping plans

Goal 3. There is ongoing responsiveness to invasive species in a changing climate

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Partner with relevant organizations to collaborate on invasive species and pest vulnerability management.	Partnership	Short-term	Ongoing	$$	Long Range Planning and Sustainability Parks Operations	Invasive Species Society	RDNO; OBWB; OCCP; Province

Details: The City will collaborate with local and regional governments and partners such as the Okanagan and Similkameen Invasive Species Society (http://oasiss.ca) to better understand how climate change will affect invasive species and pests in Vernon, and provide recommendations on how Vernon should detect, prevent and control the spread. Results of this collaboration will be used to update resources and communications materials to enrol residents and other local organizations to help in pest management.

How will this action influence…		Investment savings	Funding
…GHG emissions? No influence 	…Adaptation? Moderate influence 	Pests can cause considerable economic damage (such as to the farming sector)	Canada Nature Fund

What are the co-benefits?

- Supports local food security initiatives –pests can have a very negative effect on food production
- Improves biodiversity/habitat – a balanced ecosystem can help prevent the spread of pests
- Reduces waste; optimizes resources – by helping to ensure that resources are is not wasted through damage to crops

What can individuals do?

- Learn about invasive species and pests and do your part to detect, prevent and control invasive species and pests on your property, in the community and at nearby lakes and streams

What can organizations do?

- Learn about invasive species and pests and do your part to detect, prevent and control invasive species and pests on your property, in the community and at nearby lakes and streams

Buildings & Real Estate

Vision: Vernon has transitioned to zero emissions buildings that are resilient to the impacts of climate change

Goal 1. All new buildings are efficient, use zero carbon energy systems, and are resilient to, and adapted for, projected climate impacts and hazards

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Adopt the BC Energy Step Code and continue to engage and work with developers and the building industry to provide training and build capacity to implement the requirements of the Step Code.	Engagement/ Policy	Ongoing	Short-term	$	Building and Licensing	Long Range Planning and Sustainability	Local builders and developer; CHBA; UDI

Details: In order to meet goals related to implementation of the BC Energy Step Code, the building community needs to understand the new requirements. This goal ensures that the steps, requirements and standards of the new code are understood locally. This will increase buy in and make the permitting process more efficient.

Supporting action 1. Continue conducting consultation with industry and sponsoring training sessions.
Supporting action 2. Develop an incentive program for mid-construction blower door testing on Part 9 Buildings.
Supporting action 3. Adopt the BC Energy Step Code for both Part 9 and Part 3 buildings, and put in place measures to encourage low carbon energy systems following the BC Energy Step Code Best Practices Guide for Local Governments.
Supporting action 4 Identify and create climate ready building guidelines (e.g. building materials, ambient air quality, comfort) and provide this information to the building community and residents.

How will this action influence…		Investment savings	Funding
…GHG emissions? High influence 	…Adaptation? Moderate influence 	New building actions are expected to save $1.7 million per year by 2025	BC Hydro Sustainable Communities Fortis BC

What are the co-benefits?

- Improves cost savings – by reducing energy costs for new buildings

- Improves human health & well-being – through improving efficiency and ventilation in new buildings
- Supports clean energy transition – by making new buildings easier to retrofit with low carbon heating systems

What can individuals do?

- Ask for a home with increased energy efficiency and lower carbon emissions by requesting these items from your builder or realtor

What can organizations do?

- Builders can learn about the Energy Step Code and energy efficiency, then build to steps of the BC Energy Step Code and install low carbon energy systems

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 2: Implement a program for building energy labelling and benchmarking for energy, emissions, and resilience in accordance with the guidance in the BC Energy Step Code.	Policy	Ongoing	Medium-term	$	Buildings and Licensing	Long Range Planning and Sustainability	Local builders and developers; CHBA; UDI; realtors

Details: In coordination with adoption of the BC Energy Step Code, the City consider will implementing energy labelling, as it is important to help the market understand that new buildings (especially dwellings) are being built to energy efficiency standards. Energy benchmarking will also help to ensure that existing commercial buildings reduce their emissions over time.

Supporting action 1. Provide low barrier public and small business friendly information to provide support regarding building energy labelling and program access.

How will this action influence…		Investment savings	Funding
…GHG emissions? High influence 	…Adaptation? Moderate influence 	New building actions are expected to save $1.7 million per year by 2025	BC Hydro Sustainable Communities Implementation Fund

What are the co-benefits?

- Improves cost savings – by reducing energy costs for new buildings
- Improves human health & well-being – through improving efficiency and ventilation in new buildings
- Supports clean energy transition – by making new buildings easier to retrofit with low carbon heating systems

What can individuals do?

- When building a new home tell your builder that you want energy efficiency and to reduce carbon emissions
- Ask for an energy label for your new home
- Look into labeling your existing home

What can organizations do?

- Builders can promote themselves as a leader in building efficient homes
- Share your experience with energy labelling
- If you are building your business look into energy labelling

Goal 2. Existing buildings are retrofitted to be energy efficient, use zero-carbon energy systems, and are resilient to, and adapted for, projected climate change impacts and hazards

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Develop a building retrofit program to support residents to be more resilient to climate change, reduce energy investments over time, and reduce greenhouse gas emissions by improving building efficiency and installing low-carbon energy systems.	Program	Short-term	Continuous	$$$$	Building and Licensing	Long Range Planning and Sustainability	Local trades / contractors building supply and appliance retailers; community groups; Energy Advisors; Chamber of Commerce; Downtown Vernon Association

Details:
Existing buildings will always be the bulk of the housing stock in the community. Without addressing the energy use of these buildings, reaching our targets is very difficult. This is a task that needs to be done in each and every house across the community. The City will support homeowners in their efforts with a retrofit program and sharing incentives and education materials.

Supporting action 1. Promote existing energy efficiency incentive programs.
Supporting action 2. Create a retrofit program targeting residential homes; identify and promote climate ready building standards (e.g. building materials, ambient air quality, comfort, energy efficiency).
Supporting action 3. Work to expand the retrofit program to multi-family buildings and commercial / industrial buildings.
Supporting action 4. Monitor development of the Province's upcoming "retrofit Step Code" (expected in 2024).
Supporting action 5: Lobby the Provincial Government to enact enabling legislation for a PACE (Property Assessed Clean Energy) program, or similar, to allow commercial and residential property owners to borrow and finance funds for energy efficient upgrades (including retrofits, new construction and EV charging infrastructure).
Supporting action 6: Explore financing and funding models to incentivize the installation of air source heat pumps and other low carbon heating and cooling systems for buildings.
Supporting action 7. Provide low barrier public and small business friendly information to provide support regarding building energy retrofits and program access.

How will this action influence…		Investment savings	Funding
…GHG emissions? High influence 	…Adaptation? High influence 	Existing buildings actions are expected to save $2.8 million per year by 2025	Federation of Canadian Municipalities Community Efficiency Financing (FCM CEF); Fortis BC – Climate Action Partners Program; BC Hydro – Sustainable Communities

What are the co-benefits?

- Improves cost savings – by reducing building energy costs
- Improves equity / improvements for vulnerable populations – by reducing energy costs and improving comfort in buildings
- Improves community livability / vitality – by reducing energy costs and improving comfort in buildings

What can individuals do?

- Sign up for the program, and retrofit your home

What can organizations do?

- Retrofit your business to save money, increase comfort and reduce GHG emissions

Economic Development

Vision: Vernon has a diverse economy with businesses and industries that have embraced the opportunities of the low carbon economy and are adapted to the impacts of climate change

Goal 1. Local businesses are ready for climate change

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders and Partners	
Action 1: Establish a resource and information support program to help local businesses, including the tourism sector, get ready for climate change.	Program	Short-term	Continuous	$$	Economic Development and Tourism	Long Range Planning and Sustainability	Tourism stakeholders Chamber of Commerce/Junior Chamber Tourism Commission Downtown Vernon Association

Details:
Connect local businesses with resources and information to help them get ready for climate change by improving energy efficiency, reducing GHG emissions, and improving resilience to climate change impacts. Resources and information will focus on the potential economic benefits and cost savings of climate readiness actions. Identifying critical impacts on our tourism sector and other climate-exposed businesses, and working together to explore additional economic opportunities, will benefit Vernon's local jobs and economy over time.

Supporting action 1: Where appropriate, the City will support the tourism sector as it works to diversify seasonal offerings and adapt to the future climate.
Supporting action 2: Work with the Chamber of Commerce and Downtown Vernon Association to increase understanding of climate change and how and why small businesses can be prepared.
Supporting action 3: Leverage and build on Tourism Vernon's marketing to promote ethical, low carbon, active tourism activities and local experiences.
Supporting action 4: Engage tourism businesses, including hotels and restaurants, in conversations on how to reduce impacts and emissions (such as bike friendly facilities and gear).
Supporting action 5: Promote opportunities for tourists and locals to offset their emissions for their travel.
Supporting action 6: Promote information on public transportation system for tourists (such as taking the bike on the bus to the rail trail trailhead – or science centre, art gallery).
Supporting action 7: Continue to promote downtown Vernon as a walkable tourist destination.

How will this action influence…		Investment savings	Funding
…GHG emissions? Moderate influence 	…Adaptation? Moderate influence 		Community Economic Recovery Infrastructure Program

What are the co-benefits?

- Improves cost savings – by helping businesses avoid damage from climate impacts
- Optimizes energy savings – by reducing energy consumption
- Creates jobs – by helping businesses survive and thrive with a changing climate

What can individuals do?

- Be a local tourist:
- Plan a staycation
- Visit a local tourism business
- Take advantage of local or off-season rates at local tourism destinations
- Visit a restaurant

What can organizations do?

- Visit the City of Vernon website to access resources and information. Utilize the resources to enhance the climate readiness of your business:
  - Develop a business continuity plan
  - Know your risks
  - Assess your air filtration
  - Have a plan to keep you, your staff and customers safe
  - Develop or update your corporate Emergency Management Plan

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders and Partners	
Action 2: Advance a buy local campaign to build the capacity and networks of local businesses, industries and manufacturers.	Program	Short-term	Continuous	$	Economic Development and Tourism		Downtown Vernon Association; Chamber of Commerce; local businesses

Details:
Encouraging consumers to buy local and to support locally responsible, climate-ready businesses, will help to build capacity, networks and resilience among local businesses, industries and manufacturers over time and under changing conditions. Continue to perform the Business Walks survey to elicit key information about the local economy. A buy local campaign could include an awareness campaign promoting the farmer's market and street fairs and initiatives like Downtown Dollars from the Downtown Vernon Association.downtown.

How will this action influence…		Investment savings	Funding
…GHG emissions? 	…Adaptation? 	Supporting local businesses	N/A
What are the co-benefits? • Enhances local autonomy – by supporting local businesses rather than external • Creates jobs – by helping local businesses grow • Increased focus on green business opportunities – by supporting locally responsible, climate-ready businesses			

What can individuals do?

- Support local businesses and buy local
- Participate in rebates and other buy local programming

What can organizations do?

- Participate in buy local campaign, including tracking and monitoring retail sales

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders and Partners	
Action 3: Integrate climate change considerations into economic development planning and decisions.	Plan	Short-term	Short-term	$	Economic Development and Tourism	Long Range Planning and Sustainability	Chamber of Commerce; Downtown Vernon Association

Details: Economic development planning helps to maintain and/or advance economic diversification while addressing key economic risks. The City will work with local businesses, including seasonal sectors, to ensure that strategic actions help local businesses be prepared for disruptive and unexpected events, that seasonal sectors are prepared for the impacts of a changing climate, and that all sectors support improving energy efficiency and reducing GHG emissions.

Supporting action 1: Review tourism programming using a climate lens to provide suitable recreation options for residents and tourists year-round.
Supporting action 2: Work with partner organizations such as the Downtown Vernon Association and Chamber of Commerce to support local businesses to develop Business Continuity plans for emergency preparedness.

How will this action influence…		Investment savings	Funding
…GHG emissions? Moderate influence 	…Adaptation? Moderate influence 	Avoided damages and costs over time by helping local businesses respond to climate change	N/A

What are the co-benefits?

- Creates jobs – by helping local businesses grow
- Increased economic diversity and strength – by ensuring businesses will survive and thrive in the transition
- Increased focus on green business opportunities – by supporting businesses in transitioning to climate-readiness

What can individuals do?

- Support local businesses

What can organizations do?

- Participate in development of Economic Development initiatives or strategies and co-develop climate-ready policies and practices
- Communicate and implement outcomes of the Economic Development Strategy to your employees, clients and partners

Goal 2. Diverse businesses, industry, entrepreneurs, and remote working professionals continue to thrive in Vernon

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Develop a clean energy (e.g. renewable or zero-emissions) and innovation network to support clean tech sector growth, facilitate business-to-business connections and identify top priorities for the sector, educational institutions and the City.	Partnership	Short-term	Short-term	N/A	Economic Development and Tourism		Accelerate Okanagan; Okanagan College; UBCO; Chamber of Commerce

Details: A clean energy and innovation network considers strategies, incentives, and local policies to attract and retain businesses, industries, and manufacturers related to clean tech, that will advance job and economic opportunities within the community, while also aligning with efforts to become a climate-ready community. The Okanagan is the second largest clean-tech and innovation hub in the province. Linking to regional and ongoing clean tech and innovation networks will be crucial in identifying key opportunities to attract and retain clean business.

Supporting action 1: Link into regional economic development networks to coordinate opportunities to advance the clean energy/technology industry in Vernon; include skill gap identification and collaboration with the college to address.
Supporting action 2: Collaborate with the clean energy sector and educational institutions to identify key priorities and skill gaps and competency development, in order to re-train, attract and retain a clean growth workforce.

How will this action influence…		Investment savings	Funding
…GHG emissions? Moderate influence 	…Adaptation? Little influence 	Ensuring Vernon has a thriving business sector in a low carbon future	Community Energy Leadership Program

What are the co-benefits?

- Creates jobs – by helping start new businesses, and helping existing businesses grow
- Enhances local autonomy – by growing local businesses rather than importing
- Supports clean energy transition – by helping create a clean tech sector in Vernon

What can individuals do?

- Seek out greener alternatives for your home
- Get behind a new green technology business

What can organizations do?

- Participate in networking to identify business-to-business and innovation advancement opportunities through regional hubs and networks such as Accelerate Okanagan

Agriculture & Food Security

Vision: Vernon is food secure and has a resilient agriculture and food economy

Goal 1. Residents are food secure and have opportunities for local food production

	Type	Timeline (initiation)	Timeline (completion)	Investment	City Lead	Other Leaders & Partners	
Action 1: Explore the role of the City of Vernon in supporting the food/agriculture system.	Plan	Medium term	Long-term	$$	RDNO	Long Range Planning and Sustainability	ALC; non-profits; community groups; community institutional organizations

Details: The City will work with the RDNO as they work on the food security policies identified in the Regional Growth Strategy. Climate change may bring some positive aspects such as a longer food growing season and increasing local food production. Policies could work to enhance local employment skills development and ensuring existing food crops are resilient to extreme weather events and future climate conditions.

Supporting action 1: Investigate options to support small-scale gardening and local food production, particularly in high density neighbourhoods.
Supporting action 2: Develop policies and programs to permit and facilitate food gardens on public and private lands, including unused public lands.
Supporting action 3: Investigate options to support a resilient local food system.

How will this action influence…		Investment savings	Funding
…GHG emissions? 	…Adaptation? 	Keeping food dollars local	Real Estate Foundation of BC – Grant Program

What are the co-benefits?

- Increase local autonomy – by increasing local food production
- Reduces GHG emissions related to importing food from outside the region
- Reduces waste; optimizes resources – by optimizing the use of local agricultural land
- Improves human health & well-being – as local food is often healthier and less processed (e.g. fresh fruit and vegetables)

What can individuals do?

- Buy local food
- Learn how local food and local food production contribute to personal health and well-being
- Plant a garden/get backyard hens/ grow tomatoes on your patio
- Go to the farmer's market
- Do a farm stand tour
- Subscribe to a Community Supported Agriculture box

What can organizations do?

- Buy local food or use caterers that do
- Use and/or lease available space (including underutilized lands) to grow food

Appendix 3
Mitigation Assessment and Community GHG Report

City of Vernon Greenhouse Gas Emissions: Modelling and Reduction Targets Report

February 2020

CITY OF Vernon

Community Energy Association

Executive Summary

The City of Vernon is taking action to protect the community, improve quality of life and reduce local and global risks associated with a changing climate. Vernon has signed on to the BC Climate Action Charter, committing to working towards reduced carbon operations, measuring community emissions, and creating a complete, compact community. Provincial legislation requires that each local government establish targets, plans and strategies to do their part to mitigate climate change.

The purpose of this Modelling & Targets Report for the City of Vernon is to inform the municipality of their most recent complete emissions inventory (2017), identify targets for greenhouse gas emission reduction that are informed by the Intergovernmental Panel on Climate Change (IPCC) recommendation to limit warming to 1.5°C, and model the impacts of potential (categorical) high-level actions to reduce greenhouse gas emissions and meet these targets.

Vernon's current greenhouse gas emissions inventory (2017) is dominated by mobility fuels, natural gas consumption for heating in buildings, and emissions associated with waste decomposition at the regional landfill.

Vernon's Climate Action Advisory Committee has proposed Council adopt targets aligned with the IPCC recommendation, which aims to limit global warming to no more than 1.5 degree Celsius by stopping production of carbon emissions by 2050. To support Vernon reaching these targets a staged approach is proposed and it is recommended that the City adopt the following interim targets;

- 23% below 2017 levels by 2025
- 52% below 2017 levels by 2030
- 76% below 2017 levels by 2040

The City of Vernon contracted Community Energy Association to propose a suite of categorized high-level mitigation actions that can be implemented to reduce greenhouse gas emissions and model the impacts of actions on those emissions. The actions are categorized into the following 'Big Moves':

- Decarbonize transportation (passenger transportation as well as fleet, medium- and heavy-duty vehicles)
- Shifting travel beyond the car to active and assisted transportation
- Eliminate the impact of new buildings
- Retrofit Existing Buildings
- Divert and compost organic waste
- Waste diversion and re-use

In addition to this climate mitigation assessment, the City of Vernon engaged Integral Group to complete a similar activity to assess climate adaptation opportunities. A summary of their assessment is provided in a separate report. It is the intent of the forthcoming Climate Action Plan to identify synergies between the proposed mitigation and adaptation actions, undertake public engagement on the actions and draft a final plan that will identify goals and their implementation within the framework of climate resilience.

Table of Contents

Section 1: Introduction

The City of Vernon is in the process of developing a Climate Action Plan (CAP). The plan will combine mitigation and adaptation actions, taking opportunities to integrate these into low-carbon resilience strategies where feasible. The plan will identify both corporate and community-wide actions.

In 2018, the City established a Climate Action Advisory Committee (CAAC) (formerly the Climate Action Task Force) to assist in developing the CAP. The mandate of the Committee is to provide recommendations to Council on policies and strategic initiatives that relate to climate change mitigation and adaptation; information is brought by staff to the Committee for review.

In advance of the Climate Action Plan development, the City conducted separate climate mitigation and adaptation identification and evaluation processes. The mitigation process intended to result in community wide emissions inventories and future Green House Gas (GHG) emissions projections and reduction targets based upon specific actions. Community Energy Association presents this summary report which details Vernon's current emissions (2017), proposes emission reduction targets for 2025, 2030, and 2040 in order for Vernon to achieve their 2050 objective of 100% emission reductions, and summarizes (at a high-level) the mitigation actions the City and the community must complete at a minimum to achieve significant emission reduction impacts.

This document is a companion document to the *Interim Community Energy and Emissions Inventory and Projections Report – DRAFT*, which was submitted to the City in October 2019 and included in this report as Appendix 2.

Section 2: Current Community Emissions

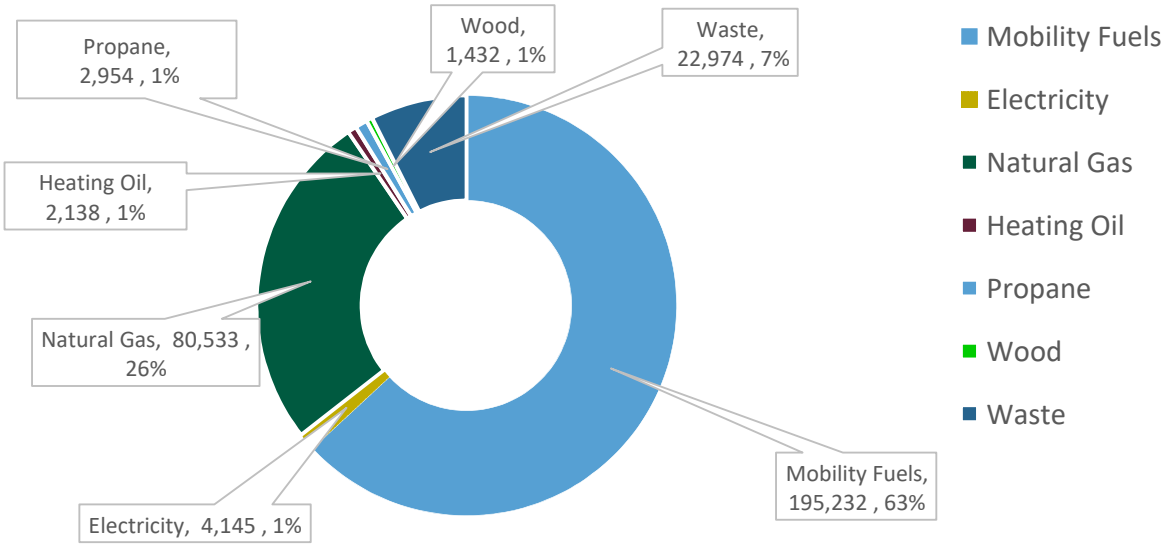
Community inventory data was collected for the City of Vernon from 2007 to 2018, but the most recent inventory year that is complete is 2017, so it is the year used to describe Vernon's current energy consumption and greenhouse gas emissions and is the baseline for modelling and projected emission reduction impacts out to 2050. The community inventory includes emissions both from residents, businesses, industry, and emissions from the corporation of the City of Vernon. The specifics of the emissions from the corporation of the City of Vernon are provided in a separate report.

In 2017 in Vernon:

- Energy consumption for the community is estimated at 6,219,942 GJ
- Greenhouse gas emissions for the community are estimated at 309,407 tonnes of CO_2e
- Energy expenditures are estimated for the community at $167,205,092

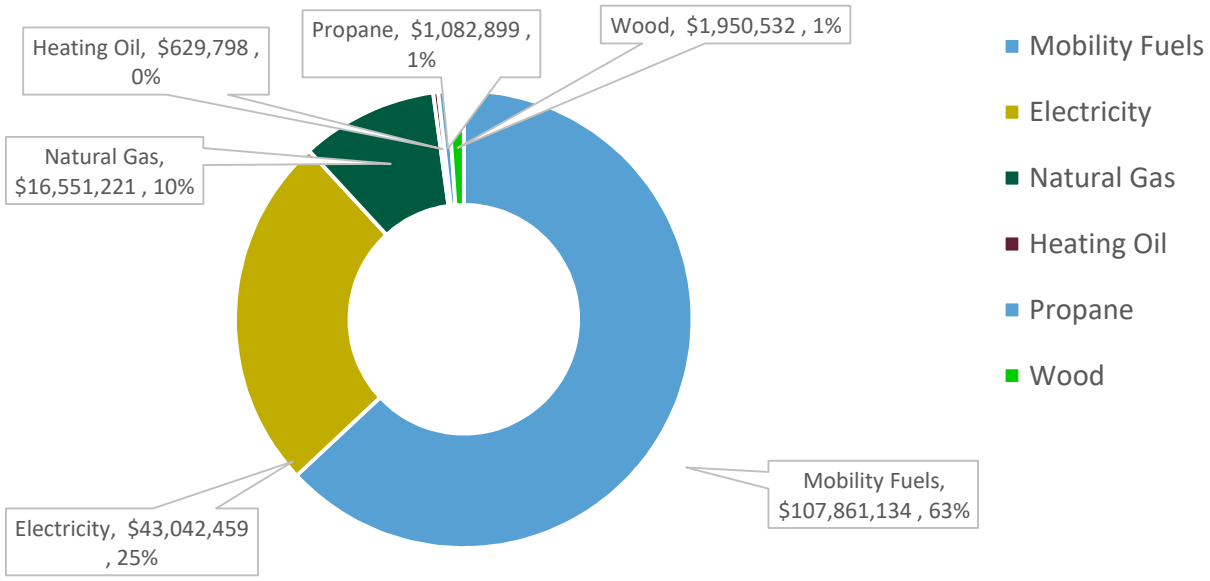
The vast majority of community greenhouse gas emissions in Vernon are due to mobility fuels (gasoline & diesel), and natural gas (Figure 1). Waste contributes a small proportion of greenhouse gas emissions, while electricity, heating oil, propane, and wood are almost negligible. Greenhouse gas emissions split by fuel type and waste are shown in Figure 1.

FIGURE 1 – GHG EMISSIONS BY FUELS AND WASTE IN 2017



Estimated energy expenditures by fuel type only (waste is not included) are shown in Figure 2. Mobility fuels and electricity are the two largest expenditures, with natural gas costs third.

FIGURE 2 – ENERGY EXPENDITURES BY FUEL IN 2017, %



The following two figures show the proportion of energy consumption, greenhouse gas emissions, and estimated energy expenditures for 2017. Figure 3 shows the split between fuel types and waste, while Figure 4 shows the split by sector; buildings, transportation, waste.

FIGURE 3 – PROPORTION OF ENERGY, EMISSIONS, AND COST BY FUELS AND WASTE IN 2017, %

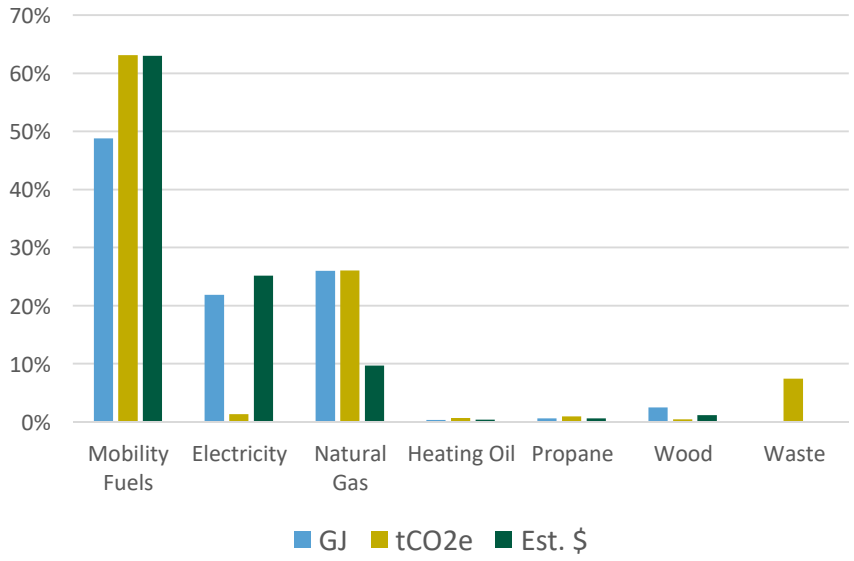
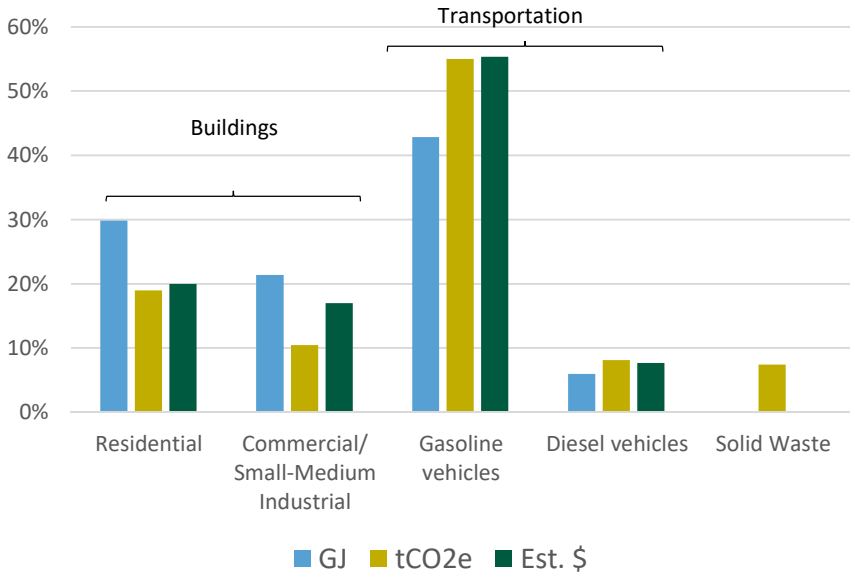


FIGURE 4 – PROPORTION OF ENERGY, EMISSIONS, AND COST BY SECTOR IN 2017, %



The City of Vernon's influence on greenhouse gas emission sources spans the spectrum of direct control to little influence as described in the image below, thus collaboration with community stakeholders both in the City of Vernon and across the region will be necessary for the City to achieve its targets as detailed in Section 3.

Direct Control	Direct Influence	Indirect Influence	Little Influence
Municipal infrastructure, buildings & fleet	Transportation network Land use patterns Solid waste Building efficiency standards	Transportation mode share Residential & business energy efficiency Food security	Air travel Industrial energy efficiency Vehicle standards Energy utilities

2.1 Forecasted Emissions in Business As Usual Scenario

If Vernon were to take no additional action with respect to climate mitigation, greenhouse gas emissions would increase as per Business As Usual (no change to current policies, regulations, behaviours). Figure 5 and Figure 6 depict the projected energy use by fuel type (electricity, gasoline, diesel, natural gas, etc.) and sector (buildings and transportation) for the Business As Usual Scenarios respectively. The sharp decrease in the use of mobility fuels post 2040 is due to the already enacted provincial legislation surrounding electric vehicles and the associated reduction in emissions that would ensue.

FIGURE 5. FORECASTED ENERGY USE BY FUEL FOR BUSINESS AS USUAL SCENARIO (GJ/YR)

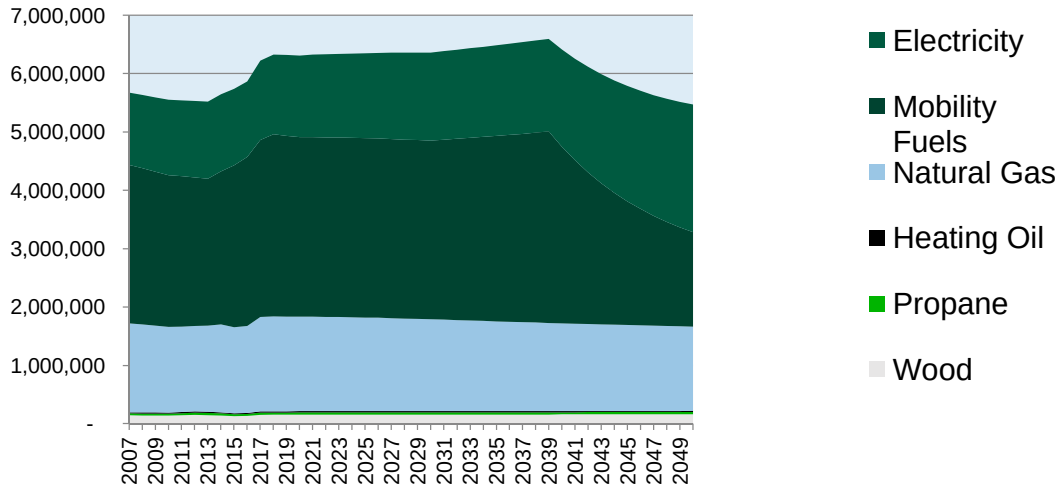
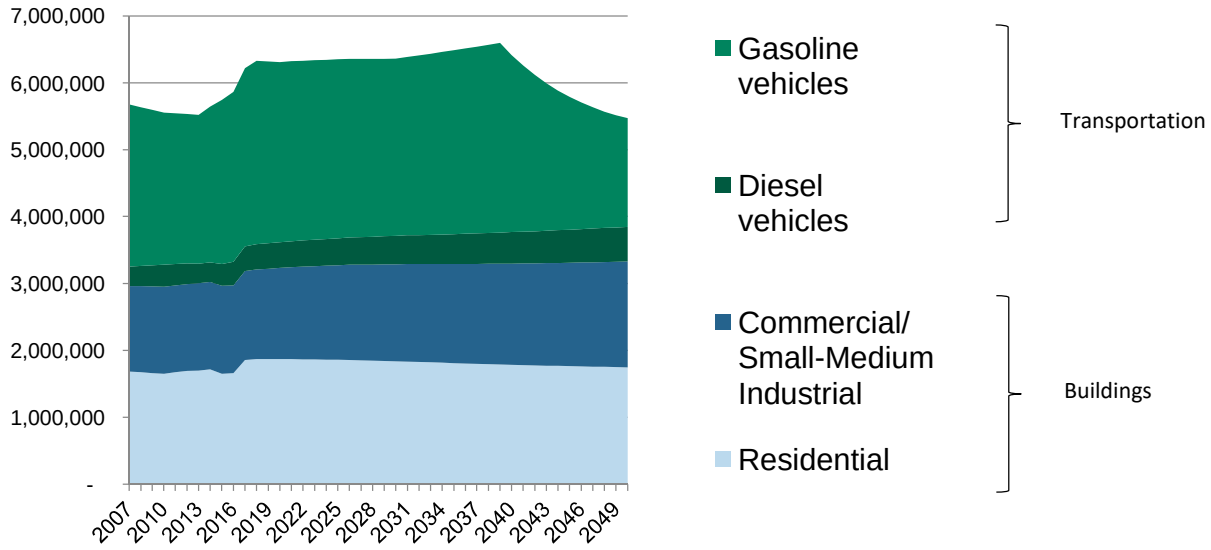


FIGURE 6. FORECASTED ENERGY USE BY SECTOR FOR BUSINESS AS USUAL SCENARIO (GJ/YR)



Section 3: Targets – How We Get There

To reach the targets proposed in this section will take ongoing commitment by the City of Vernon over the next 30 years. The City will need to collaborate extensively with other governmental and non-governmental partners to promote the necessary per capita reductions in greenhouse gas emissions within the City of Vernon:

23% below 2017 levels by **2025**

- Equivalent to 29 % per capita reduction*

52% below 2017 levels by **2030**

- Equivalent to 58% per capita reduction

76% below 2017 levels by **2040**

- Equivalent to 81% per capita reduction

100% below 2017 levels by **2050**

- Equivalent to 100% per capita reduction

Every person and business reducing emissions 3% every year from 2017 to 2050 on average

**per capita = per person*

Reaching the targets will take ongoing commitment, with the biggest changes in how people get around the community. More cycling, walking, e-mobility and transit can make a significant difference in the short term, as it reduces the use of vehicles (and the emissions they create). The biggest shift will be to electric vehicles over time as existing internal combustion engine (ICE) vehicles are replaced. This will reduce emissions (BC Hydro electricity is 98% emission-free) and save 90% of the fuel cost since ICE are only about 20% efficient and gasoline is twice as expensive as electricity for the same amount of energy. How we heat our homes will change as well. New buildings will be much more efficient (80% more efficient as compared to today's base building code by 2030) and we will shift heating from natural gas to electricity through the uptake of electric air source heat pumps (Fortis BC has recently committed to 15% renewable natural gas content by 2030, however our models do not take this into account at this time). In addition, we will stop wasting our food scraps and yard trimmings, instead of being buried in a landfill, they will be collected for compost. Vernon is situated within the Regional District of North Okanagan, the RDNO already operates a gas capture and utilization system at the regional landfill, we assume capture efficiency and utilization will continue to increase.

The timeline in Table 1 details some of the changes necessary to meet the targets, further specifics will be identified through the development of the Climate Action Plan. The City has an important role to play in setting up the infrastructure required, establishing policy/regulation, creating or promoting incentives to drive the change, and supporting the transition to a low carbon community through education and outreach to citizens.

TABLE 1. TARGETS & ACTIONS TO MEET 2050 100% GREENHOUSE GAS EMISSION REDUCTION TARGET

2020	0% per-capita GHG reduction	▪ Targets and actions committed to (development of Climate Action Plan). ▪ Infrastructure starting to be deployed. ▪ Policies identified and developed to shape future growth. ▪ Budget approvals process for further policy and infrastructure development initiated
2025	29% per-capita GHG reduction	▪ EVs or low carbon fuels comprise 20% of vehicles on the road (5,700) ▪ 20% of existing homes complete home-energy retrofits - air tightness, insulation upgrades (interior and exterior), high-efficiency windows and doors (4,300) ▪ Step Code adopted and being implemented, all new buildings constructed 20% more efficient than baseline (Baseline will be Energy Step Code relevant Step). ▪ 75% of new homes implement low carbon energy systems
2030	58% per-capita GHG reduction	▪ EVs or low carbon fuels comprise 50% of vehicles on the road (15,000) ▪ 50% of buildings have low carbon energy systems (12,500 private dwellings and half of all businesses)
2040	81% per-capita GHG reduction	▪ EVs or low carbon fuels comprise 75% of vehicles on the road (25,000) ▪ 75% of buildings using low carbon energy systems (21,000 private dwellings and ¾ of all businesses) ▪ No organics from Vernon go to the landfill
2050	100% per-capita GHG reduction	▪ 100% of vehicles and buildings use low carbon energy systems ▪ 100% of landfill emissions collected and utilised

The citizens and businesses of Vernon have the biggest role. The change depends on their individual choices about how to get around, where to live, and how to handle food waste and yard material. To engage citizens and businesses, the forthcoming Climate Action Plan will necessarily depend on ongoing, sustained engagement to help residents understand their choices and how those choices impact the direction of the community.

3.1 Pathway for Greenhouse Gas Emission Reductions

CEA's modelling tool was used to project the impact of the actions detailed in the following section (Figure 7). Acknowledging current local government powers, there are limitations as to the authority the City has over community-wide greenhouse gas emissions. This fact, paired with emerging technologies and almost certain innovations in the clean energy sector over the next decade means that many of the solutions to achieve 1.5 degrees will not be available to the City in the near future. With the actions and levers currently within the authority of the City, it is not possible to meet 100% of the target for 2050 (grey coloured area of 'remaining emissions' in Figure 7). CEA's model is intentionally conservative which is based on currently available technology (e.g. nothing is available today for electrification of commercial fleets which encompass medium and heavy-duty vehicles) and existing adoption rates for low-emission technologies (for example, electric air source heat pumps, and electric vehicles). Adoption rates will increase in the future as communities and their residents move through the technology adoption lifecycle, where rates peak at percentages greater than 50. These realities (low adoption rates, available technology), paired with the City's current resources (staff, policies,

authority, and most importantly limited budget) inform the projections. Access to significant funding, and ability to influence community-wide emissions through policy could significantly improve the ability of local governments to influence their community-wide emissions, however that this plan reflects the present-day scenario.

The 'remaining emissions' are detailed by fuel type (Figure 9) and sector (Figure 10), the 'remaining emissions' in both figures are those that are above the 1.5 °C target (Draft) red line of each figure. By fuel type, the remaining greenhouse gas emissions in 2050 include natural gas and mobility fuels (gasoline and diesel) primarily. By sector type, the remaining greenhouse gas emissions in 2050 include transportation and buildings (residential and commercial/small – medium industrial). Commercial buildings are Part 3 non-residential buildings, including offices, commercial retail outlets, government buildings (such as schools and hospitals), other institutions and industrial facilities. This category also includes any other customers that do not fall under the residential subsectors.

Though not included in the model, CEA anticipates the 'remaining emissions' can be addressed in the future as per the following;

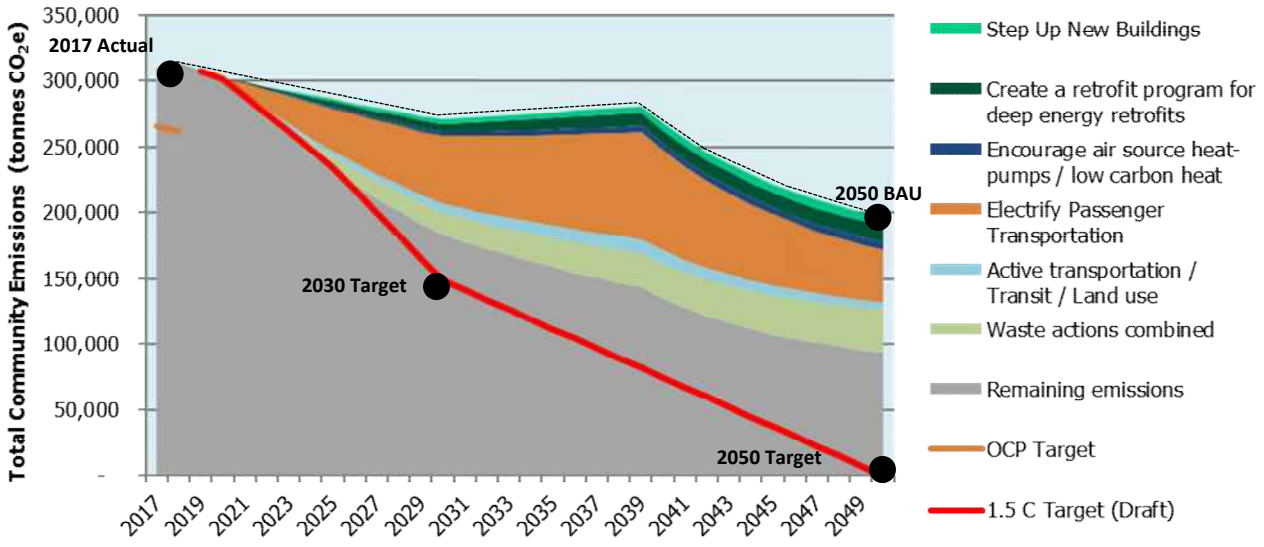
- Accelerated adoption of electric air source heat pumps as economies of scale are realized and they achieve capital and operating cost parity with natural gas furnaces
- The City of Vernon is provided more authority with respect to requiring existing building retrofits opportunities. The CleanBC Plan does indicate an intent to explore increased authority around energy efficiency in retrofits.
- Electricity or low-carbon fuelled options for medium and heavy-duty vehicles are commercialized
- Sequestering and/or offsetting greenhouse gas emissions
- The City accelerates the pace of implementation, which would require a significant increase of resources (human and financial). Any increase in the rate of implementation or resources allocated will mostly likely result in the City achieving greenhouse gas emission reductions in excess of our current forecasts. This requires early and active engagement with regional partners (e.g. Kal Tire, or other prominent organizations) who can help to support and demonstrate leadership.
- New Provincial and Federal programs that we cannot yet anticipate. A past example of a successful program that would be beneficial to the City of Vernon was the Province's Live Smart BC Efficiency Incentive Program.

Given this, we recommend the City of Vernon update and re-evaluate the model and impact of actions every 3-5 years.

With respect to the current modelling depicted in Figure 7, the Business As Usual forecast (black dotted line) indicates a 37% reduction in greenhouse gas emissions from 2017 would be achieved by 2050 if Vernon adhered only to existing policies and regulations and if no additional resources were allocated to accelerate implementation. The model (Figure 7) shows that working towards the proposed targets will require change primarily in the areas of retrofitting (building envelope energy efficiency initiatives including exterior insulation wrap, increased interior insulation, and high-efficiency windows & doors), and electrifying heating for buildings,

diverting organic waste from landfills, increasing landfill gas capture efficiency and electrifying passenger transportation.

FIGURE 7. ANTICIPATED GREENHOUSE GAS EMISSION REDUCTIONS FOR BIG MOVES



Section 4: Actions & Impacts

By undertaking the actions summarized below (high-level), the City can affect reductions in future community energy consumption and greenhouse gas emissions. The following figures show the projected emissions reductions that can result from the actions in this plan, compared to forecasted emissions in a scenario of Business As Usual.

FIGURE 8. BUSINESS AS USUAL SCENARIO - GREENHOUSE GAS EMISSIONS BY FUELS & WASTE (TONNES/YEAR)

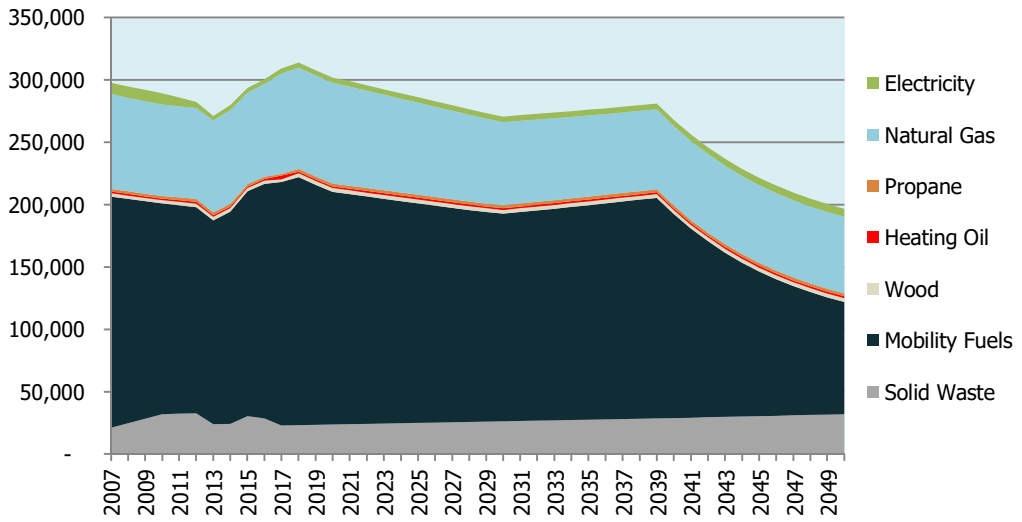


FIGURE 9. IMPACTS OF MITIGATION ACTIONS – GREENHOUSE GAS EMISSIONS BY FUELS & WASTE (TONNES/YEAR)

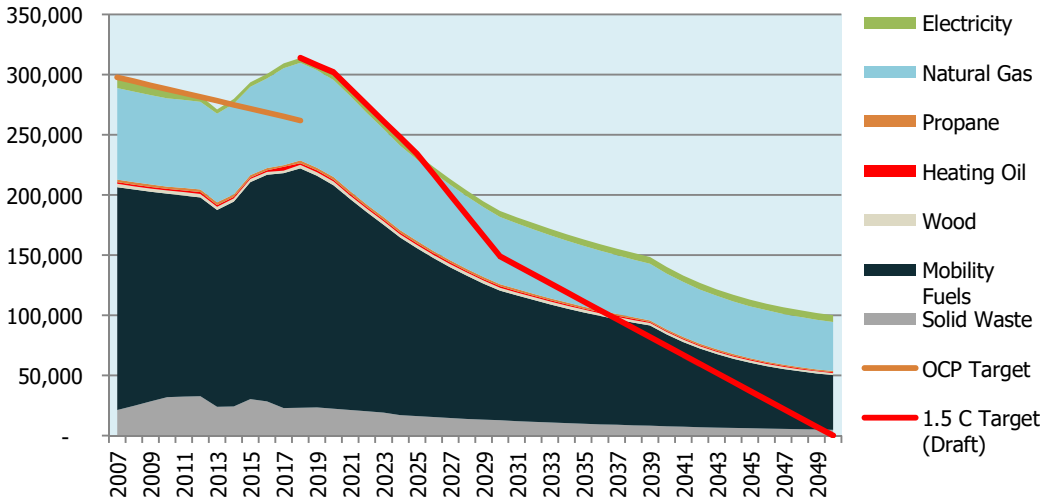
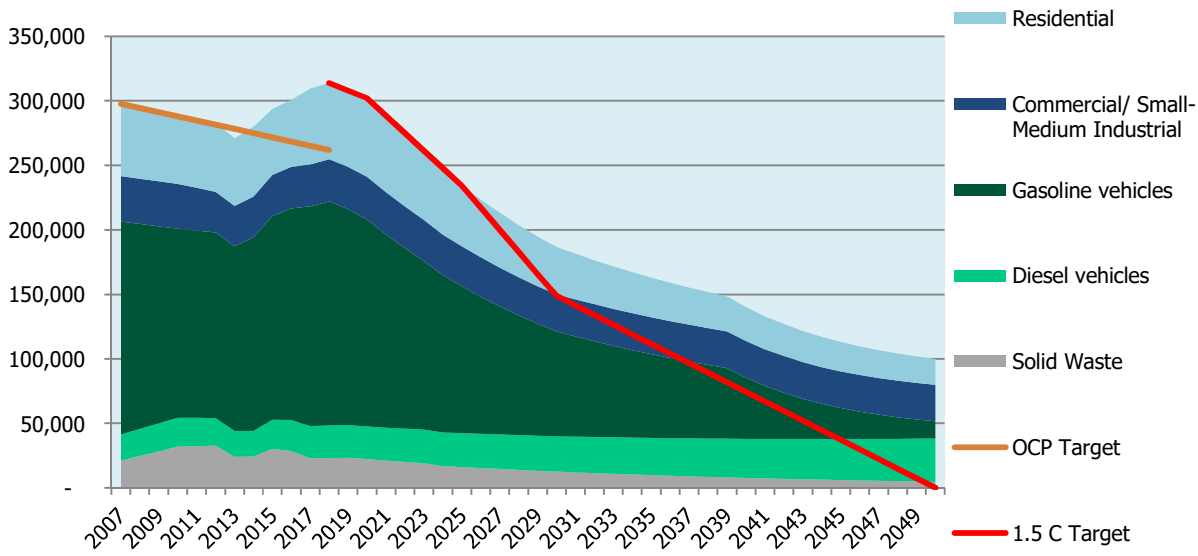


FIGURE 10. IMPACTS OF MITIGATION ACTIONS – GREENHOUSE GAS EMISSIONS BY SECTOR (TONNES/YEAR)



Through CEA's decades of experience in helping BC local governments with energy & emissions, and deep thinking on what strategies a community should focus on to achieve maximum emissions reductions, CEA has developed a suite of Big Moves for local governments to focus on if they have indicated their intent to limit emissions aligned with the IPCC 1.5-degree target. In Vernon, the Climate Action Advisory Committee has proposed adoption of the 1.5-degree target to Council. Given this context, the following is a summary of seven Big Moves that Vernon will need to undertake, at a minimum, to reduce emissions to meet the targets summarized in Section 3. A detailed implementation plan (timing, budget, policies, etc.) including supplementary actions that will address 'remaining emissions' as per our modelling, will be detailed in the forthcoming Climate Action Plan.

The Big Moves are characterized by sector;

- **Zero Emission Transportation**
  - Decarbonize passenger transportation as well as commercial fleets and medium- and heavy-duty vehicles. Vernon can do this by;
    - Adopting ZEV-ready building requirements
    - Designing, funding (leveraging grants, etc.) and building a public ZEV charging network
    - Incentivizing zero-emission car sharing and ride-hailing
  - Change travel modes to those beyond the car via active and assisted transportation (such as walking cycling and public transit).
    Vernon can do this by;
    - Building safe routes for walking, cycling, and other forms of zero emission mobility (e-bikes, scooters, where appropriate low-speed EV's such as golf carts)
    - Support a zero-emission transit network
    - Identify and reduce policy barriers to e-mobility on demand, such as electric scooter and/or electric bike sharing
- **Zero Emission Buildings**

- Construct new buildings so that all the community's new buildings are energy efficient and operate exclusively with zero-emission energy sources.
  Vernon can do this by:
  - Adopt the BC Energy Step Code and supplement with incentives targeting zero-emissions heating systems, i.e. electric air source heat pumps
  - Require building energy labelling and benchmarking (to inform consumers and encourage real-estate market value in energy efficiency).
  - Coordinate outreach and education to support the building industry through the transition to high-performance low carbon construction
- Retrofit Existing Buildings so that the community's existing buildings are energy efficient and generate zero greenhouse gas emissions in operation.
  Vernon can do this by:
  - Exploring financing and incentive mechanisms to enable deep energy retrofits
  - Reduce barriers to heat pump adoption
  - Coordinate with the Province in the development of retrofit requirements

- **Organic Waste**
  - Divert Organic Waste from the landfill and compost organic material; use or sell compost materials.
  - Capture Value from Waste, landfill gas collection and flare, or ideally re-use. Vernon will need to coordinate with the Regional District of North Okanagan as they do not have direct influence or control over the landfill.

The following table (Table 2) summarizes the suite of actions detailed above and provides initial estimates of their impacts specific to the City of Vernon (modelling completed using Vernon's 2017 emissions inventory) for 2025, 2030, 2040 and 2050. As compared to Table 1 which summarizes what must be done to achieve the targets, Table 2 summarizes the impacts that will be observed based on the initial mitigations identified as part of this report.

TABLE 2. SUMMARY OF PROPOSED MITIGATION ACTIONS & IMPACTS

Sector	Zero Emission Transportation		Zero Emissions Buildings			Organic Waste Re-Use
Big Move	**Decarbonize Transportation (Personal, Industrial, Commercial, Corporate Fleets)**	**Shift Beyond the Car: Active & Assisted Transportation**	**Retrofit Existing Residential Buildings**	**Eliminate the impact of new buildings (residential and commercial)**	**Electric Air Source Heat Pump Adoption (applicable to existing buildings only)**	**Divert Organic Waste & Improve landfill gas collection efficiency** **Capture Value from Waste**
2020 – 2025						
Expected Emissions Reductions by 2025 **(54, 104 tonnes CO_2 reduction between 2020 – 2025)**	31,805 CO_2e	4,294 CO_2e	3,654 CO_2e	1,907 CO_2e	1,700 CO_2e	10,744 CO_2e
Necessary Implementation	5,700 EVs or 20% of corporate fleet	300 single-occupancy vehicle kilometers travelled shifted per person, (2.5 % reduction of total vehicle km travelled per person)	4,300 dwellings	All new buildings must be 20% more efficient that baseline (Baseline is the current adopted Step as per the BC Energy Step Code) 75% of new builds use low carbon energy systems	1,300 dwellings	34% reduction in organics going to landfill 10% improvement in landfill gas collection efficiency
Percentage of total expected emission reductions (this period).	58%	8%	7%	4%	3%	20%
2025 - 2030						
Expected Emissions Reductions **(87,171 tonnes CO_2e reduction between 2025 - 2030)**	51,004 CO_2e	6,886 CO_2e	6,256 CO_2e	3,347 CO_2e	2,985 CO_2e	16,693 CO_2e

Necessary Implementation	14,400 EVs, 48% of fleet	600 single-occupancy vehicle kilometers travelled shifted per person (5.1% reduction of total vehicle km travelled per person)	7,600 dwellings	All new buildings must be 20% more efficient that baseline (Baseline is the current adopted Step as per the BC Energy Step Code – the baseline will be a higher step than the one adopted for 2020-2025) 75% of new builds use low carbon energy systems	2,300 dwellings	51% reduction in organics to landfill and 10% improvement in landfill gas collection efficiency (if not achieved previously)
Percentage of total expected emission reductions (This period).	59%	8%	7%	4%	3%	19%
2030 – 2040						
Expected Emissions Reductions **(132,808 tonnes CO_2e reduction between 2030 - 2040)**	75,965 CO_2e	10,256 CO_2e	10,145 CO_2e	5,428 CO_2e	4,840 CO_2e	26,174 CO_2e
Necessary Implementation	24,100 EVs, 73% of fleet	1,200 single-occupancy vehicle kilometers travelled shifted per person. (10.5% reduction of total vehicle km travelled per person)	12,300 dwellings	All new buildings must be 20% more efficient that baseline (Baseline is the current adopted Step as per the BC Energy Step Code – the baseline will be a higher step than the one adopted for 2025-2030)	3,700 dwellings	73% reduction in organics going to landfill and 10% improvement in landfill gas collection efficiency (if not achieved previously)

Percentage of total expected emission reductions (This period)	57%	8%	7%	4%	4%	20%
2040 - 2050						
Expected Emissions Reductions **(103,236 tonnes CO_2e reduction between 2040 - 2050)**	39,456 CO_2e	5,327 CO_2e	12,311 CO_2e	6,587 CO_2e	5,873 CO_2e	33,682 CO_2e
Necessary Implementation	34,100 EVs, 94% of fleet	1,900 single-occupancy vehicle kilometers travelled shifted per person. (16.1% reduction of total vehicle km travelled per person)	14,900 dwellings	All new buildings must be 20% more efficient that baseline (Baseline will be the current adopted Step as per the BC Energy Step Code)	4,500 dwellings	85% reduction in organics going to landfill, and 10% improvement in landfill gas collection efficiency (if not achieved previously)
Percentage of total emission reductions (this period)	38%	5%	12%	6%	6%	33%

Appendix 1: Energy & Emission Inventory Data – Community Level

This appendix contains the raw energy & emissions community inventory data for each complete each year available (either partial or complete) back to 2007.

2018				
Sector	Subsector Description	Fuel	GJ	t CO_2e
On-Road Transportation	Mostly private	Gasoline	2,743,393	173,632
On-Road Transportation	Mostly commercial / institutional	Diesel Fuel	376,298	25,213
2017				
Sector	Subsector Description	Fuel	GJ	t CO2e
On-Road Transportation	Mostly private	Gasoline	2,664,292	170,181
On-Road Transportation	Mostly commercial / institutional	Diesel Fuel	370,459	25,050
Solid Waste	Community Solid Waste	Solid Waste	0	22,974
Buildings	Residential	Electricity	636,227	1,885
Buildings	Residential	Natural Gas	1,008,495	50,297
Buildings	Residential	Propane	36,956	2,260
Buildings	Residential	Heating Oil	20,942	1,432
Buildings	Residential	Wood	154,804	2,954
Buildings	Commercial/Small-Medium Industrial	Electricity	721,509	2,138
2016				
Sector	Subsector Description	Fuel	GJ	t CO2e
On-Road Transportation	Mostly private	Gasoline	2,543,355	163,955
On-Road Transportation	Mostly commercial / institutional	Diesel Fuel	352,929	24,085
Solid Waste	Community Solid Waste	Solid Waste		28,603
Buildings	Residential	Electricity	585,461	1,735
Buildings	Residential	Natural Gas	891,335	44,454
Buildings	Residential	Propane	32,089	1,962
Buildings	Residential	Heating Oil	18,183	1,243
Buildings	Residential	Wood	134,415	2,565
Buildings	Commercial/Small-Medium Industrial	Electricity	708,121	2,098
2015				
Sector	Subsector Description	Fuel	GJ	t CO2e
On-Road Transportation	Mostly private	Gasoline	2,448,661	157,851
On-Road Transportation	Mostly commercial / institutional	Diesel Fuel	329,222	22,467
Solid Waste	Community Solid Waste	Solid Waste	0	30,386
Buildings	Residential	Electricity	592,325	1,755
Buildings	Residential	Natural Gas	876,903	43,734
Buildings	Residential	Propane	31,673	1,937
Buildings	Residential	Heating Oil	17,948	1,227
Buildings	Residential	Wood	132,675	2,531
Buildings	Commercial/Small-Medium Industrial	Electricity	718,401	2,129
2014				
Sector	Subsector Description	Fuel	GJ	t CO2e
On-Road Transportation	Mostly private	Gasoline	2,328,830	150,126

On-Road Transportation	Mostly commercial / institutional	Diesel Fuel	290,669	19,836
Solid Waste	Community Solid Waste	Solid Waste	0	24,363
Buildings	Residential	Electricity	598,985	1,775
Buildings	Residential	Natural Gas	921,030	45,935
Buildings	Residential	Propane	34,291	2,097
Buildings	Residential	Heating Oil	19,431	1,329
Buildings	Residential	Wood	143,641	2,741
Buildings	Commercial/Small-Medium Industrial	Electricity	719,825	2,133
2013				
Sector	Subsector Description	Fuel	GJ	t CO2e
On-Road Transportation	Mostly private	Gasoline	2,222,805	143,291
On-Road Transportation	Mostly commercial / institutional	Diesel Fuel	293,066	20,000
Solid Waste	Community Solid Waste	Solid Waste	0	24,109
Buildings	Residential	Electricity	599,841	1,666
Buildings	Residential	Natural Gas	894,235	44,598
Buildings	Commercial/Small-Medium Industrial	Electricity	722,976	2,008
2012				
Sector	Subsector Description	Fuel	GJ	t CO2e
On-Road Transportation	Mostly private	Gasoline	2,230,627	143,795
On-Road Transportation	Mostly commercial / institutional	Diesel Fuel	313,803	21,415
Solid Waste	Community Solid Waste	Solid Waste	0	32,692
Buildings	Residential	Electricity	593,516	2,253
Buildings	Residential	Natural Gas	886,101	44,193
Buildings	Residential	Propane	36,956	2,260
Buildings	Residential	Heating Oil	20,942	1,432
Buildings	Residential	Wood	154,804	2,954
Buildings	Commercial/Small-Medium Industrial	Electricity	719,249	2,730
2010				
Sector	Subsector Description	Fuel	GJ	t CO2e
On-Road Transportation	Mostly private	Gasoline	2,273,862	146,582
On-Road Transportation	Mostly commercial / institutional	Diesel Fuel	328,263	22,402
Solid Waste	Community Solid Waste	Solid Waste	0	32,035
Buildings	Residential	Electricity	588,106	4,139
Buildings	Residential	Natural Gas	872,832	43,531
Buildings	Residential	Propane	33,225	2,032
Buildings	Residential	Heating Oil	18,827	1,287
Buildings	Residential	Wood	139,176	2,655
Buildings	Commercial/Small-Medium Industrial	Electricity	703,374	4,950
Buildings	Commercial/Small-Medium Industrial	Natural Gas	595,431	29,696
2007				
Sector	Subsector Description	Fuel	GJ	t CO2e
On-Road Transportation	Mostly private	Gasoline	2,424,703	165,046
On-Road Transportation	Mostly commercial / institutional	Diesel Fuel	287,668	20,232
Solid Waste	Community Solid Waste	Solid Waste	0	21,205
Buildings	Residential	Electricity	565,777	4,086
Buildings	Residential	Natural Gas	918,712	45,819

Buildings	Residential	Propane	34,518	2,111
Buildings	Residential	Heating Oil	19,560	1,337
Buildings	Residential	Wood	144,593	2,759
Buildings	Commercial/Small-Medium Industrial	Electricity	674,318	4,870
Buildings	Commercial/Small-Medium Industrial	Natural Gas	605,846	30,215

Appendix 2: Vernon Interim Community Energy & Emissions Inventory and Projections Report

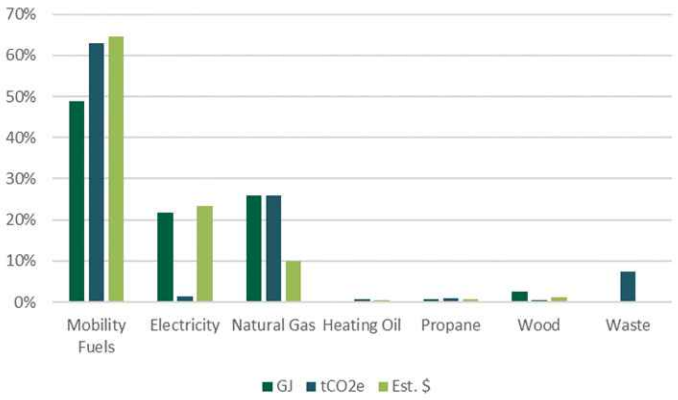
Summary

This document provides inventory emissions data from 2007 to 2018 for the City of Vernon, and identifies Business As Usual (BAU) projections for emissions through to 2050. It has been created to help the City with understanding its current energy and emissions situation, in light of the draft community GHG reduction targets congruent with the IPCC's recent 1.5°C report.

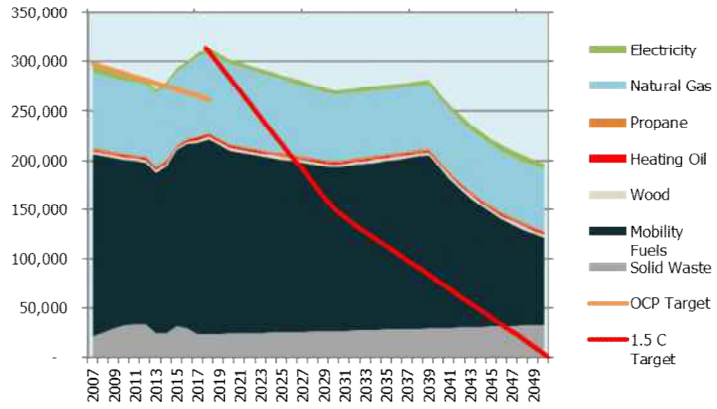
In 2017, the last year with a mainly complete inventory for the whole community:

- Energy consumption is estimated at 6,219,942 GJ
- GHG emissions are estimated 309,407 tonnes of CO_2e
- Energy expenditures are estimated at $167,205,092

How this splits by fuels is shown in the adjacent figure.



Inventory data from 2007 to 2018 was collected, with BAU projections through to 2050. These are shown in the adjacent figure, split by fuel, and compared to the current OCP target (12% below 2007 levels by 2018), and 1.5°C targets (45% reduction from 2010 levels by 2030, 100% reduction by 2050).



From 2007 to 2018, Vernon's emissions rose by 5%, due mostly to increases in mobility fuel and natural gas usage. This indicates that there is significant work necessary if the City wishes to meet the 1.5°C 2030 target.

The next step will be to develop specific actions to meet these sectoral targets, in order to meet the overall GHG targets.

Introduction

This short document describes inventory data from 2007 to 2018 for the City of Vernon, and Business As Usual (BAU) projections through to 2050. It has been created to help the City with understanding its current energy and emissions situation, in light of the interest by the Climate Action Advisory Committee for Vernon to meet community GHG reduction targets congruent with the IPCC's recent 1.5°C report.

Current Energy Consumption & Emissions

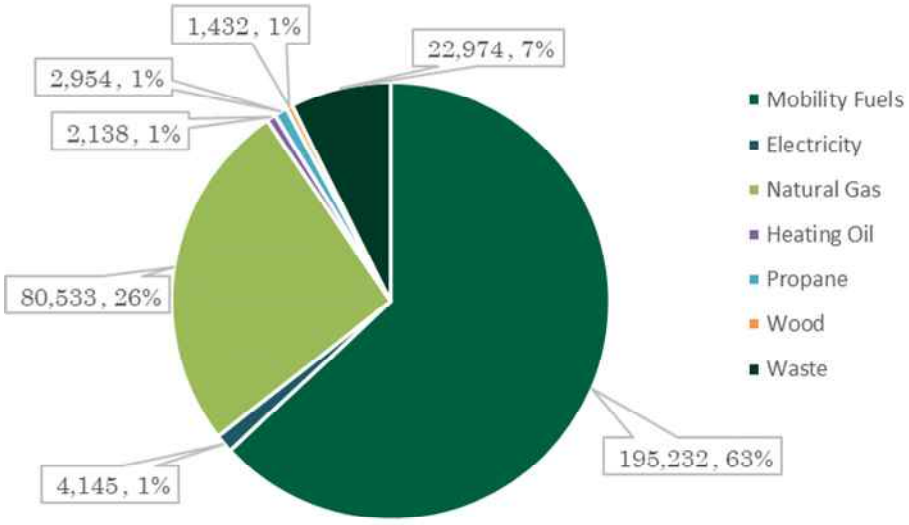
Inventory data was collected from 2007 to 2018, but the most recent inventory year that is almost fully complete is 2017, so that is used to describe Vernon's current energy consumption and emissions.

In 2017:

- Energy consumption is estimated at 6,219,942 GJ
- GHG emissions are estimated at 309,407 tonnes of CO_2e
- Energy expenditures are estimated at $167,205,092

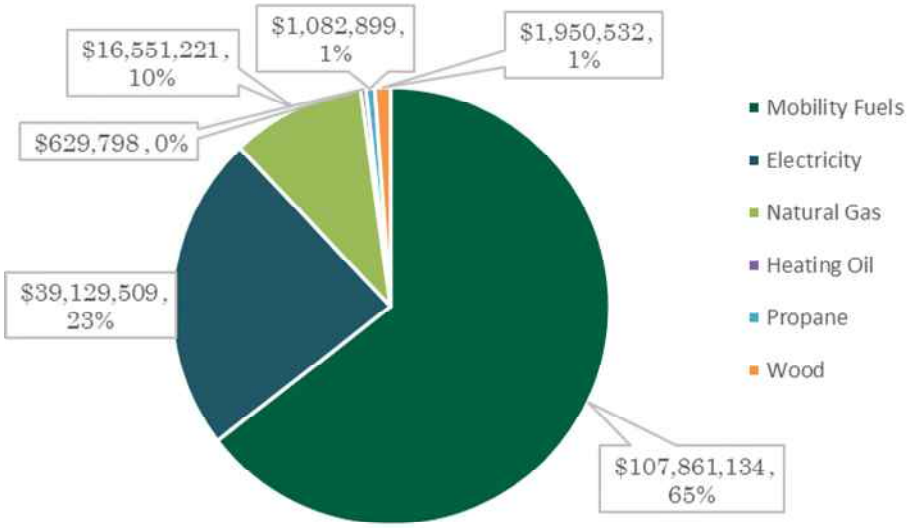
GHG emissions split by fuels and waste are shown in Figure **1**. The vast majority of emissions are due to mobility fuels (gasoline & diesel), and natural gas. Waste contributes a small proportion, while electricity, heating oil, propane, and wood are almost negligible.

FIGURE 11 – GHG EMISSIONS BY FUELS AND WASTE IN 2017



Estimated energy expenditures by fuel are shown in Figure **2**. Mobility fuels and electricity are the two largest, but natural gas is also significant. It is interesting that although electricity has very low GHG emissions, due to the amount of money spent on it, consumption of it should also be tackled in order to manage community energy expenditures. Electricity produces very few GHGs per unit of energy, but is quite an expensive fuel.

FIGURE 12 – ENERGY EXPENDITURES BY FUEL IN 2017, %



The following two figures conveniently show the proportion of energy consumption, emissions, and estimated energy expenditures all together. The first figure shows the split between fuels and waste, the second by sector.

FIGURE 13 – PROPORTION OF ENERGY, EMISSIONS, AND COST BY FUELS AND WASTE IN 2017, %

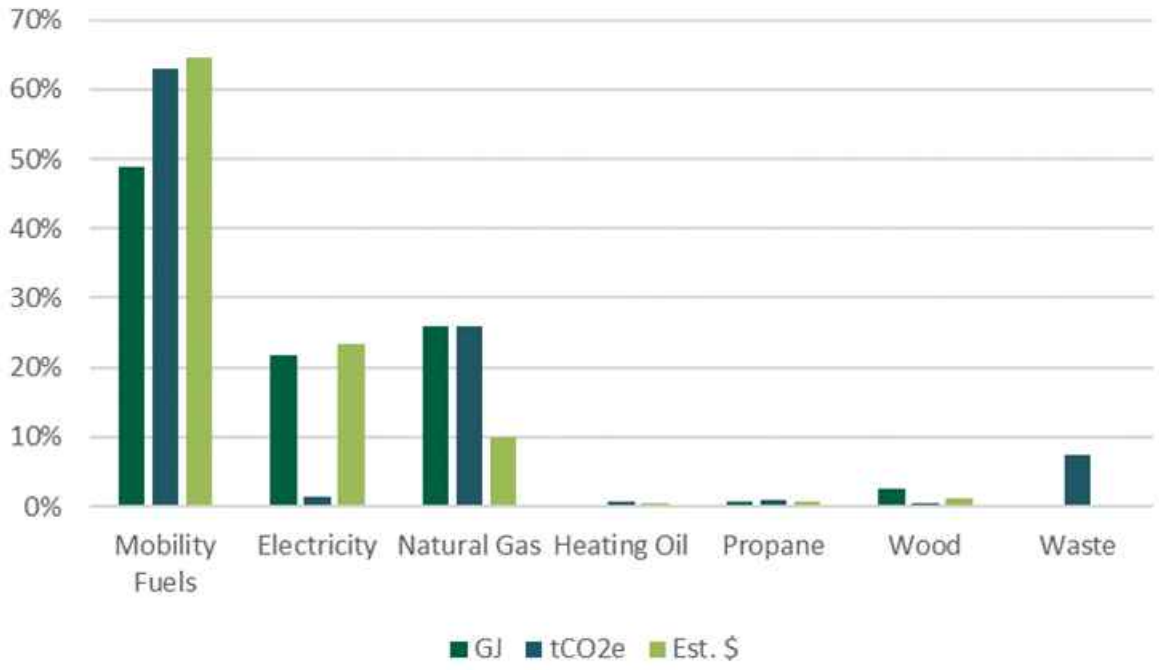
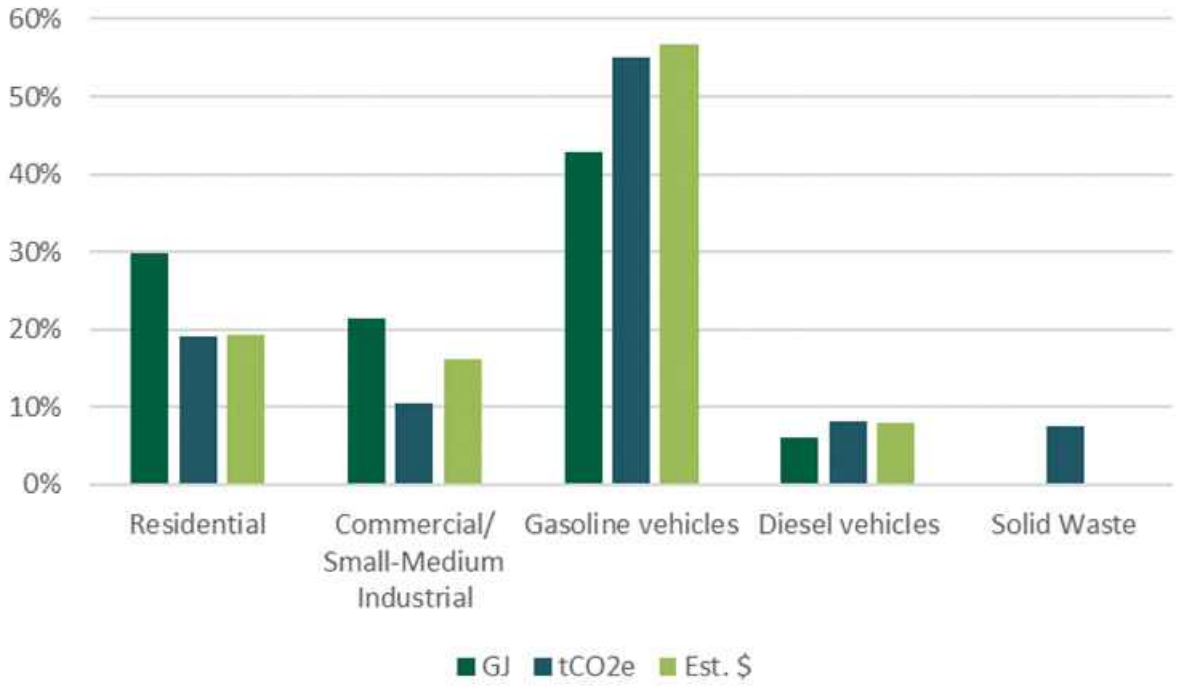


FIGURE 14 – PROPORTION OF ENERGY, EMISSIONS, AND COST BY SECTOR IN 2017, %



All sectors should be tackled, although emissions from waste contribute the lowest among sectors.

Trends and Forecast

Inventory data from 2007 to 2018 is shown in this section, with Business As Usual (BAU) projections through to 2050.

Figure 15 shows the BAU projections compared to the current OCP target, and emissions targets that would be congruent with meeting 1.5°C. In the OCP, the City decided to try to meet a GHG reduction target of 12% below 2007 levels by 2018. The City has not met this target. Radical action is necessary to meet the 1.5°C aligned reduction target of carbon neutrality by 2050.

These emission numbers and targets are also represented in Table 3.

1.5°C targets

From the IPCC's report, community GHG emission reduction targets congruent with meeting 1.5°C are, from 2010 levels:

- 45% reduction by 2030
- 100% reduction by 2050

FIGURE 15 – INVENTORY AND BAU PROJECTIONS, IN RELATION TO THE CURRENT OCP GHG EMISSION REDUCTION TARGET, AND 1.5°C TARGETS

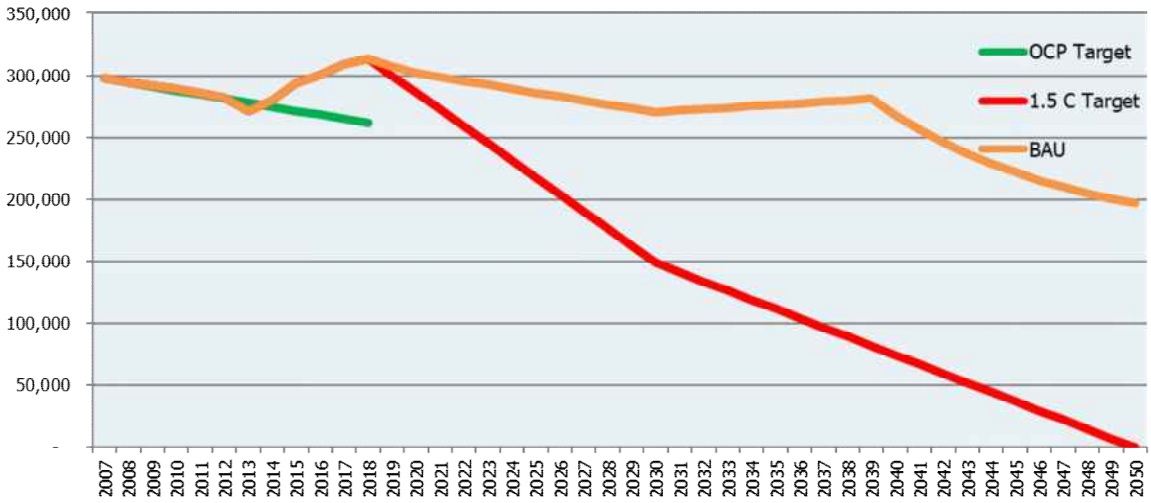


TABLE 3 – EMISSIONS AND TARGETS

	2007	2010	2019	2030	2050
Inventory & BAU estimate	297,682	289,309	307,707	270,785	197,006
OCP target trajectory	297,682	287,939	n/a	n/a	n/a
1.5°C target trajectory	297,682	289,309	300,092	148,932	0

From 2007 to 2018, Vernon's emissions increased by 5%, which indicates the need for significant change. If the City wishes to meet the stringent targets that are congruent with meeting 1.5°C, then highly impactful actions will need to be adopted quickly.

Figure 16 and Figure 17 are similar to Figure 15, but they show exactly where emission reductions have fluctuated historically, will change in a BAU scenario, and where reductions will need to be made to meet the 1.5°C targets.

FIGURE 16 – INVENTORY AND BAU PROJECTIONS SPLIT BY FUELS & WASTE, WITH OCP AND 1.5°C TARGETS

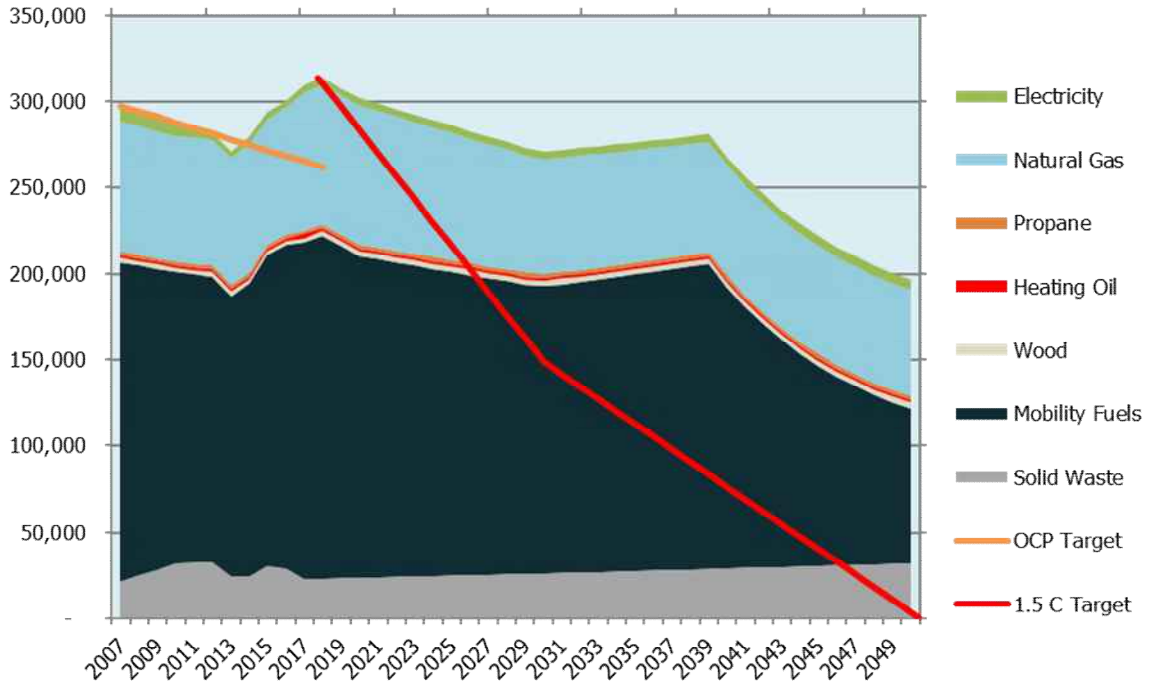
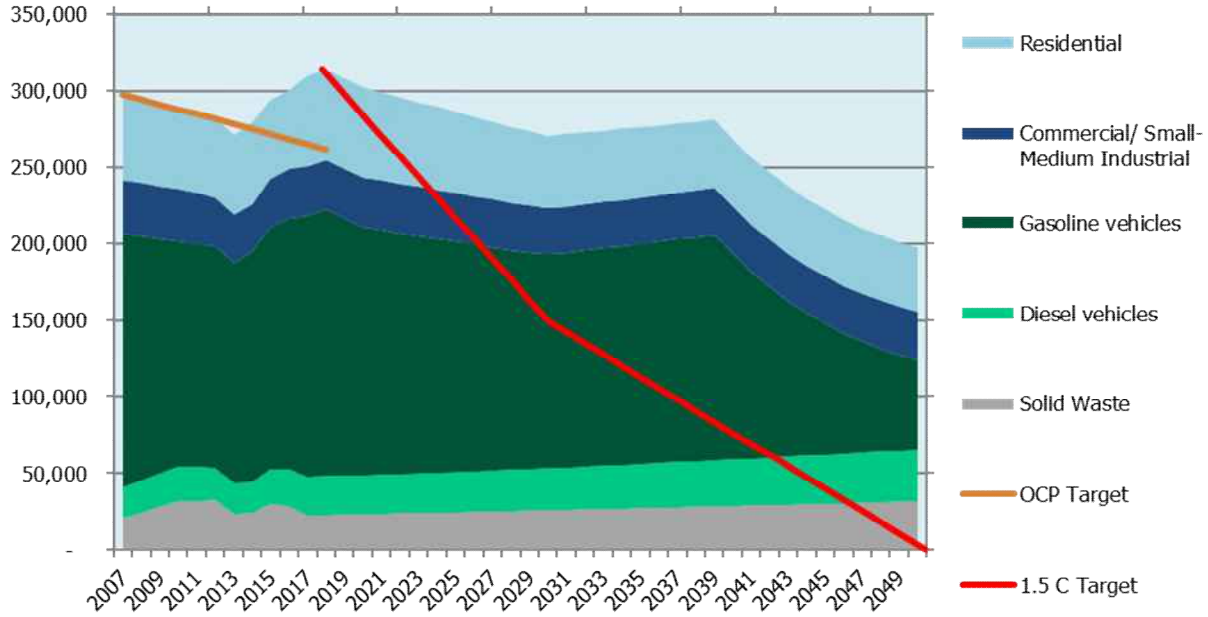


FIGURE 17 – INVENTORY AND BAU PROJECTIONS SPLIT BY SECTOR, WITH OCP AND 1.5°C TARGETS



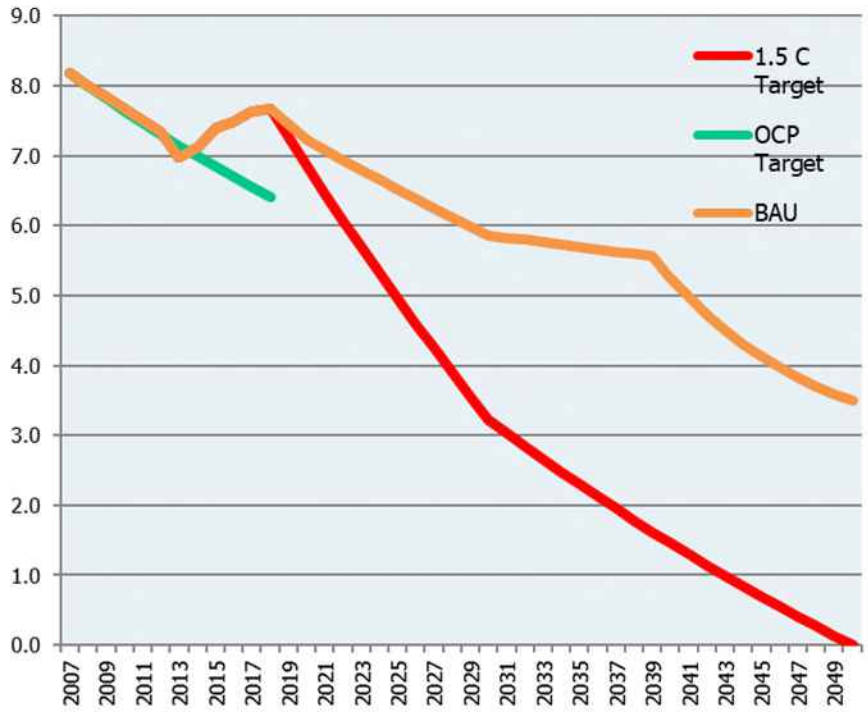
From 2007 to 2018, emissions have primarily fluctuated with gasoline fuel usage. This is likely due to fluctuations in economic activity. Residential natural gas emissions remained consistent until 2017, where it saw a 10% increase. Waste emissions have remained relatively consistent, albeit starting from a low base.

Projecting forwards, in a BAU scenario it is believed that emissions from passenger vehicles will decrease because of vehicle electrification, and residential emissions will continue to slowly decrease.

Despite this progress, to meet the 2030 targets natural gas and mobility fuels will need to be tackled for the residential, commercial / small-medium industrial, and vehicle sectors. For 2050 targets, all sectors will need to be tackled.

Given Vernon's considerable population growth (2007: 36,403; 2018: 40,930; 2050 projection: 56,457), it is worth also reflecting on per capita emissions. A growing population makes it more challenging to reduce absolute GHG emissions, as each additional person requires energy for their daily needs. Per capita emissions and targets are shown in Figure 18.

FIGURE 18 – PER CAPITA INVENTORY AND BAU PROJECTIONS, IN RELATION TO THE CURRENT OCP GHG EMISSION REDUCTION TARGET, AND 1.5°C TARGETS



Per capita:

- Vernon's GHG emissions decreased by 6% from 2007 to 2018.
- The 1.5°C 2030 target would be a 61% decrease from 2007 levels

From a per capita perspective, it is clear that Vernon has made some progress in reducing its GHG emissions. However, even in this context the 1.5°C targets continue to be challenging to meet.

Appendix 1 – Methodology & Assumptions

This appendix contains details on the methodology and assumptions for creating the community energy & emissions inventories and projections for Vernon.

Inventories

Vernon's inventories were created using data for electricity, natural gas, heating oil, propane, wood and waste obtained from the Province of BC, and data on gasoline and diesel sales from Vernon gas stations obtained from Kent Group. Based on the data compiled, full inventory years are: 2007, 2010, 2012, 2014, 2015, 2016, and 2017. Partial inventory information was also obtained for 2013 and 2018, which was also factored in to the model.

Emissions factors for inventory years are shown in the following table, and are sourced from the Province of BC.

TABLE 4 – EMISSIONS FACTORS USED FOR INVENTORY YEARS

GHG/GJ, by Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Gasoline Vehicles	0.068	0.067	0.066	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064
Diesel Vehicles	0.070	0.070	0.069	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068
Mobility fuels	0.068	0.067	0.066	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.064
Electricity	0.007	0.007	0.007	0.007	0.005	0.004	0.003	0.003	0.003	0.003	0.003
Natural gas	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Wood	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.014
Heating oil	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.141
Propane	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.039

Some of the emission factors have changed over time. The emission factors for mobility fuels have decreased as a result of the Renewable and Low Carbon Fuel Requirements Regulation. The emissions factor for electricity has decreased as a result of ongoing efforts to decarbonise the BC Hydro electricity grid.

The buildings and waste data sources have been the Province of BC's Community Energy & Emissions Inventory (CEEI) data,[1] and utilities and landfill waste data at the utility level.[2]

Assumptions made with respect to the inventories are as follows:

- The Province of BC made a series of standard assumptions in the creation of the CEEI data, which are outlined on the CEEI webpage: https://www2.gov.bc.ca/gov/content/environment/climate-change/data/ceei. The CEEI inventory years in the preceding charts are 2007 and 2010.
- The Province of BC made other assumptions for the the other buildings and landfill waste emissions information after 2012, which are outlined in the community level spreadsheets on the Provincial Inventory webpage: https://www2.gov.bc.ca/gov/content/environment/climate-change/data/provincial-inventory
- In creating the inventories, CEA made other assumptions in addition to these:

[1] https://www2.gov.bc.ca/gov/content/environment/climate-change/data/ceei
[2] https://www2.gov.bc.ca/gov/content/environment/climate-change/data/provincial-inventory

- For all years of fuel data (2007-2018), Kent Group data was used as described below. This is because the most recent year that the Province provided transportation data for Vernon was 2010.
- Though FortisBC gas data was included with the new Provincial inventory up to 2017, only residential numbers were incorporated for all years, with commercial/industrial data only incorporated up to 2010, as commercial/industrial data for 2012 and beyond included large industrial. FortisBC commercial/industrial gas data post-2012 is therefore prorated with population growth. It has been decided not to include large industrial gas consumption for two reasons. Firstly, BC Hydro does not provide large industrial electricity consumption, and so this component of the inventory would be incomplete. Secondly, the City has no control over the emissions from the plant whatsoever.

Fuel data was derived through Kent Group fuel sales data for the City of Vernon for 2007-2018. The fuel sales approach to estimating transportation energy consumption and emissions is different to the one that the Province has taken with CEEI before. It will include tourism and through-traffic, while the Province's approach would have only included vehicles registered in the community. For a discussion on the pros and cons of the different approaches see 'Assessing vehicular GHG emissions, a comparison of theoretical measures and technical approaches' by Pacific Analytics[3].

In addition to these methodological challenges, a major drawback is fuel sales through card lock stations are not included with the data. This means that many commercial diesel vehicles are excluded. Based on a previous release of the CEEI data, and making assumptions based on population growth, commercial card lock vehicles may have accounted for 48,500 tonnes in 2012. If that is approximately accurate, then that would constitute a considerable omission as Vernon's 2012 GHG emissions are estimated at 282,000 tonnes of CO_2e excluding most commercial vehicles. 48,500 tonnes would be about 17% of this.

Emissions from Land Use, Land Use Change, and Forestry are not included. The Province has only provided these for Vernon for 2012.

Projections

As previously described, there are full or partial inventory years that describe the community's emissions profile from 2007-2018. From 2019 onwards, all of the data is an estimate as a BAU projection.

The assumption is that energy consumption and emissions will increase proportionally with increases to population, although the impact of policies from higher levels of government are also incorporated, and other assumptions. Only policies that have already been adopted (or are likely to) and that will have quantifiable impacts are incorporated. Assumptions are:

- The Province's incremental steps to net zero energy ready buildings by 2032.
- Tailpipe emissions standards.
- Renewable & low carbon transportation fuel standards.

[3] See: https://www2.gov.bc.ca/assets/gov/environment/climate-change/z-orphaned/ceei/ceei-comparison-study.pdf

- An average annual decrease of 1.228% in natural gas consumption per residential connection is included, as FortisBC does in its planning.
- The CleanBC target for Renewable Natural Gas in natural gas, of 15% by 2030.
- The Province's CleanBC Plan zero emission vehicle mandate of 100% of new vehicles by 2040, and increases up to that point.
- How the impacts of a changing climate will affect building energy consumption.

The final assumption had the following methodology:

- Climate change data for the region was obtained from ClimateData.ca.
- Projected global emissions to 2030 currently places the world in the range for the IPCC's Fifth Assessment Report's Representative Concentration Pathway (RCP) 6.0 scenario.
- RCP 6.0 scenario not available on ClimateData.ca, therefore RCP 4.5 (median values) used as a proxy. This is a more conservative scenario.
- Decreases in residential and commercial natural gas consumption are assumed to be proportional to decreases in Heating Degree Days (HDD's) and the proportions of natural gas consumed for space heating for each sector, with this data obtained from the Navigant 2017 Conservation Potential Review for FortisBC Gas.
- Decreases in residential and commercial electricity consumption assumed to be proportional to decreases in HDD's and the proportions of electricity consumed for space heating for each sector. However, for residential this is partially offset by, and for commercial more than offset by the proportions of electricity consumed for space cooling by each sector and how this will increase proportional to projected increases to Cooling Degree Days (CDD's). These proportions were obtained from the Navigant 2016 Conservation Potential Review for BC Hydro.

Appendix 4
Corporate GHG Report

City of Vernon

Corporate Emissions Inventory

February 2020

CITY OF Vernon

Community Energy Association

Table of Contents

List of Acronyms

BAU	Business As Usual
CAC	Climate Action Charter
CARIP	Climate Action Revenue Incentive Program
CEA	Community Energy Association
CNAP	Corporate Carbon Neutral Action Plan
CO_2	Carbon Dioxide
EV	Electric Vehicle
FCM	Federation of Canadian Municipalities
GHG	Greenhouse Gas (there are several different anthropogenic GHGs and they have different relative impacts. When tonnes of GHGs are stated in the document the standard practice of stating this in equivalent of tonnes of carbon dioxide is followed. Carbon dioxide is the most important anthropogenic GHG.)
GJ	Gigajoules (a standard measures of energy)
kWh	kilowatt hours (a standard measure of energy, typically used with electricity)
OCP	Official Community Plan
PCP	Partners for Climate Protection (Program)
PSO	Public Sector Organization
tCO_2e	Tonnes of CO_2 equivalent. The unit for GHGs used in CARIP reporting
RGS	Regional Growth Strategy
UBCM	Union of British Columbia Municipalities

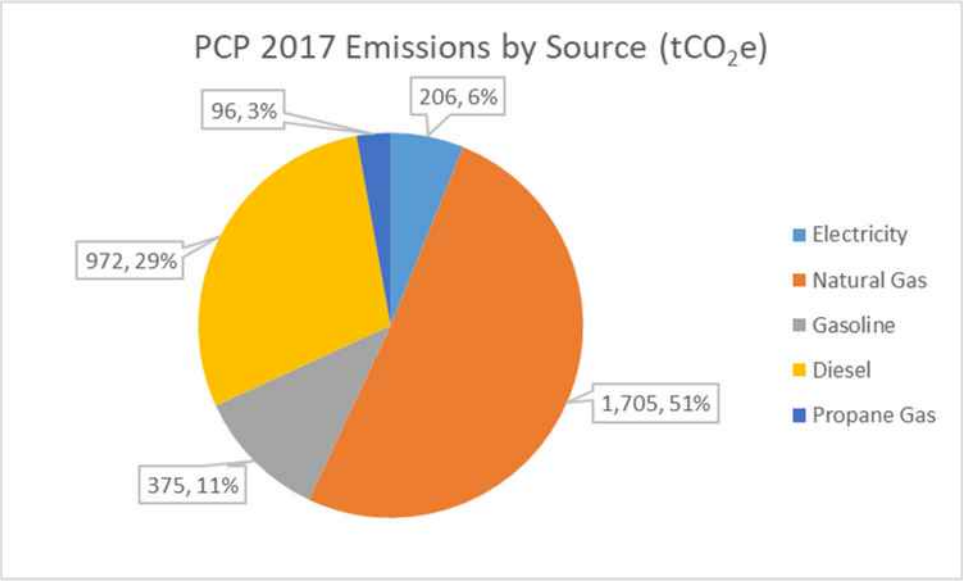
Executive Summary

The City of Vernon has signed the Climate Action Charter, committing the City to work towards being carbon-neutral in its own operations, and so staff and Council are actively seeking strategies to reduce the carbon footprint of the City.

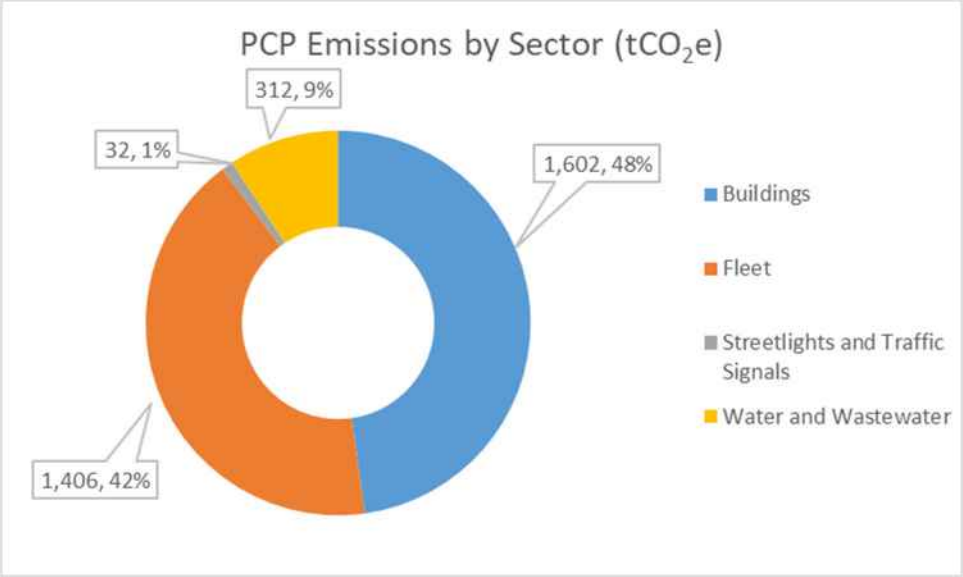
This Corporate Greenhouse Gas Emission Inventory identifies the corporate portion of community energy and emissions, as identified in the recently completed Community-level Energy & Emissions Inventory completed for the City in 2019. This inventory will also inform the development of the corporate portion of the upcoming Climate Action Plan.

The first step in becoming carbon neutral is to measure all corporate emissions. As a Climate Action Charter signatory, the City has measured its energy consumption and emissions since 2009 to report to the Province. This report uses the data collected by the City, which outline the corporate facilities, fleet, and energy consumption in 2017. This document has been designed to align with reporting requirements as per FCM-ICLEI's Partners for Climate Protection (PCP) program's Corporate Milestone 1. A similar inventory based on the Climate Action Revenue Incentive Program (CARIP) is shown in Appendix 2.

Vernon 2017 Corporate GHG Emissions Profile by Source:



Vernon 2017 Corporate GHG Emissions by Sector:



Note that the City does not currently track its own corporate solid waste tonnage or emissions, which is one of the emission sectors under the PCP program. It is recommended that the City begin tracking its waste production from corporate operations in the future.

Introduction

Reducing Greenhouse Gas Emissions in BC

There is increasing evidence that global climate change resulting from emissions of carbon dioxide and other greenhouse gases (GHG's) are causing significant impacts to Canadian communities both economically and socially. Since 2007, the BC Government has embarked upon a number of initiatives to reduce GHG emissions in BC including:

- All ministries and other public sector organizations (PSOs) required to be carbon neutral in their operations beginning in 2010.
- Local governments required to incorporate GHG reduction targets, policies and actions to reach these targets into their Official Community Plans (OCP's) and Regional Growth Strategies (RGS's) through the *Local Government (Green Communities) Statutes Amendment Act* (Bill 27 – 2008).
- Local governments encouraged to become proactive in achieving carbon neutrality in their corporate operations by becoming signatories to the **Climate Action Charter**. Signatories commit to working towards being carbon neutral in their local government operations through a combination of emission reductions and offsets.
- In 2018, the Province released *CleanBC: Our Nature. Our Power. Our Future* outlining the provincial plan to reduce climate pollution and build a low-carbon economy. The Province's new targets for GHG emission reductions are:
    - 40% below 2007 levels by 2030
    - 60% below 2007 levels by 2040 and
    - 80% below 2007 levels by 2050

Community and Corporate Emissions

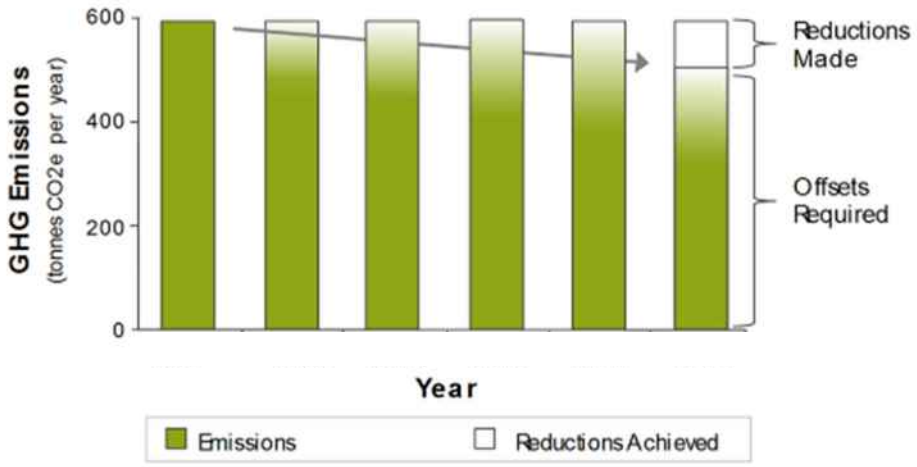
Actions to reduce energy consumption and GHG emissions are frequently divided into the realm of corporate and community emissions.

- **Corporate emissions** – those that the local government creates through its activities (and which it has control over) such as local government building operations, recreation centres, vehicle fleets, and utility services; and
- **Community emissions** – those that the residents and businesses in the community create through their activities. The local government cannot directly control these emissions, but may be able to influence them through planning and program activities. (i.e., the focus of the Community Energy and Emissions Plan – CEEP)

Carbon Neutrality

Carbon neutrality means that the operations of the local government will result in no net GHG emissions to the atmosphere. Carbon neutrality results from a combination of:

- Reduction measures to reduce the GHG emissions from operations. This is accomplished through retrofits, efficiency initiatives, and behavioural change of staff; and
- Carbon Offsets – which are reductions made by others – elsewhere in the community or province – through registered and reviewed projects that reduce GHG emissions. Owners of these offset projects may sell these 'reduction credits' to other parties that are working to neutralize their carbon footprint.



Getting to Carbon Neutral:

Efficiency improvements will reduce the emissions from operated facilities.

However, there will always be some emissions remaining, and these will be 'neutralized' through the purchase of offsets.

About the Inventory

An inventory is a compiled list of all the **energy** consumed, the associated **GHG emissions** created, and the **money spent** on energy by the local government in their operations for one year. Energy use and emissions are also broken down by end use to identify high-energy use activities and major emissions sources that may provide the best opportunities for cost and emissions reductions.

The City of Vernon tracks its own corporate energy consumption and GHG emissions using utility bills and internal ledgers for its reporting as a Climate Action Charter signatory, and to apply for the Provincial Climate Action Revenue Incentive Program (CARIP) grant. The Community Energy Association (CEA) has used these spreadsheets, along with updated emissions factors from the BC Best Practices Methodology for Quantifying GHG Emissions, to compile the graphs and charts shown in this report.

This inventory report will be categorized according to the categories specified as per the Federation of Canadian Municipalities (FCM) and ICLEI's Partners for Climate Protection (PCP) Program, as Vernon is a member of the PCP Program. It includes all buildings, vehicles, facilities, and equipment operated by the City. It must also include all solid waste emissions including those from decomposition, however Vernon does not track its corporate solid waste tonnage, based on conversations with the City. For more information on the PCP Program, refer to the description at the end of this section.

- Buildings
- Corporate Solid Waste
- Fleet
- Streetlights and Traffic Signals
- Water and Wastewater

Another categorization method commonly used for inventories is through the CARIP program, which is based on "traditional services", as specified below:

- Administration and Governance
- Drinking, Storm and Waste Water
- Solid Waste Collection, Transportation and Diversion
- Roads and Traffic Operations
- Arts, Recreation and Cultural Services
- Fire Protection

An inventory using the CARIP method is described in Appendix 2.

The Vernon internal process to keep the inventory current works for the size of its corporate assets. Vernon is encouraged to maintain the current process known by the Province's Carbon Neutral team as "Alternative Tools". Support for tracking and reporting annual emissions is found on the Province's website at: https://www2.gov.bc.ca/gov/content/environment/climate-change/public-sector/carbon-neutral. They are also encouraged to begin tracking corporate solid waste tonnage and associated emissions as part of its overall mandate on Climate Action. Lastly, the City should also continue to ensure that it updates the GHG emission factors it utilizes by using the latest version of the Province of BC's *Best Practices Methodology for Quantifying Greenhouse Gas Emissions.*

Climate Action Plan (CAP)

In conjunction with this Corporate GHG Inventory, the City of Vernon is working with CEA to develop a Climate Action Plan (CAP) upon completion of this inventory. The CAP will incorporate corporate and community-level mitigation efforts identified through to take action towards Vernon's Climate Charter commitments. As part of the CAP planning exercise, the City of Vernon will be participating as follows:

- Reviewing and suggesting updated community OCP GHG reduction targets, looking at buildings, transportation, and waste;
- Helping to integrate energy efficiency programs promotion into everyday operations of the community and ensuring that the community is working to reduce energy consumption through planning & policy;
- Learning and applying third party resources such as Community of Practice webinars, policy development and educational events, to share successes and practices; (i.e., BC Hydro, FortisBC, FCM Partners for Climate Protection Program, BC Energy Step Code)
- Working with community partners to develop the CAP. Together the partners work on the overall objective to reduce community energy and emissions and support education/building Healthy and Active Communities.

FCM-ICLEI Partners for Climate Protection Program

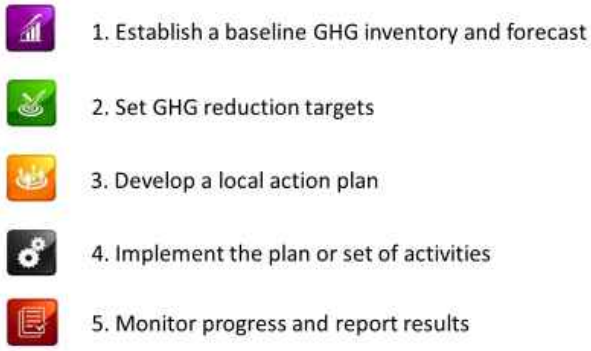
The City has taken its climate action charter commitment seriously and commits to be Carbon Neutral in its operations. The City has also joined the FCM-ICLEI Partners for Climate Protection program.

> *The Partners for Climate Protection (PCP) program is a network of Canadian municipal governments that have committed to reducing GHG's and to acting on climate change. Since the program's inception in 1994, over 350 municipalities have joined PCP, making a public commitment to reduce GHG emissions. PCP membership covers all provinces and territories and accounts for more than 65 per cent of the Canadian population.*

The PCP program is managed and delivered by FCM and ICLEI Canada. FCM and ICLEI Canada form the PCP Secretariat, which provides administrative and technical support, develops tools and resources, and delivers capacity building activities to support members in reducing local GHG emissions. The Secretariat also provides national recognition for member achievements.

The program empowers municipalities to take action against climate change through a five-milestone process that guides members in creating GHG inventories, setting GHG reduction targets, developing local action plans, implementing actions to reduce emissions, and monitoring and reporting on results.

Under PCP, there are five milestones, under both corporate and community categories. The five milestones are:



For Corporate Milestone 1, the inventory in this report is sufficient.

For Corporate Milestone 2, the City of Vernon sets a corporate emissions target, which will be determined at a later date.

For Corporate Milestone 3, the action plan will be developed upon completion of this inventory report.

For Corporate Milestone 4, the City will need to implement actions in this plan, and report on this activity in its annual CARIP reports. Then it will need to submit these reports to FCM.

For Corporate Milestone 5, a rigorous document would need to be created, with updated inventory information (already being tracked by the City) and that quantifies the impacts of actions that have been conducted.

Corporate Energy and GHG Inventory

Overview

This inventory describes the GHG emissions, energy consumption, and annual energy expenditures of all corporate assets as per PCP guidelines. Assumptions are described in Appendix 1.

The CARIP inventory is in Appendix 2. This is because the City, though a PCP member, currently does not have any milestones achieved. This inventory will help to achieve Corporate Milestone 1 in the PCP Program. Having said that, including the CARIP inventory is useful for the City, as it will be need to be updated annually for carbon tax calculations.

Source names were allocated according to the appropriate PCP categories. The following table lists the GHG emissions within the categories of "Buildings", "Fleet", "Streetlights and Traffic Signals", and 'Water and Wastewater". Note that there is a row for Corporate Solid Waste as well, however Vernon does not track its own corporate solid waste tonnage or emissions. To reduce the carbon footprint of the City, concentrate action on the highest emitters; in this case focusing on natural gas usage in buildings and fleet vehicles.

Vernon 2017 Corporate GHG Emissions Profile:

PCP Emissions by sector (tCO2e)	
Buildings	1,602
Fleet	1,406
Streetlights and Traffic Signals	32
Water and Wastewater	312
Corporate Solid Waste	0
Total	**3,354**

Breakdown and Trends

The City of Vernon uses internal utility bills and fleet vehicle receipts to report annual corporate GHG emissions and track energy and emissions. By tracking consumption over several years, the inventory can become a mechanism for tracking changes in energy use, GHG

emissions, and energy expenditures. The charts in this section show the summarized data for the year 2017, for internal operations. Note that data for a partial 2018 inventory was provided, however it did not include contracted emissions, which contributes entirely to fleet vehicles.

What is a GJ?

A gigajoule (one billion joules) is a measure of energy. One GJ is about the same energy as:

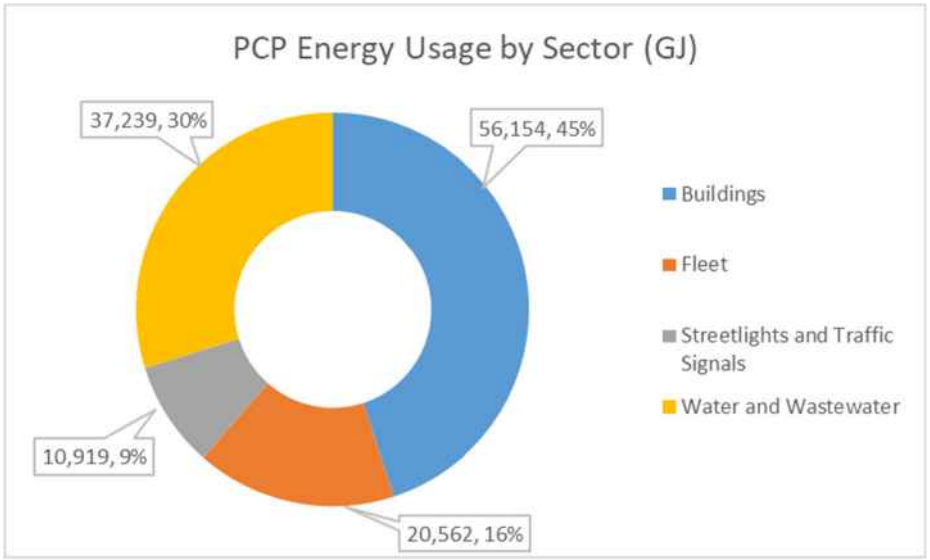
- Natural gas for 3-4 days of household use
- 25-30 litres of diesel or gasoline
- Two 20 lb propane tanks
- The electricity used by a typical house in 9 days

What is a tonne (tCO_2e) of GHG?

A tonne of GHG's is the amount created when we consume:

- 385 litres of gasoline (about 10 fill-ups)
- $200 of natural gas (a month of winter heating)
- Enough electricity for 8.5 average BC Hydro homes for a year (93,700 kWh)

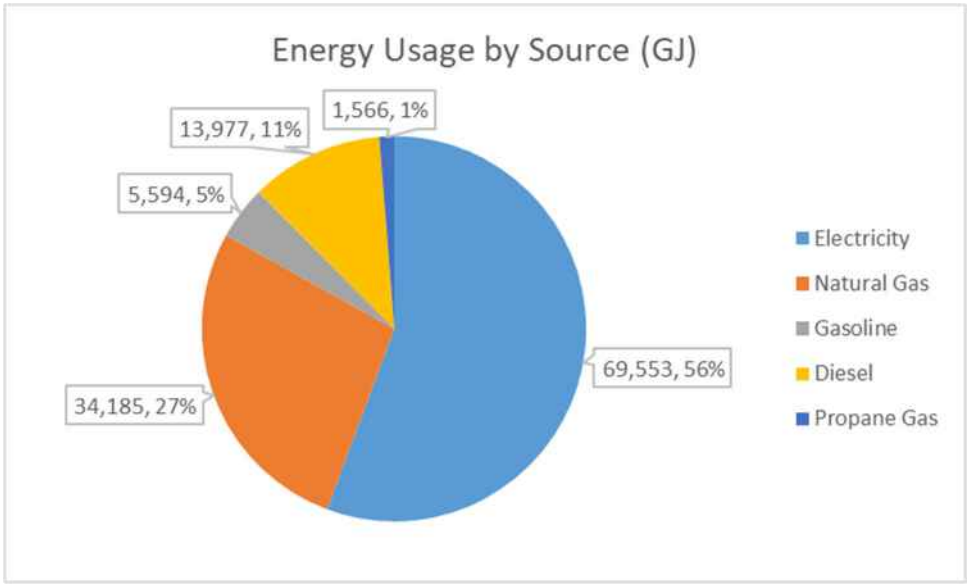
Vernon 2017 Energy Consumption by Sector:



The City of Vernon consumed a total of 124,875 GJ among all corporate operations. Buildings comprise the largest portion of Vernon's corporate profile at 45%, followed by water/wastewater at 30%, and fleet at 16%. A further breakdown of fleet energy consumption between

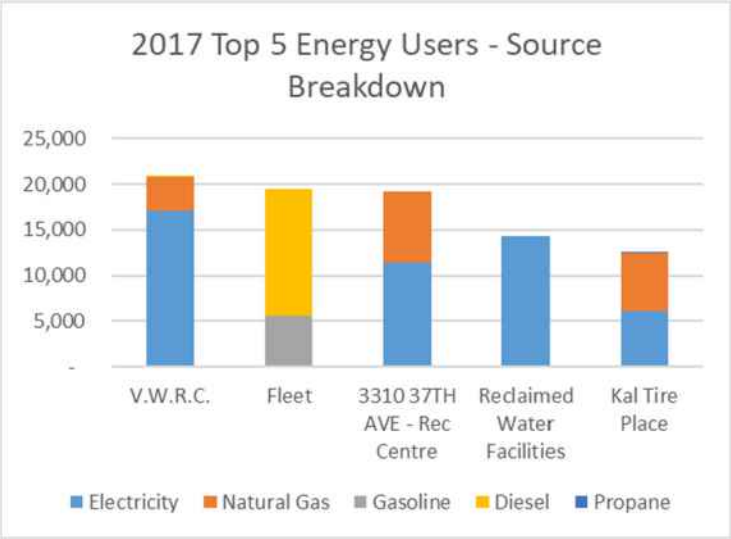
internal and contracted vehicles shows that internal vehicles account for 12% of total energy, and contracted vehicles at 4%.

Vernon 2017 Energy Consumption by Source:



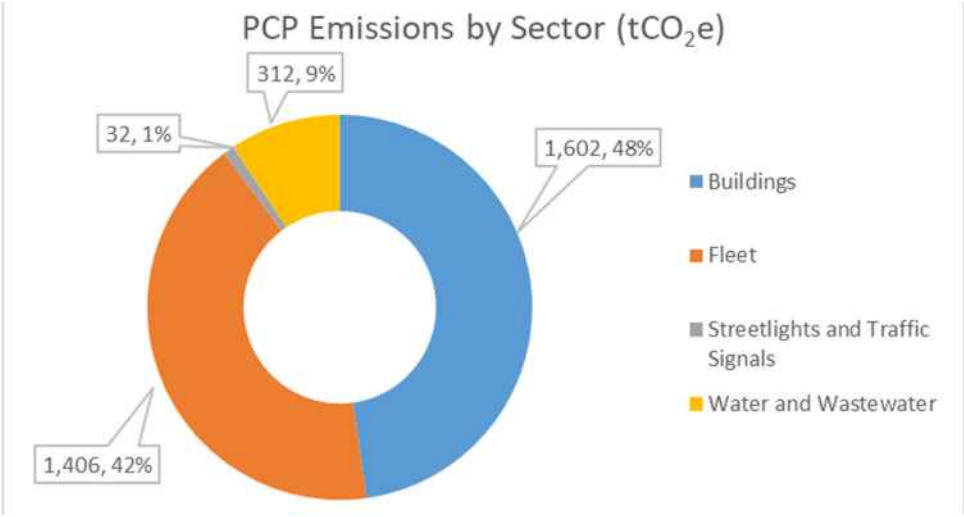
In 2017, 56% of all energy consumed by the City was from electricity, followed by natural gas at 27%. Diesel followed next at 11%, and gasoline at 5%, with just a small fraction of propane.

Vernon 2017 Top 5 Energy Consumers:



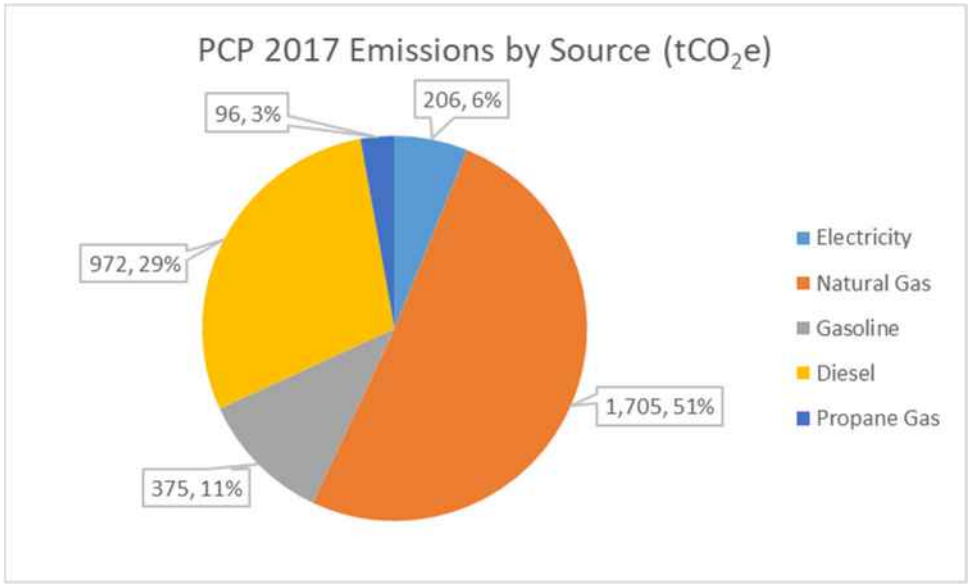
The single largest energy user among corporate operations in 2017 was from the Water Reclamation Centre (V.W.R.C.) at 20,875 GJ, or about 16.7% of all consumption, with most of the energy coming from electricity. The corporate fleet followed closely at 20,562 GJ (16.5%) with approximately 3/4 coming from diesel. The Recreation Centre followed at 19,172 GJ at a 60/40 split of electricity to natural gas. Reclaimed Water Facilities, and Kal Tire Place complete the top 5.

Vernon 2017 GHG Emissions by Sector:



As per the preceding graph, 48% of Vernon's corporate energy consumption is from buildings. The graph also shows the importance of addressing Fleet emissions, as they contribute 42% of Vernon's corporate emissions, despite only accounting for 16% of energy usage. The relatively high emissions per unit energy consumed for the fleet is due to high gasoline and diesel consumption. Buildings, on the other hand, ran on approximately 2/3 electricity and 1/3 natural gas.

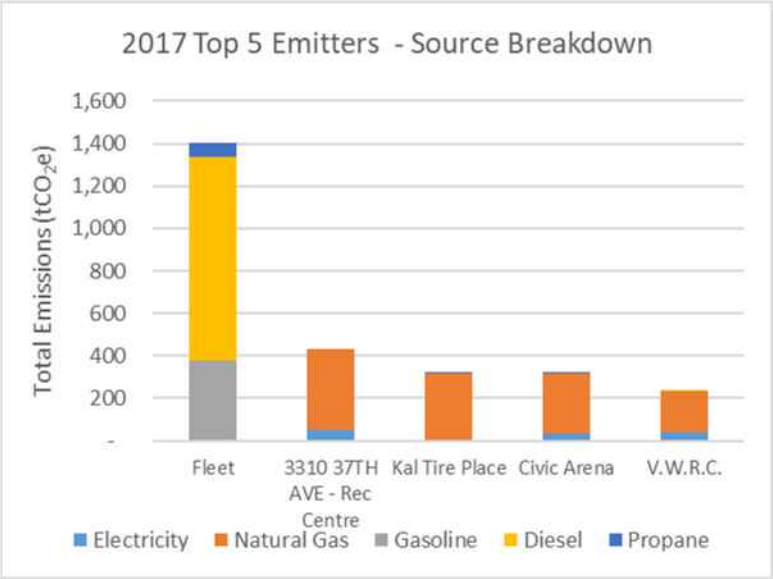
Vernon 2017 GHG Emissions by Source:

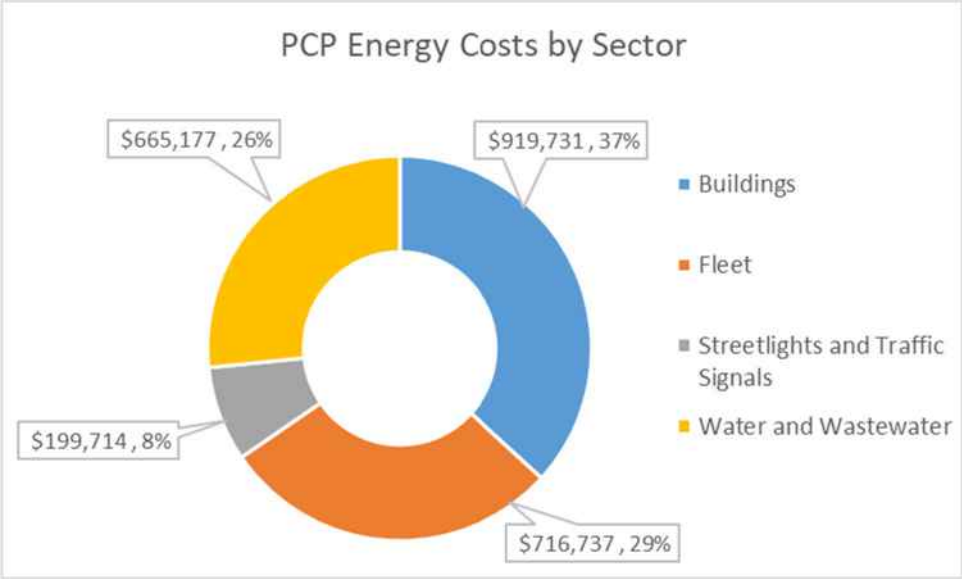


Natural gas comprises the largest proportion of emissions at 51%, followed by diesel and gasoline at 29% and 11% respectively. Note that electricity comprised only 6% of overall emissions, despite contributing 56% of energy consumption. This is due to the energy mix of electricity, which is 98.4% renewable in BC, resulting in an emission factor that is approximately 6% that of fossil fuels.[1]

[1] Canada's Renewable Power Landscape 2017 – Energy Market Analysis, 2019. https://www.cer-rec.gc.ca/nrg/sttstc/lctrct/rprt/2017cndrnwblpwr/prvnc/bc-eng.html

Vernon 2017 Top 5 Emitters:



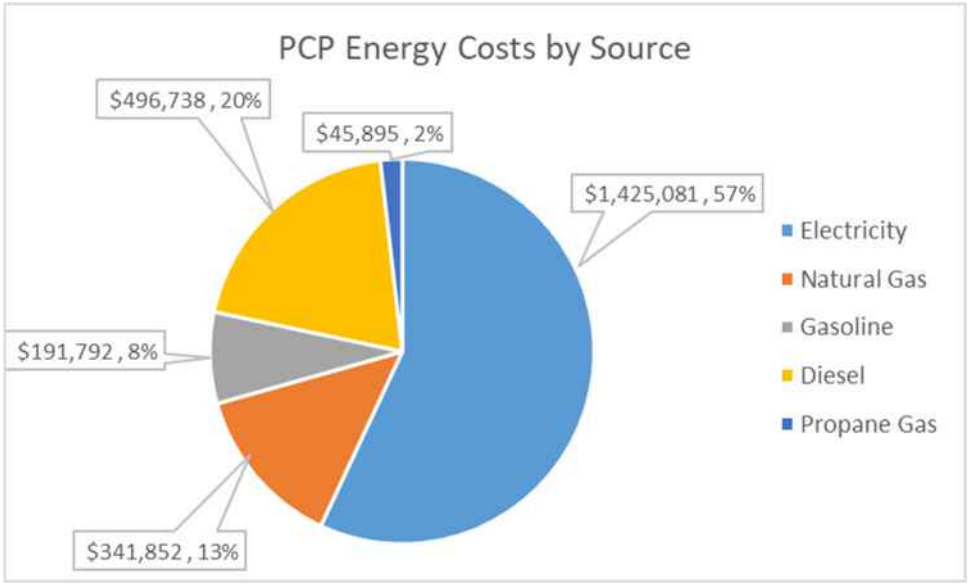


The Fleet contributed the majority of all single sourced corporate emissions, at 1,406 tCO_2e, 68% of which is from diesel. Among buildings, the Recreation Centre contributed the largest at 418 tCO_2e of GHG emissions, followed by Kal Tire Place at 342 tCO_2e, and the Civic Arena at 305 tCO_2e. Note that the vast majority of building emissions are due to natural gas space heating.

Vernon 2017 Energy Expenditures by Sector:

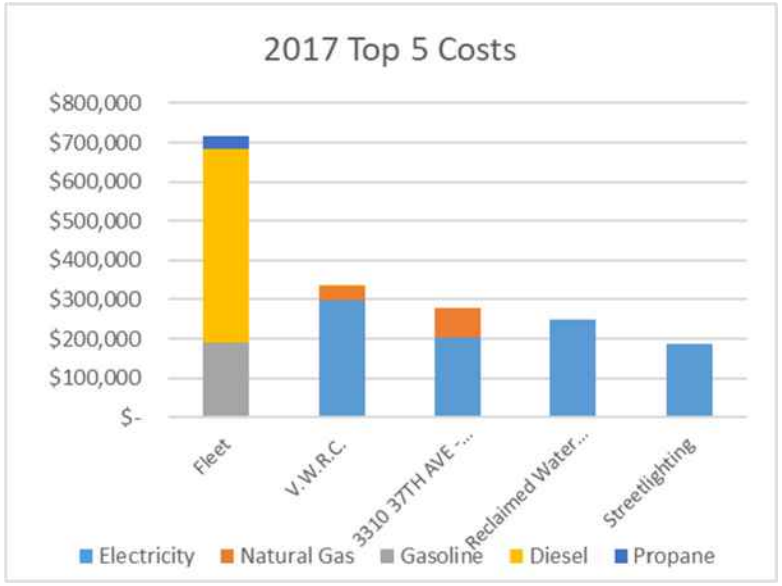
Buildings comprised the largest proportion of energy costs at $919,731 (37%), with Fleet, and Water/Wastewater comprised nearly identical proportions at $716,737 (29%) and $665,177 (26%). Streetlights and Traffic Signals comprise the remaining costs at $199,714.

Vernon 2017 Energy Expenditures by Source:



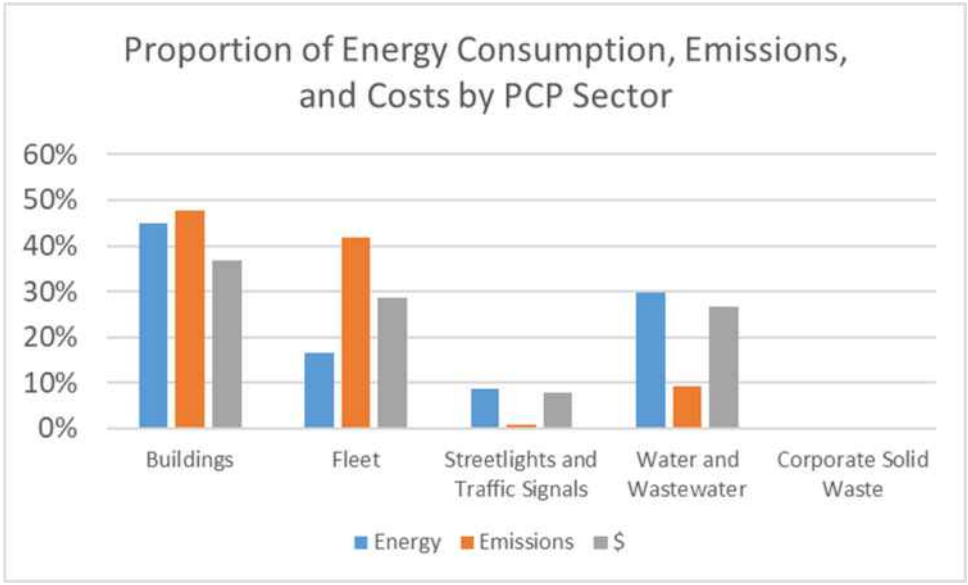
Although electricity usage forms small part of the carbon footprint because it has a low GHG intensity, it accounted for 57% of the City's energy expenditures in 2017 because it has a high cost per unit of energy. Thus, work to reduce electricity usage is also very important as it will reduce operating costs, even though it will have a low impact on the corporate GHG footprint.

Vernon 2017 Top 5 Expenditures:



Among single items, the corporate fleet contributed the largest cost, at just over $700,000, 69% of which came from diesel and 27% from gasoline. Among buildings, the V.W.R.C. was the largest energy expenditure at just over $336,000, 88% of which was from electricity consumption. Costs for the remaining three items (Reclaimed Water Facilities, Recreation Centre, and Streetlighting) were due either exclusively, or mainly from electricity.

Vernon 2017 Corporate Energy Consumption, Emissions, and Energy Expenditures by Sector:



The preceding chart shows what percentage of energy consumption, GHG emissions, and energy expenditures can be attributed to each asset. Buildings comprised the largest proportion of all three categories, with nearly an equal split of energy and emissions, with electricity contributing the majority of energy consumption and costs, while natural gas contributed most of the emissions. As for the Fleet, the disproportionate percentage of emissions versus the energy consumed is due to the use of high-emission fossil fuels as the energy source. Conversely, Water and Wastewater, and Streetlights and Traffic Signals were relatively minor contributors to emissions, but disproportionately high in costs. This is due to their energy profiles being dominated by low-emission but high-cost electricity.

Inventory Summary

Overall, Vernon's corporate services consumed 124,875 GJ and emitted 3,354 tCO_2e at a total cost of $2.5 million. Vernon's energy consumption profile shows higher dependence on electricity than other fuels (51%), with natural gas second (29%). Buildings contributed the largest proportion of energy consumption, emissions, and costs overall. Among single users, the V.W.R.C. consumed the largest amount of energy at 20,876 GJ, though this was mainly from low-emission electricity. On the other hand, Fleet energy consumption was nearly equal to the V.W.R.C., but due to its dependence on fossil fuels, had 3.5x higher emissions. The Fleet also had the highest cost, at over $716,000. No corporate solid waste data was available, as the City does not track waste tonnage. It is recommended that the City begin to track its corporate

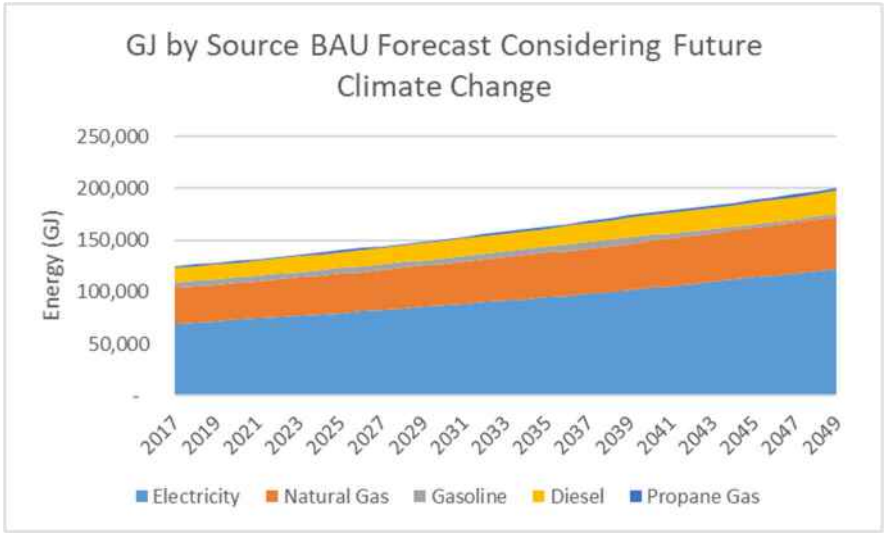
solid waste as an action in the upcoming CAP. Reporting and measuring annually on overall corporate energy consumption will also provide incentive to work on actions to reduce GHGs and ultimately energy costs for the corporation.

The City should look at all opportunities to reduce energy consumption, emissions, and energy expenditures. One opportunity in particular is the corporate Fleet, which alone is 42% of the City's carbon footprint and 29% of costs, despite only consuming 16% of energy. With the recent Clean BC mandate on zero-emission light duty vehicles, and advances in electric technology for trucks and heavy-duty vehicles, the City has an opportunity for fleet conversion as their vehicles approach the end of their service life. Other opportunities for emission reductions will be from the Recreation Centre, Kal Tire Place, and Civic Arena, all of which rely on natural gas heating, contributing 40-50% of all energy consumed and nearly 100% of all emissions.

Business As Usual Forecast

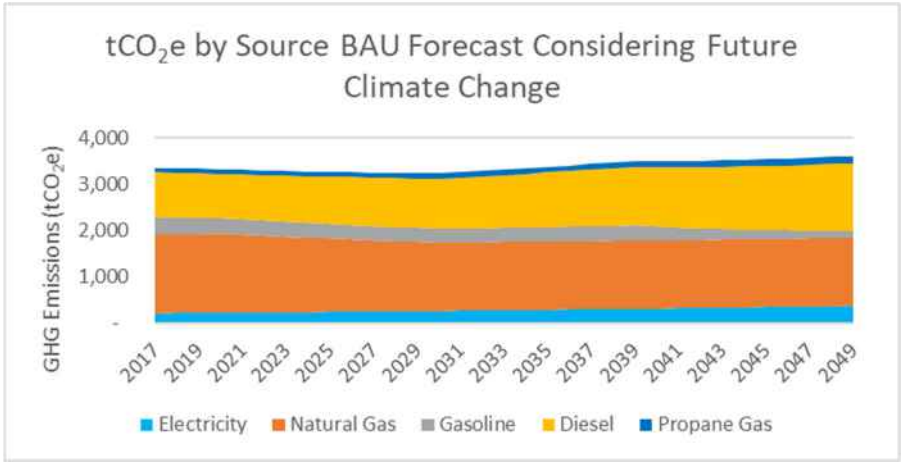
If the City of Vernon conducts no efficiency or conservation activities, and assuming that future changes are proportional with population increase at 1.60% per year, then the City's energy consumption and emissions are forecast to change as shown in the following charts under a Business As Usual (BAU) scenario. These charts also consider climate adaptation data to account for decrease in heating degree days and increases in cooling degree days up to 2050.

Vernon BAU energy consumption forecast to 2050 Considering Future Climatic Change:



Though energy usage will continually increase to 2050, emissions will remain relatively consistent after incorporating low carbon fuel standards for gasoline and diesel, renewable natural gas standards, consistent reduction in carbon intensity for natural gas as per FortisBC mandates, and fleet shifting towards electric vehicles as a result of the Clean BC Zero Emission Vehicle mandate.

Vernon BAU GHG emissions forecast to 2050 Considering Future Climatic Change:



Accounting for adaptation results in a displacement of 7,000 GJ of natural gas with approximately 5,900 GJ of electricity. Because the emission factor for electricity is 6% that of natural gas, the overall effect is a 218 tCO_2e reduction in GHG emissions.

It is difficult to predict these future increases, but it is clear that an increasing population will provide upward pressure on energy consumption, and that this should be managed going forwards.

No BAU chart for energy expenditures has been created because of the considerable uncertainty around predicting future energy prices.

Appendix 1

Inventory Emissions Factors, Assumptions, and Data Sources

The emissions factors and assumptions used to create the inventories are described in all six versions of the Province of BC's *Best Practices Methodology for Quantifying GHG Emissions*, which describe the 2017 year. Note that the original spreadsheet provided by Vernon staff used an electricity emission factor approximately twice that of Best Practices Methodology. Emissions were corrected using the 2017 emission factors from the Methodology document.

The emissions factors used for the 2017 inventory year are:

GHG Emission Factors	tCO2e / GJ
Stationary Sources	
Electricity	0.00296
Natural Gas	0.04987
Mobile Sources	
Gasoline	0.06696
Diesel	0.06956
Propane	0.06115

The BAU trajectory was calculated by using available inventory data, and then projecting forwards.

For the BAU projection modelling, the assumption is that energy consumption and emissions will increase proportionally with increases to population, although the impact of policies from higher levels of government are also incorporated, and other assumptions. Only policies that have already been adopted and that will have quantifiable impacts are incorporated. Assumptions are:

- The Province's incremental steps to net zero energy ready buildings by 2032.
- The Province's Zero-Emission Vehicle mandate as part of the Clean BC plan, requiring 100% of new vehicle purchases in 2040 as electric.
- Tailpipe emissions standards.
- Renewable & low carbon transportation fuel standards.
- An average annual decrease of 1.2 per cent in natural gas consumption per residential connection is included, as FortisBC does in its planning.
- How the impacts of a changing climate will affect building energy consumption.

The final assumption had the following methodology:

- Climate change data for the region obtained from ClimateData.ca.
- Projected global emissions to 2030 currently places the world in the range for the IPCC's Fifth Assessment Report's Representative Concentration Pathway (RCP) 6.0 scenario.
- RCP 6.0 scenario not available on ClimateData.ca, therefore RCP 4.5 (median impact scenario) used as a conservative proxy.

- Decreases in natural gas consumption assumed to be proportional to decreases in HDD's and the proportions of natural gas consumed for space heating for the commercial sector, and that proportion obtained from the Navigant 2017 Conservation Potential Review for FortisBC Gas.
- Decreases in electricity consumption assumed to be proportional to decreases in HDD's and the proportions of electricity consumed for space heating for the commercial sector. However, this is more than offset by the proportions of electricity consumed for space cooling for the commercial sector and how this will increase proportional to projected increases to Cooling Degree Days (CDD's). These proportions were obtained from the Navigant 2016 Conservation Potential Review for FortisBC Electric.

Data Sources

The City of Vernon uses internal ledgers and utility bills to track corporate energy consumption and GHG emissions, and for its reporting as a Climate Action Charter signatory and to apply for the Provincial Climate Action Revenue Incentive Program (CARIP) grant. The Community Energy Association (CEA) has used these spreadsheets to compile the graphs and charts shown in this report. Additional fuel cost data was derived from Natural Resources Canada, as well as BC Hydro.

Adaptation data (Heating degree days and cooling degree days) used in the business as usual forecast was derived from Climatedata.ca. Justification for the 60 Gt global emissions and RCP 6.0 scenario estimate by 2050 are from Climate Action Tracker Emission Gaps - https://climateactiontracker.org/global/cat-emissions-gaps/ and the International Panel of Climate Change (IPCC)'s Global Warming of 1.5°C Special Report Summary for Policymakers - https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_summary-for-policymakers.pdf.

Cost data for electricity was obtained through BC Hydro for business clients, and was applied to each building according to consumption.* For simplicity, it was assumed that the small business tier applied to consumers of less than 100,000 kWh/yr, medium from 100,000 – 550,000 kWh/yr, and large over 550,000 kWh/yr. It was also assumed that peak load for both medium and large consumers were 150 kW per month. Cost data for natural gas was obtained from FortisBC,† along with empirical data observed from communities of similar size. Gasoline, diesel, and propane data was obtained from Natural Resources Canada's online database on historical fuel prices.‡

* https://app.bchydro.com/accounts-billing/rates-energy-use/electricity-rates/business-rates.html
† https://www.fortisbc.com/accounts-billing/billing-rates/natural-gas-rates/business-rates
‡ https://www.nrcan.gc.ca/our-natural-resources/domestic-and-international-markets/transportation-fuel-prices/4593

Appendix 2

CARIP Inventory

The City of Vernon is a member of the Climate Action Charter. As part of that mandate, the City is required to submit annual reports on climate change actions, as well as a summary of emissions from corporate operations, as part of the Climate Action Revenue Incentive Program (CARIP). This appendix outlines the corporate inventory according to the categories described in CARIP.

Overview

This inventory describes the GHG emissions, energy consumption, and annual energy expenditures of all corporate assets as per CARIP guidelines. Note that unlike PCP, the CARIP inventory is categorized by "traditional services" to maintain consistency and comparability between corporate inventories for different BC communities. Traditional services include:

- Administration and Governance
- Drinking, Storm and Waste Water
- Solid Waste Collection, Transportation and Diversion
- Roads an d Traffic Operations
- Arts, Recreation and Cultural Services
- Fire Protection

Of particular note, the City's spreadsheets as submitted, grouped all internal fleet vehicles under "General Fleet", with exception of fire vehicles. Due to the difficulty in separating out consumption for individual vehicles, and reclassifying them according to the traditional services, this inventory will assume that all fleet vehicles will fall under the traditional service of "Roads and Traffic Operations".

CARIP Emissions by classification (tCO2e)	
Administration and Governance	578
Arts, Recreation and Cultural Services	1,129
Drinking, Storm and Waste Water	314
Fire Protection	103
Roads and Traffic Operations	1,069
Solid Waste Collection, Transportation and Diversion	113
Total	**3,305**

Assumptions and Emission Intensity Values

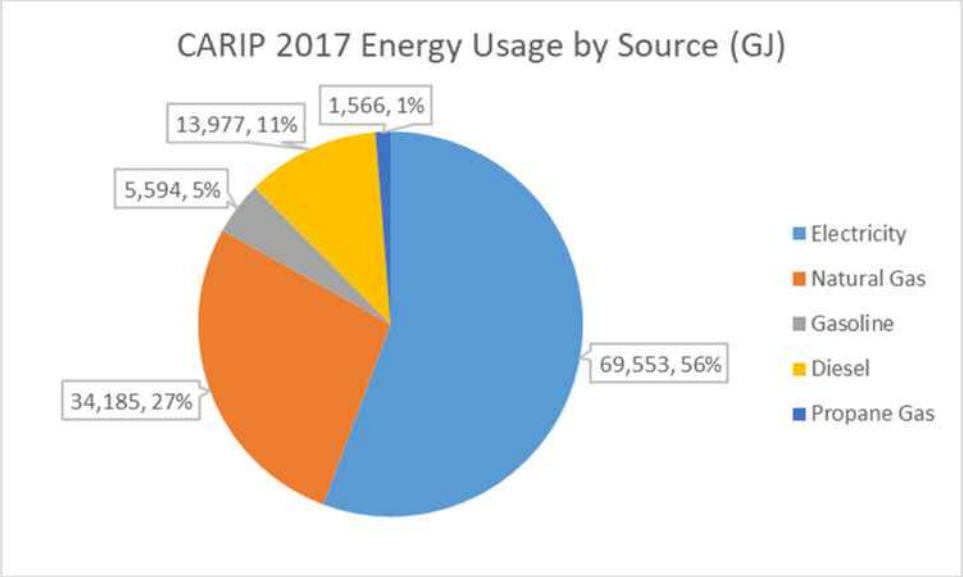
Assumptions and emissions factors are described in Appendix 1

Inventory Emissions Factors, Assumptions.

Breakdown and Trends

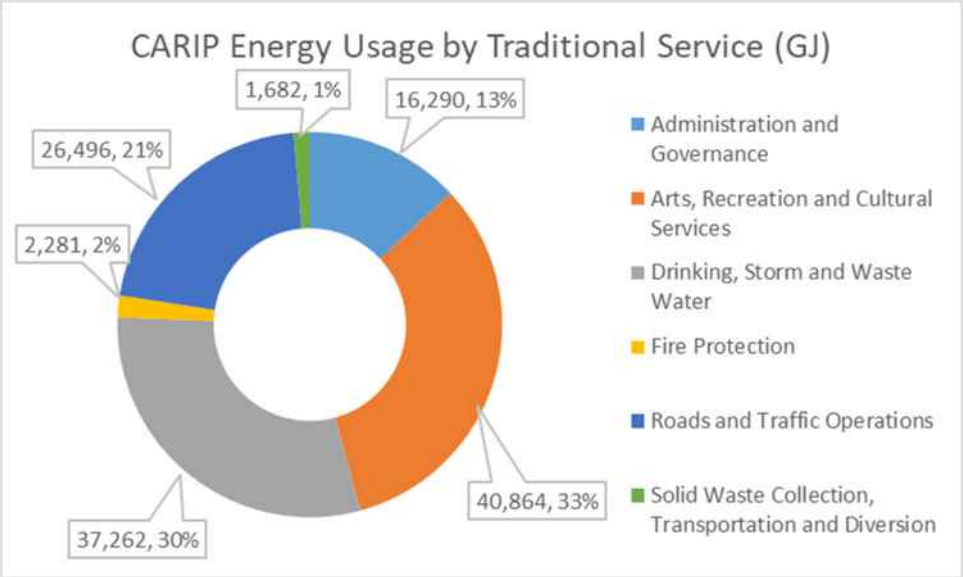
The charts in this section show the summarized data for 2017, for internal operations.

Vernon 2017 Energy Usage by Source:



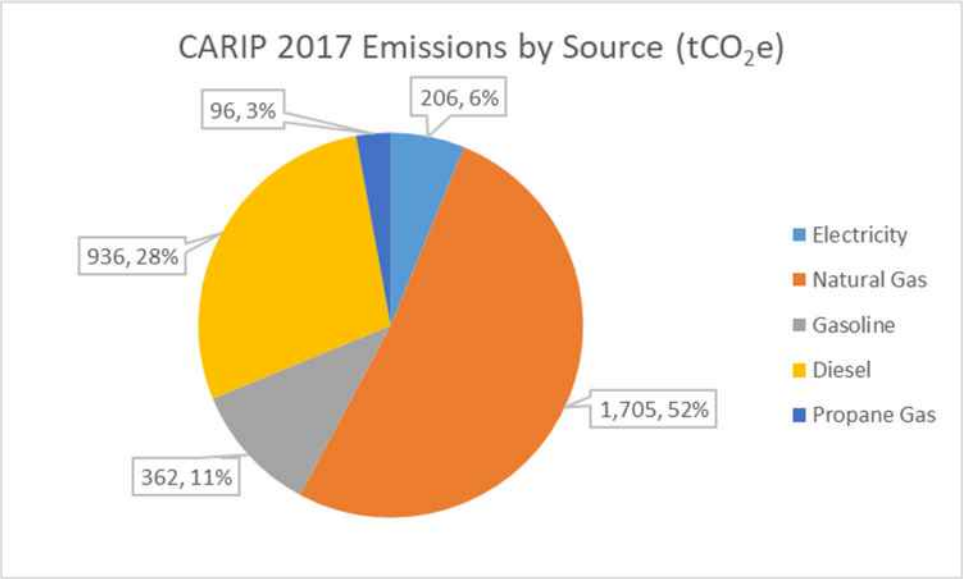
Electricity comprised 56% of all energy used, followed by natural gas at 27%. Diesel and gasoline comprise 11% and 5% respectively, with a small proportion of propane gas.

Vernon 2017 Energy Usage by Traditional Service:



Among traditional services, Arts, Recreation and Cultural Services consumed the largest proportion at 33%, with Drinking, Storm and Waste Water following at 30%. Fire Protection and Solid Waste Colleciton, Transportation and Diversion contributed minimally to energy consumption.

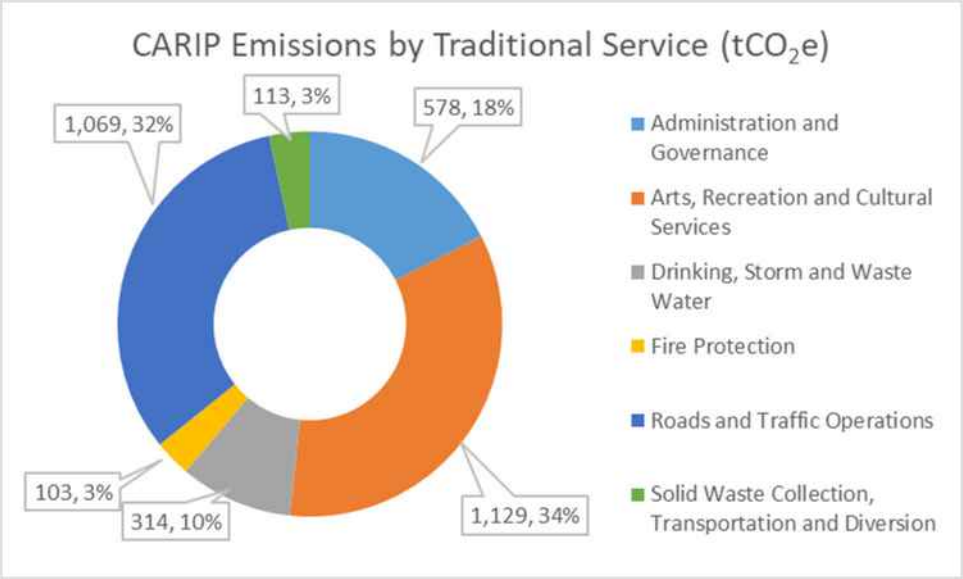
Vernon 2017 GHG Emissions by Source:



Natural gas comprises the largest proportion of emissions at 52%, followed by diesel and gasoline at 28% and 11% respectively. Note that electricity comprised only 6% of overall emissions, despite contributing 56% of energy consumption. This is due to the energy mix of electricity, which is 98.4% renewable in BC, resulting in an emission factor that is approximately 1/20th that of fossil fuels. [§]

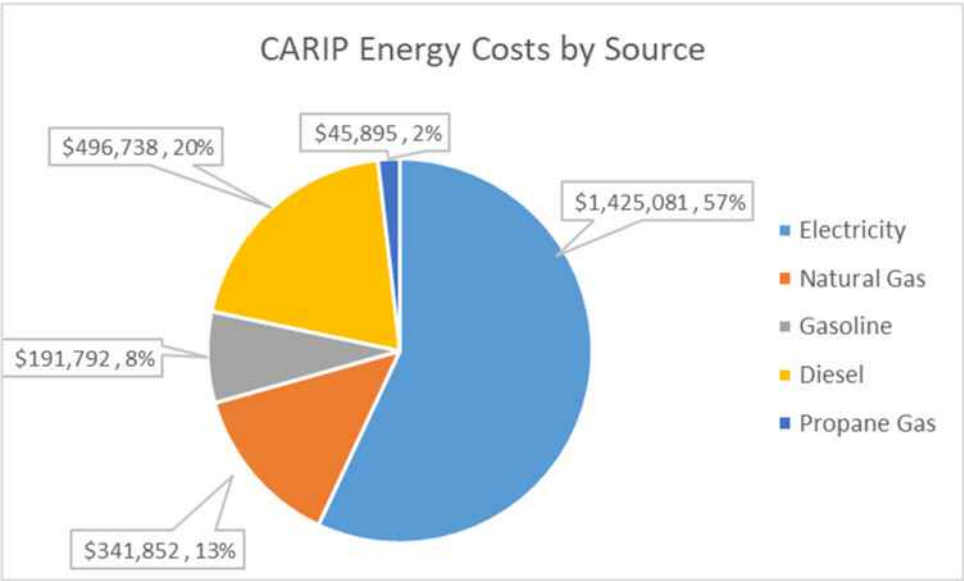
Vernon 2017 GHG Emissions by Traditional Service:

[§] Canada's Renewable Power Landscape 2017 – Energy Market Analysis, 2019. https://www.cer-rec.gc.ca/nrg/sttstc/lctrct/rprt/2017cndrnwblpwr/prvnc/bc-eng.html



Top emitters among traditional services were roughly equally split among Arts, Recreation and Cultural Services, and Roads and Traffic Operations at 34% and 32% respectively. Note that the latter contributed 12% less in energy consumption; the reason for the disproportionate emission contribution is due to the reliance on fossil fuels, namely from the fleet. Conversely, Drinking, Storm and Wastewater contributed only 10% of emissions, despite accounting for 30% of energy consumed. This is due to the higher proportion of electricity consumption.

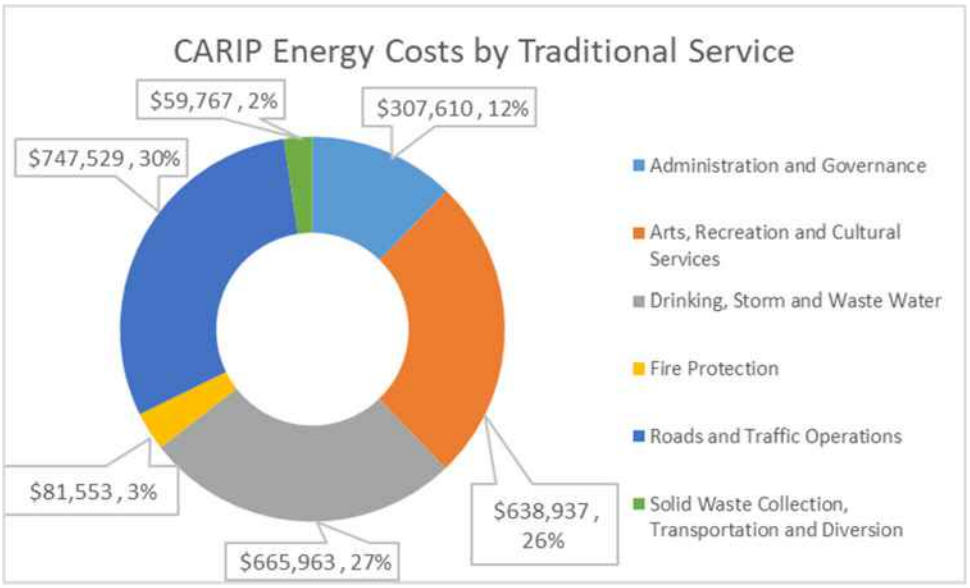
Vernon 2017 Energy Expenditures by Source:



Although electricity usage forms small part of the carbon footprint because it has a low GHG intensity, it accounted for 57% of the City's energy expenditures in 2017 because it has a high cost per unit of

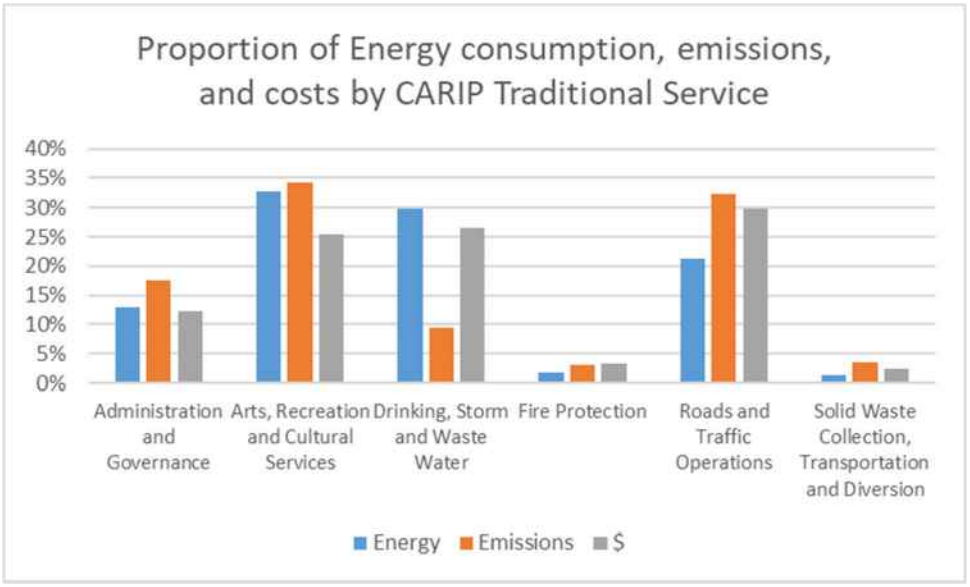
energy. Thus, work to reduce electricity usage is also very important as it will reduce operating costs, even though it will have a low impact on the corporate GHG footprint.

Vernon 2017 Energy Expenditures by Traditional Service:



Roads and Traffic Operations comprised the highest percentage of energy costs at $747,529 (30%), while Drinking, Storm and Waste Water, and Arts, Recreation and Cultural Services followed closely at 27% and 26% respectively.

Vernon 2017 Corporate Energy Consumption, Emissions, and Energy Expenditures by Traditional Service:



Arts, Recreation and Cultural Services contributed the largest proportion of energy (33%), owing to a large amount of electricity and natural consumption. The latter also contributed to its high emission

proportion of 34%. Roads and Traffic Operations also contributed a high proportion of emissions despite a lower proportion of energy consumption, due to the inclusion of all fleet vehicles (except fire vehicles). Drinking, Storm and Waste Water also contributed a high proportion of energy and costs (30% and 27%), despite a relatively low emission footprint at 9%. This is due to the high proportion of low-emission, but high cost electricity.

Inventory Summary

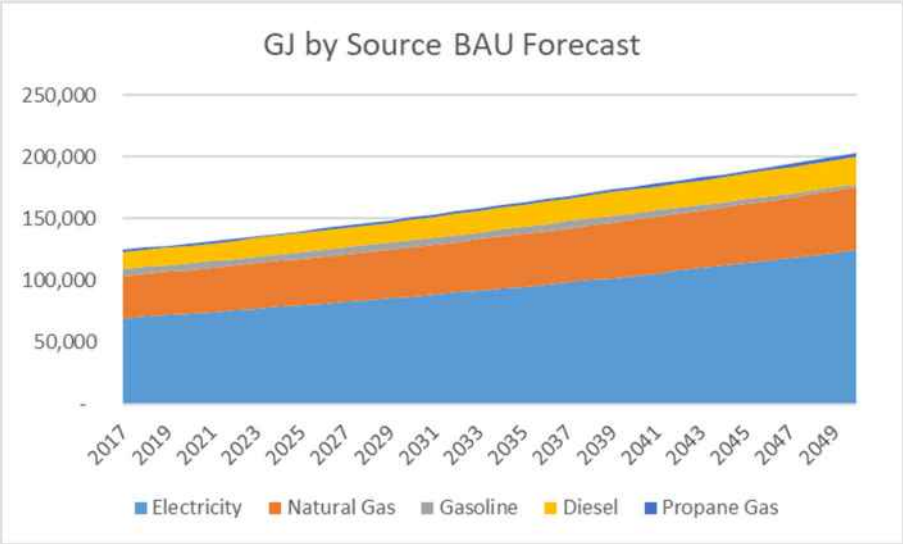
Overall, Vernon's corporate services consumed 124,875 GJ and emitted 3,305 tCO_2e at a total cost of $2.5 million. Vernon's energy consumption profile shows higher dependence on electricity than other fuels (52%), with natural gas second (28%). As for emissions, natural gas contributed 52% of all emissions, followed by diesel at 28%. By traditional service, Arts, Recreation and Cultural Services contributed the largest proportion of energy consumption and emissions, while Drinking, Storm and Waste Water operation had the highest cost overall. On the other hand, Fleet energy consumption was nearly equal to the V.W.R.C., but due to its dependence on fossil fuels, had 3.5x higher emissions. The Fleet also had the highest cost, at over $716,000. Reporting and measuring annually on overall corporate energy consumption provides incentive to work on actions to reduce GHGs and ultimately energy costs for the corporation.

The City should look at all opportunities to reduce energy consumption, emissions, and energy expenditures. One opportunity is the Fleet, which alone is 42% of the City's carbon footprint and 28% of costs, despite only consuming 15% of energy. With the recent Clean BC mandate on zero-emission light duty vehicles, and advances in electric technology for trucks and heavy-duty vehicles, the City has an opportunity for fleet conversion as their vehicles approach the end of their service life. Other opportunities for emission reductions will be from the Recreation Centre, Kal Tire Place, and Civic Arena, all of which rely on natural gas heating, contributing 40-50% of all energy consumed and nearly 100% of all emissions.

Business as Usual Forecast

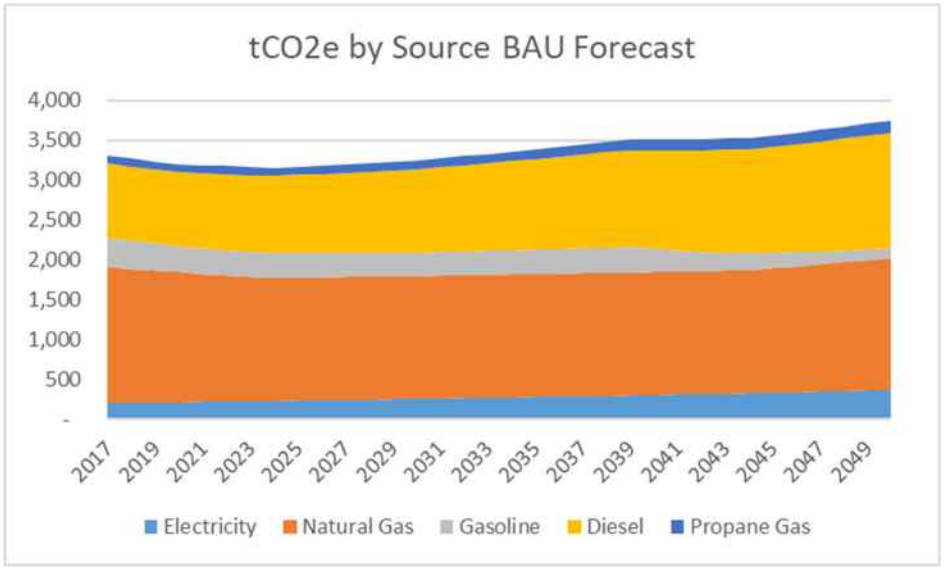
If the City of Vernon conducts no efficiency or conservation activities, and assuming that future changes are proportional with population increase at 1.60% per year, and considering climate adaptation data to account for decrease in heating degree days and increases in cooling degree days up to 2050, we have the following BAU forecast:

City BAU energy consumption forecast to 2050:



Note that overall energy usage increases steadily owing to population growth. Come 2050 however, there is about a 7,000 GJ drop in natural gas usage owing to reduced heating demand, however this is compensated for by a 5,900 GJ increase in electricity usage from increased cooling demand.

City BAU GHG emissions forecast to 2050:



Accounting for adaptation results in a displacement of 7,000 GJ of natural gas with 5,900 GJ of electricity. Because the emission factor for electricity is 6% that of natural gas, the overall effect is a 233 tCO_2e reduction in GHG emissions.

It is difficult to predict these future increases, but it is clear that an increasing population will provide upward pressure on energy consumption, and that this should be managed going forwards.

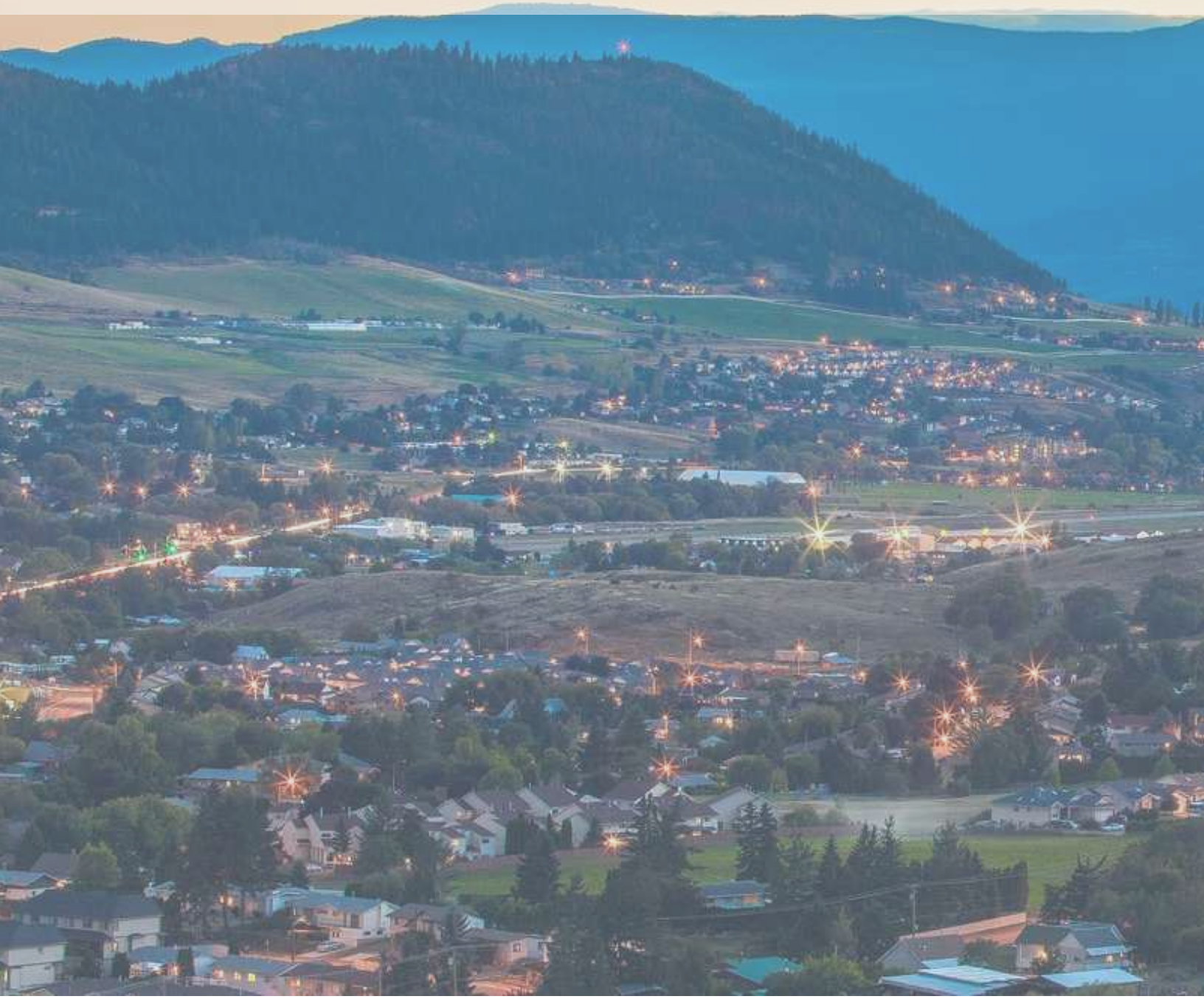
No BAU chart for energy expenditures has been created because of the considerable uncertainty around predicting future energy prices.

Appendix 5
Adaptation Assessment

City of Vernon

Climate Change Adaptation Action Planning

March 2020



Produced for:

CITY OF Vernon

Produced by:

INTEGRAL

Tamsin Mills – MSc, RPP

Table of Contents

Executive Summary

Climate disasters around the world and mounting scientific evidence make it clear that climate change is already upon us, despite global efforts to limit greenhouse gas emissions. The effects of a warming climate are apparent in Vernon, and the City has been challenged in recent years by climate-related events including flooding, landslides, and wildfires. This challenge will only increase in coming years, with future climate projections for the region indicating:

- **Increased temperatures year-round** with the most rapid increase in summer and autumn daytime highs. Valley bottoms in the Regional District of the North Okanagan can anticipate 52 days of daytime highs over 30°C relative to the current 27 day average;
- **More days of rainfall** in every season except summer, and **increased precipitation on rainy days**, posing flooding risk and challenges for Vernon's infrastructure;
- An increase in **growing season length** and **reduction in frost days**, which will drastically influence agriculture in Vernon; and
- An increase in the frequency and severity of **extreme weather events**, including wildfires, wildfire smoke events, and severe storms, all of which will be further complicated by other climatic projections and are expected to become more difficult to respond to over time.

These impacts require the City of Vernon to be proactive in how it addresses and manages climate change. As a first step, this *Climate Change Adaptation Action Planning* exercise identifies locally-relevant climate-related impacts, assesses associated vulnerability and risk, and outlines preliminary actions to address these impacts. Vernon already has a strong foundation to build on, with many local initiatives underway that relate to sustainability, emergency management, infrastructure, and asset management, and so these actions are designed to enhance existing initiatives wherever possible. Based on a series of workshops with a staff working group and key stakeholders, this document presents over 70 preliminary actions items across eight thematic areas:

1. **Water:** Actions designed to maintain long-term water supply and quality.
2. **Natural Assets and Green Space:** Actions designed to address invasive species, protect biodiversity and environmentally sensitive areas, and enhance municipal parks and public open spaces.
3. **Agriculture and Food Security:** Actions designed to improve food security, support agriculture, and increase opportunities for local food production.
4. **Built Infrastructure:** Actions designed to prepare municipal infrastructure (transportation, sewer, drainage) for changing climate conditions.
5. **Community Health and Well-being:** Actions designed to increase community resilience to high temperatures and poor air quality resulting from a changing climate, and to increase social resilience.
6. **Emergency Response and Preparedness:** Actions designed to prepare the City to respond to weather-related emergency events and climate-related hazards.
7. **Tourism and Economic Development:** Actions designed to ensure Vernon's economy remains robust in a changing climate, particularly winter tourism.
8. **Corporate Operations**: Actions designed to ensure city staff and operations incorporate a climate lens.

Important to note is that these preliminary impacts are only intended to provide the information necessary for future phases of work, and will need to be updated as new information becomes available during the development of Vernon's *Climate Change Action Plan.*

1. Introduction

The Climate Change Challenge

Climate disasters around the world and mounting scientific evidence make it clear that climate change is upon us, despite global efforts to limit greenhouse gas (GHG) emissions (i.e. climate change **mitigation**).

Warming temperatures associated with GHG emissions will bring increases in the volume and intensity of precipitation, shifting growing seasons, and higher frequency and severity of extreme weather events (e.g. wildfires and heat waves). These changes present profound consequences for natural, human, and built systems, and the economic and service sectors that are linked to them.

In 2018, the National Aeronautics and Space Administration (NASA) highlighted that average global temperatures have already increased by 1° Celsius since the 1880s and will continue to rise for the next several decades[1]. Recognizing the threat, the Intergovernmental Panel on Climate Change (IPCC) has emphasized the need to limit global warming to 1.5°C above pre-industrial levels to limit the worst impacts of climate change[2].

This target is particularly important for Canada which, because of its northern latitude, is experiencing a rate of warming approximately twice the global average[3]. Canada has already warmed by an average of 1.7°C across the country (and up to 2.3°C in more northern areas) since 1948 when historical records became available. If GHG emissions are not drastically decreased soon, the country is projected to warm by an average of up to 6°C by 2100, relative to the period from 1986 to 2005[4].

Addressing Climate Change in Vernon

The effects of a warming climate are apparent in Vernon. Between 2017 and 2019, climate-related events including flooding, landslides and wildfires, and associated emergency creek works and services for wildfire evacuees cost the City approximately $775,000 after accounting for staff working hours and internal resources. Vernon has also seen declines in tourist numbers potentially correlated with climate-related events. For example, visitor centre attendance dropped by more than a third (from 17,365 in 2016 to 10,860 in 2018), correlated with periods of heavy wildfire smoke[5].

Climate change will have dramatic impacts on the region, its residents, and City operations, including:

- Challenges for community health and well-being;
- Strain on essential services, including healthcare;
- Challenges with municipal infrastructure designed for historic climate patterns;
- Threats to ecosystems, natural areas, and agriculture;
- Challenges for local economic development.

These impacts require the City of Vernon to be proactive in how it addresses and manages climate change (i.e. climate change **adaptation**). Resilience refers to the ability of a system to rebound from a shock or stress and, though this report, **low-carbon resilience** can be thought of as a merging of adaptation and mitigation, by responding to the negative impacts of climate change while simultaneously reducing emissions.

---

[1] NASA. (2019). *2018 Fourth Warmest Year in Continued Warming Trend, according to NASA, NOAA.*
[2] United Nations Intergovernmental Panel of Climate Change (IPCC). (2018). *Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C Approved by Governments.*
[3] Environment and Climate Change Canada. (2019). *Canada's Changing Climate Report.*
[4] Environment and Climate Change Canada. (2019). *Canada's Changing Climate Report.*
[5] City of Vernon staff communication.

As a first step, this *Climate Change Adaptation Action Planning* report identifies locally-relevant climate-related impacts, assesses associated vulnerability and risk, and outlines specific adaptation actions to address higher risk impacts. It also includes preliminary guidance on how to carry out those adaptation actions. The *Assessment* is intended to feed into the City of Vernon's upcoming *Climate Action Plan*, in conjunction with recently completed work on climate mitigation. As such, actions included in this report are primarily designed to provide the information necessary for future phases of work, rather than for public consumption. They should be updated to dovetail with mitigation actions wherever possible and updated as new information becomes available during the development of the *Climate Action Plan*. Actions should be edited to be widely understood across audiences prior to public engagement.

- **Section 1** provides background information on the need for adaptation action in Vernon, and the steps involved in the Assessment.
- **Section 2** outlines Vernon's past and present plans, strategies, policies, and initiatives associated with climate change adaptation.
- **Section 3**provides a review of Vernon's projected future climate, along with associated impacts.
- **Section 4** prioritizes climate impacts by assessing likelihood, consequence, and overall vulnerability.
- **Section 5** sets out adaptation actions for Vernon sorted by thematic area, including both short- and longer-term projects.
- **Section 6** discusses key considerations moving forward, including the cost of inaction, potential for savings, and importance of equitable climate planning.
- **Section 7** provides a brief conclusion and indicates next steps for the City.

Conducting the Assessment

This *Climate Change Adaptation Action Planning* report was undertaken following the *BC Climate Risk Assessment Framework*[6], modified to fit the context of adaptation planning for local governments (see **Figure 1** below). It also drew from the currently under development modernization of the *Hazard and Risk Vulnerability Assessment* (HRVA)[7] process and the ICLEI (Local Governments for Sustainability) *Building Adaptive and Resilient Communities* (BARC)[8] program. The methodology followed four general steps, outlined below:

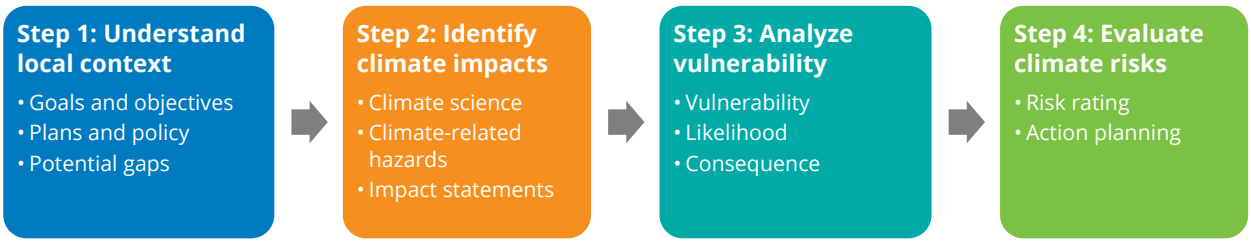


Figure 1: BC Climate Risk Assessment Framework (graphic adapted from the Province of BC)

Step 1 was completed by the consultant team, while impacts, vulnerabilities, and risks to the City and broader community, and preliminary actions to address these risks (**Steps 2 through 4**) were identified through two workshops with key stakeholders. Workshop participants included City of Vernon staff, members of the Climate Change Advisory Committee (CAAC) (a committee of Council), and representatives from other levels of government and partner organizations. Workshop outcomes were further refined with follow-up input from across these stakeholder groups.

[6] Government of BC. (2019). *Strategic Climate Risk Assessment Framework for British Columbia.*
[7] Government of BC. (2019). *Hazard, Risk & Vulnerability Analysis.*
[8] ICLEI Canada. (2017). *BARC Program.*

Stakeholders and partners paramount to the success of the *Climate Change Adaptation Action Planning* report include:

Regional District of North Okanagan
Greater Vernon Water
Neighbouring municipalities
Okanagan Indian Band
Interior Health Authority
Climate Action Advisory Committee
Social Planning Council for the North Okanagan
Vernon RCMP
Greater Vernon Chamber of Commerce
BC Agriculture & Food Climate Action Initiative

Important to note is that the above process was not fully completed during the Assessment. Preliminary actions have been identified, but thorough action planning will take place during the development of the *Climate Change Action Plan.*

2. Understanding the Context

Step 1 in developing adaptation actions involved generating a baseline understanding of Vernon's local context, including local goals and objectives. The project team reviewed the City's existing policies, plans, programs and projects that intersect with climate change adaptation, and then identified potential gaps and opportunities to enhance resilience. This review revealed that the City of Vernon has already shown leadership on environmental sustainability by developing and implementing a range of environmental policies and bylaws. Many of these efforts already contribute to enhancing climate resilience through the community. This Assessment focuses on building on existing initiatives and identifying gaps that require new actions.

Having signed onto the *BC Climate Action Charter*, the City of Vernon has committed to achieving substantial GHG emission reductions and to creating a more sustainable community. The City's *Carbon Tax Revolving Fund* supports this by providing a regular source of funding for climate action projects that can demonstrate corporate or community GHG reductions. The City has also established a *Climate Action Advisory Committee* to provide recommendations to Council on addressing climate change, and has trained a group of Climate Ambassadors to engage peer networks throughout the community on climate issues.

The City's *Official Community Plan* (OCP) aligns with the Charter by establishing policies on energy and emissions management. The OCP also sets priorities of protecting green spaces and sensitive areas, creating a culture of sustainability, protecting agricultural land, encouraging compact and complete neighbourhoods, and providing alternative transportation. Finally, it includes policies to protect life and property from natural hazards such as steep sloops, flooding, and wildfires.

Additional policies and efforts that explicitly recognize the need for climate change adaptation include:

- The *Parks Master Plan* recognizes climate change and includes goals and policies to foster resilience, including xeriscaping, emphasizing native species, and introducing edible plants into local parks.
- The City's *Emergency Management Plan* provides an overall framework for City staff to prepare for, respond to, and recover from extreme events. It includes a *Hazards, Risks and Vulnerability Assessment* (HRVA) which identifies extreme events of greatest relevance to Vernon today, with the top three risks deemed to be wildfires, floods, and dangerous goods spills.
- The *Community Wildfire Protection Plan* outlines the impacts of climate change on local ecosystems and forests, along with how this will influence fuel management and wildfire threat reduction. It also identifies wildfire threats that could impact local development and makes recommendations to reduce overall threat levels through the OCP, zoning, and building bylaws
- The *Drainage Infrastructure Prioritization Study* and *Flood Hazard Mapping Study* currently underway both incorporate a climate lens ensuring future projections are considered, including precipitation changes.

Further to the policies noted above, there are many others that do not address climate change adaptation directly but still help to enhance the city's resilience to a changing climate:

- The *Environmental Management Areas Strategy* establishes guiding principles of protecting air and water quality, protecting natural areas and wildlife habitat, encouraging the development of alternative energy and community GHG emissions reduction.
- The *Sustainability Grants Program* offers potential funding for projects that further Vernon's sustainability goals, including conserving energy and protecting ecosystems.
- The *Attainable Housing Strategy* makes numerous recommendations to increase social resilience, including expanding permitted types of housing to increase affordable housing stock.

A more thorough description of plans and policies that intersect with climate change adaptation can be found in the *Baseline Assessment* conducted for this study, submitted as a companion to this report.

3. Identifying Climate Impacts in Vernon

Step 2 was completed during Workshop 1, held with City staff, the CAAC, and other key stakeholders. The workshop focused on building awareness of climate projections specific to the Vernon area and identifying a range of potential impacts to the community from these anticipated changes.

To determine how the future climate will impact Vernon, the project team used quantitative regional climate parameters to represent more general climate trends. For example, overall temperature changes were represented by variables such as hottest day of the year, days above 25°C and days above 30°C. Precipitation changes were sourced from wettest day of the year, 1-in-20 wettest day and more.

> **Weather** refers to the atmospheric conditions at a given location at a given time. These conditions generally occur over a short period and are subject to frequent change.
>
> **Climate** refers to the weather conditions prevailing in an area in the long term (i.e. years or decades).
>
> **Climate change** refers to variations in climatic conditions over time that have been observed in the past, along with future conditions that are anticipated based on these projections.

This climate data was sourced from the *Climate Projections for the Okanagan Region 2020 report*[9], developed by the Regional District of North Okanagan (RDNO) and Pacific Climate Impacts Consortium (PCIC). The report states that the science is intended to support local exploration of climate impacts and provide the basis for adaptation planning as it is used in this project. All climate projections were based on the **Representative Concentration Pathway** 8.5 (RCP8.5) or "business-as-usual" climate scenario[10] (**Figure 2)**. This scenario assumes that countries around the world are unable to achieve global, coordinated action on reducing GHG emissions, and is recommended by most institutions for climate change adaptation planning.

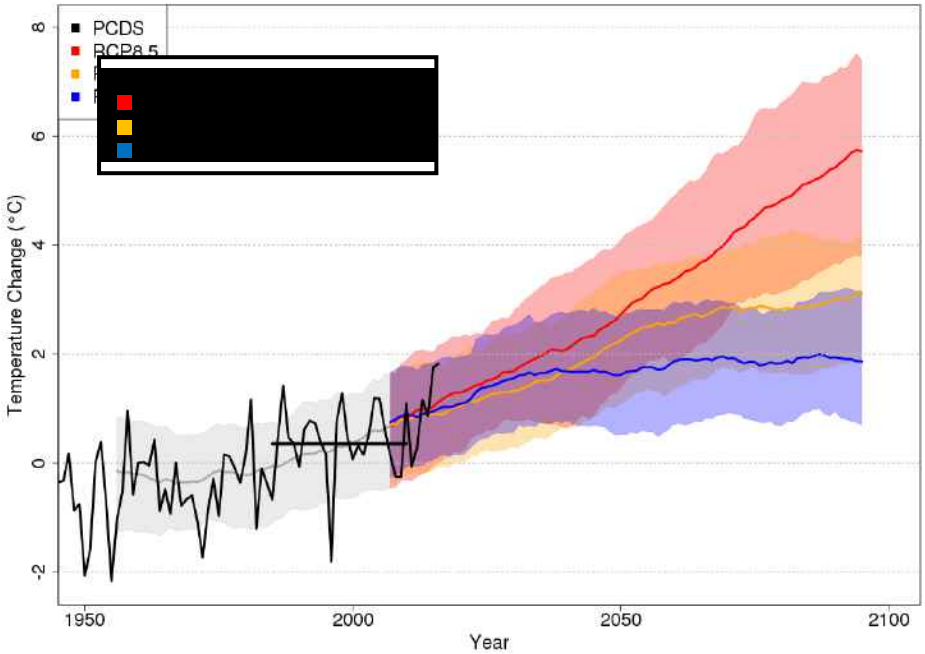


Figure 2: RCP pathways showing projected temperature changes in British Columbia under different GHG concentration scenarios based on global mitigation action (Figure courtesy of PCIC)

[9] RDNO & PCIC. (2019). *Okanagan Basin Regional Climate Projections Report.*

[10] United Nations Intergovernmental Panel on Climate Change (IPCC). (2013). *Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis.*

This conservative approach is necessary because, although mitigation efforts are underway both locally and globally, the world is essentially "locked-in" to a certain degree of climate change and the impacts that come with it. For adaptation action planning, using RCP8.5 covers the "worst-case scenario", meaning that Vernon would be prepared for climate impacts experienced under RCP4.5 and RCP2.6 as well.

Anticipated changes for Vernon under RCP8.5 are summarized below in three general categories: changes in temperature, changes in precipitation, and growing season changes. These changes will also be associated with an increase in the frequency and severity of extreme events. When a change from the past is described below, the 'past' is the common baseline period used internationally: 1971 to 2000. The values described below, unless noted otherwise, are for the valley bottoms in the Regional District of the North Okanagan (RDNO). More specific details are available in **Appendix A**.

Changes in Temperature

Vernon can expect an overall increase in temperatures across all seasons. January temperatures of the future will feel like March temperatures of the past and May will be similar to Augusts of the past. Other projected changes are noted below:

- The hottest summer daytime high temperature in RDNO valley bottoms in the past was 35.9°C. By the 2050s this is anticipated to increase 4.5°C on average closer to 40°C and by over 7°C by the 2080s to over 43°C.
- In the past, valley bottoms in the region experienced approximately a week of days with temperatures above 30°C. By the 2050s, 16 days above 30°C are projected with 31 days by the 2080s.
- Cooling degree-days (a measure of demand for air-conditioning in a building) is going to increase significantly by the 2050s and 2080s while heating degree days (a measure of demand for heating in buildings) will decrease 22% by the 2050s and 35% by the 2080s.
- Winter days and nights are going to get warmer, with the coldest nights of the year increasing by approximately 6°C by the 2050s and 10°C by the 2080s.

These temperature changes present several potential impacts for Vernon, including:

- Ecosystems functions, with shifting ranges for native species and increased opportunities for invasive species, coupled with strain on natural systems from periods of prolonged drought;
- Human health and well-being challenges, particularly from heat-related illness, smoke exposure from wildfires, and pressure on the water supply;
- Threats to Vernon's established economic drivers, such as agriculture and winter tourism. Note that taking advantage of a longer growing season and new opportunities for shoulder season recreation may somewhat alleviate these economic impacts.

Changes in Precipitation

Vernon is expected to see more days of rainfall overall in every season except for summer, and the amount of precipitation on the wettest days of the year is anticipated to increase 23% by 2080. The changes to total precipitation amounts (including rain and snow water equivalents) by season are:

- Spring: increasing by 13% by the 2050s and 20% by the 2080s
- Summer: decreasing by 11% by the 2050s and 19% by the 2080s
- Autumn: increasing by 11% by the 2050s and 20% by the 2080s
- Winter: increasing by 8% by the 2050s and 15% by the 2080s.

Other precipitation changes for Vernon include:

- The amount of rain that falls over a consecutive five-day period is projected to increase by 16% by the 2080s from 37mm in the past.
- The amount of rainfall that falls in a 1:20 year return event rainstorm (5% chance of occurring in any year) will increase by 20% by the 2050s and almost 30% by the 2080s.
- The North Okanagan region can anticipate a greater increase in rainfall on wet and very wet days than other regions in the Okanagan. On very wet days (99% percentile) valley bottoms in the RDNO can anticipate an increase of 45% by the 2050s and 89% by the 2080s from a baseline of 22mm.

Shifting precipitation patterns present several key challenges for the region:

- Vernon's stormwater system may be overwhelmed by increased rainfall that can lead to localized flooding, causing damage to buildings and infrastructure;
- Additional risk of flooding from BX Creek and other bodies of water, especially when rain aligns with periods of snowmelt;
- Decreased slope stability and increased risk of landslide from heavier and more frequent rain events, which will also cause sedimentation that damages infrastructure and aquatic habitats; and
- Strain on local potable water supplies from reduced summer rainfall, especially when compounded with warmer temperatures.

Growing Season Changes

Across the region, growing season length is projected to increase significantly, from a baseline period average of 227 days in the valley bottoms of the RDNO to 266 in the 2050s and 304 days in the 2080s. In addition, the number of frost days (where the daily minimum temperature is less than 0°C) is projected to decrease 47% by the 2050s and 69% by the 2080s.

Considering longer growing seasons, extreme weather, and increased invasive species, it is almost certain that agriculture in Vernon will look drastically different than it does today by the 2050s and 2080s.

Increase in Frequency & Severity of Extreme Events

In line with the above changes, extreme weather events that were once rare in Vernon will become increasingly common over time. While specific projections have not yet been developed for the region, residents can expect the following:

- Growing wildfire risk resulting from higher average temperatures and decreased summer rainfall.
- Increased occurrence of wildfire smoke events linked to increased wildfire activity.
- More frequent and intense storms caused by extra heat in the atmosphere and ocean.

Extreme weather events will be further complicated by other climatic projections and are expected to become more difficult to respond to over time. For example, wildfires will become increasingly challenging to fight with increased average temperatures and decreased summer rainfall. Conversely, slopes that have been ravaged by wildfire will produce increased sedimentation during heavy rainfall throughout the seasons.

The consequences of extreme events can be dire, and include;

- Power outages from flooding and storms;
- Downed trees and damage to buildings from wind gusts;
- Significant physical and mental health impacts;
- Economic losses during wildfire smoke events; and

- The need to activate emergency operations personnel more frequently, with cost implications for response and clean-up.

Identifying Impacts & Opportunities

Participants in Workshop 1 generated **over 100** climate impacts specific to Vernon, including both challenges (e.g. impacts to winter tourism) and opportunities (e.g. lower heating bills). Following the workshop, these were refined by the project team to reduce redundancy and overlap, bringing this number to **74** impacts. **Table 1** below provides examples of key impacts of climate change that were brought forward for adaptation action planning, with full details available in **Appendix B**. Important to note, however, is that the City now has a record of all potential impacts that were discussed through this process, which can be considered in future adaptation planning efforts.

Table 1: Key climate-related impacts that were used to develop adaptation actions for Vernon

Projected Climate Trends	Public Infrastructure / Water Supply	Health & Well-being / Preparedness	Land Use & Buildings / Economic Development	Natural Assets & Green Space / Agriculture
Hotter, drier summers	Strain on water supply	Increased health risk, especially for vulnerable residents Increased strain on hospitals and clinics	Increased demand for A/C resulting in higher energy costs and stress on power grid	Reduced water availability for irrigation, parks and agriculture
Warmer winters	Increased freeze/thaw damage to infrastructure Shorter lifespans of infrastructure	Changes to travel habits and mode shift	Lower heating bills Economic losses as a result of shorter winter sport seasons	Increase in invasive species
Increased frequency and intensity of precipitation	Localized flooding when stormwater system is over capacity Decreased water quality	Increased boil water advisories as turbidity and sedimentation increases	Damage to older buildings not designed for damp conditions	Increased landslide risk for prone areas Impacts to aquatic habitats
Longer growing season	Increased demand for irrigation water		Opportunities for agriculture with longer growing season	Possible advantages for agriculture and food security
Increased frequency and severity of extreme events	Increased power outages Increased costs to the City of clean-up	Increased need for emergency response and clean-up Pressure on existing evacuation routes	Increased closure and disruption of businesses Increasing insurance costs	Threats to public safety Damage to crops

During Workshop 1, participants also grounded impacts spatially through a mapping exercise. This process involved a map overlaid with three hazard layers: fire interface areas, areas at higher risk of flooding, and areas with steep slopes and higher risk of erosion. Considering these hazards and their own knowledge of the community, participants identified key challenge areas, including:

- Increased interface wildfire hazard at Kilkanee Estates and surrounding area, and Mission Hill Park including the elementary school
- The dead-end at Eastside Road, leaving one option for fire egress
- Increased flooding hazard near Polson Park, potentially affecting localized businesses, major transportation routes, and buildings downstream
- Increased flooding hazard at the airport lands and surrounding area, sanitary infrastructure, and major transportation routes
- Increased flooding hazard at the Recreation Centre, which also houses evacuees

This map was not intended to be a comprehensive evaluation of hazards in Vernon, but rather to help participants to frame their thinking about climate change challenges in Vernon. Note that no geohazard areas were recorded within City limits. The outcomes of the mapping exercise are summarized in **Figure 3**.

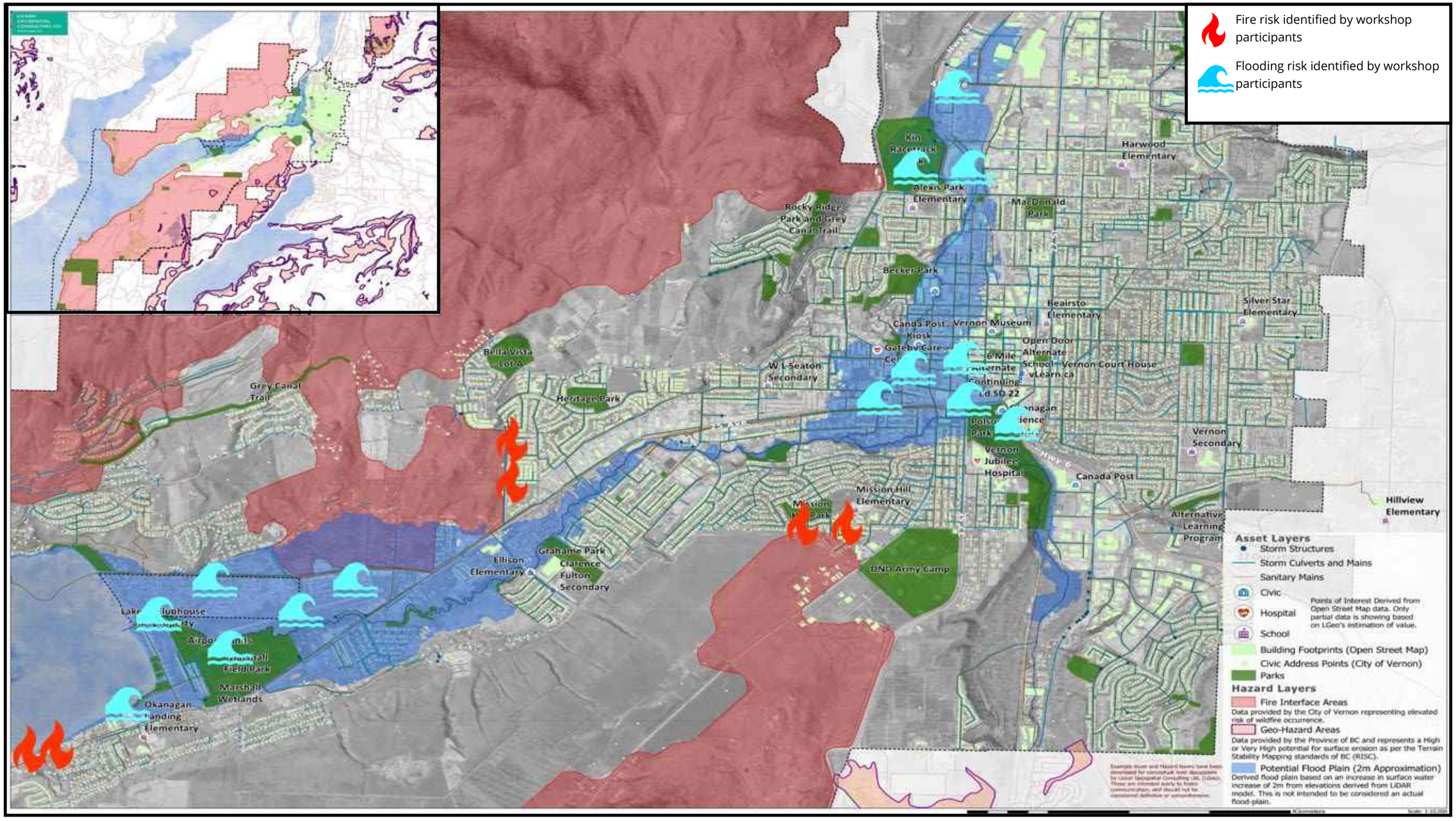


Figure 3: Map of Vernon overlaid with hazard layers and participant-submitted areas of concern (Map courtesy of Licker Geospatial Consulting LTD.)

4. Analyzing Vulnerability

Vulnerability Assessment

In **Step 3**, impact statements were prioritized to focus limited adaptation resources on the most effective areas for Vernon. This was done using a vulnerability assessment carried out in Workshop 1. The vulnerability assessment process followed ICLEI Canada's *Building Adaptative and Resilient Communities* (BARC)[11] approach to assess **vulnerability** by rating two factors:

- **Sensitivity**, or the degree to which people or systems are either positively or negatively impacted by changing climate conditions; and
- **Adaptive capacity**, the ability to prepare for and respond to impacts and consequences.

Participants formed expertise-centred groups to rate vulnerability for each impact related to their expertise. After the initial group reviewed their ratings relative to each other, impacts were traded with another participant group for a check of ratings. In total, this resulted in **46** impacts being deemed as high-vulnerability (i.e. 3 and above on a 5-point scale) and **28** impacts as low-vulnerability (i.e. 2 and below out of 5). The full outcomes of this exercise can be viewed alongside the impacts in **Appendix B**.

5. Evaluating Climate Risks

Assessing Risk

The first component of **Step 4** (risk assessment) was completed in Workshop 2. Based on the results of the vulnerability assessment, participants assessed those impacts with higher vulnerability for overall risk by considering:

- **Likelihood** of occurrence, based on the expected return period or probability of the hazard event or trend occurring in Vernon; and
- The **consequence** of that impact should it occur, based on the severity of the consequence to people, property and the environment.

In total, 46 high-vulnerability impacts were evaluated for risk. The *BC Climate Risk Assessment Framework* methodology was followed to rate risk and likelihood. Likelihood was rated for both past and future conditions, with past likelihood pre-populated ratings from Vernon's HRVA[12], where relevant. The 28 impacts with lower vulnerability ratings were not assessed for risk but were preserved for future planning endeavours.

Preliminary Action Planning

The second component of Step 4, action planning, was also started in Workshop 2. Important to note, however, is that this is only the beginning of the climate action planning process for Vernon. The outcomes presented in this section are to be considered preliminary actions and will need to be further refined through the development of the *Climate Action Plan*. Specifically, actions should be revised with publicly-accessible language, and assigned indicators for future monitoring and evaluation.

[11] ICLEI Canada. (2017). *BARC Program.*
[12] City of Vernon. (2017). *Hazards, Risks & Vulnerability Assessment.*

During the workshop, the results of the risk assessment were reviewed, discussed and "ground-truthed" with workshop participants. The impacts with lowest assessed risk were again reserved for future review with all the other impacts grouped into themes to be addressed for action planning. In focused groups, participants generated ideas and strategies to either reduce risk or capitalize on opportunities.

In order to identify synergies and limit redundancies, the project team honed this initial set of actions through consultation with stakeholders including City of Vernon department managers, Mayor and Council, the CAAC, the Emergency Program Coordinator, and staff from the Regional District of North Okanagan and Interior Health. These refined actions were then categorized into eight themes, shown below. The preliminary actions introduced through this section are described in greater detail in **Appendix C**, along with first steps for implementation where established through the engagement process (e.g. lead City department).

This Assessment sets direction in eight action areas:

1. Water
2. Natural Assets and Green Space
3. Agriculture and Food Security
4. Built Infrastructure
5. Community Health and Well-being
6. Emergency Response and Preparedness
7. Tourism and Economic Development
8. Corporate Operations

Theme 1: Water

Seasonal water shortages were ranked among the top five anticipated risks from climate change for British Columbia[13], and Vernon in particular[14]. Hotter, drier summers combined with reduced snowpack in the winter will put stress on our water supply, leading to earlier drawdown of the reservoir and reducing overall availability for irrigation, as well as both commercial and domestic use. Demand for water will simultaneously increase as the local population grows, making efforts to conserve and supplement the local water supply a key issue in addressing climate change.

Water infrastructure is also at risk from climate change. Increased precipitation will affect the frequency at which the MacKay reservoir fill and require release, and can create an increase in the number or severity of landslides and erosion, especially following particularly dry summers. With increased precipitation and storm events also comes increased turbidity and sedimentation in the water supply, which can lead to an increase in the number of boil water advisories. Protecting water supply infrastructure from these impacts will be an important area of focus in ensuring the City's continued resilience.

Objective 1: Ensure sustainable long-term operation of the water supply system and take measures to increase water conservation.

PRELIMINARY ACTIONS
Increase water conservation efforts: • education on water conservation for both tourists and residents, • promoting rain barrel use and xeriscaping on public and private lands. • Incorporating guidelines for water conservation in new and re-development projects
Request that the RDNO investigate the enforcement of water use and water meter bypass methods.
Advocate to the Province to: • Allow reclaimed water use as a non-potable supply (including for crop production) with plans for future connection to GVW non-potable distribution system
Support the Regional District of North Okanagan – Greater Vernon Water (RDNO-GVW) grant application process for larger reservoirs.

Objective 2: Maintain the quality of the water supply with regional partners.

PRELIMINARY ACTIONS
Increase planting and bank stabilization efforts where steep slopes could impact water supply infrastructure.
Provide City support for RDNO-GVW federal grant applications with respect to added water filtration treatment to Mission Hill Water Treatment Plant to avoid boil water advisories.
Work with local partners (e.g. RDNO-GVW, District of Coldstream) on stormwater management best practices to protect shared water source (e.g. Kalamalka Lake, Duteau Creek Reservoir).

[13] Province of BC. (2019). *Preliminary Strategic Climate Risk Assessment for British Columbia.*
[14] City of Vernon. (2017). *Hazards, Risks & Vulnerability Assessment.*

Theme 2: Natural Assets & Green Space

With changes in climate will come warmer annual temperatures, drier summers, and heavier precipitation. Many of these changes are likely to negatively impact local ecosystems, including impacts from increases in extreme events such as heat waves and storms. As natural ranges change, species at risk may be at even greater risk, while invasive species (e.g. pine beetle, zebra mussels) may become more successful. As such, there is a need to continue and expand on efforts to reduce the spread of invasives and preserve local biodiversity, both for the sake of local species and the enjoyment of Vernon residents. Bolstering the resilience of local parks through the selection of resilient, drought tolerant plant species and enhancing the urban forest will also help to improve the health of local ecosystems while providing amenities that reduce water consumption, reduce flooding, and provide shade from the summer heat.

Objective 1: Ensure ongoing responsiveness to invasive species in a changing climate.

PRELIMINARY ACTIONS
Continue existing education and identification programs for invasive species (e.g. Clean, Drain, Dry; Clean Before You Play; Don't Move a Mussel).
Monitor and remove invasive species in City parks and municipal lands.
Review existing bylaws relevant to invasive species management and update where needed.
Provide support for neighbourhood weed pulls.

Objective 2: Continue protection of biodiversity, riparian areas and environmentally sensitive areas in a changing climate.

PRELIMINARY ACTIONS
Work with the Regional District of North Okanagan (RDNO) and FLNRORD to identify parts of the city for habitat protection and improvement in the *Official Community Plan* (OCP).
Prevent habitat fragmentation by protecting a comprehensive network of corridors and large natural areas (hubs and sites).
Provide direction to developers on suitable vegetative species and development features that enhance habitat values.
Preserve existing riparian habitat and wetlands through partnerships, zoning, and improvement of the implementation of the *Environmental Management Strategy* (including review of the Development Permit Exemptions).
Implement aquatic and riparian habitat restoration projects. Work with partners to develop a prioritized list of potential restoration projects and seek funding for implementation.
Work with the Province to improve the management of local lakes (where possible) to the benefit of aquatic species.

Objective 3: Integrate climate change considerations into the planning and operations of municipals parks, naturalized areas, and public open spaces.

PRELIMINARY ACTIONS
Develop climate design guidelines for parks and recreation fields to increase access to potable water, drainage and shade: • Identify and apply best practices for field drainage • Investigate and pilot more drought tolerant grass species
Finalize and adopt a revised *Landscape Standards Bylaw* that includes climate resilient species and ensure applicability to City parks and municipal lands: • Incorporate xeriscaping in landscape standards and implement via attrition • Identify bee-friendly plants in the *Landscape Standards Bylaw* • Integrate FireSmart principles
Create an *Urban Forest Management Plan* using a climate lens. Focuses to include: • Improve tree maintenance for healthy tree canopy including proactive maintenance for windthrow and breakage • Identify new pests and diseases to monitor for • Identify the tree species that will flourish under future climate and develop a tree list for public planting (may consider sharing this more broadly with developers and the public) • Identify areas to prioritize for increased canopy cover (e.g. in this assessment, several areas identified such as active transportation routes) including existing private parking lots • Utilize City bylaws, standards, and permitting processes to ensure adequate canopy, root crown and root growth space is provided for trees to mature to optimal size on public and private property
Review and update the *Tree Protection Bylaw* to reduce canopy losses. Encourage residents to plant trees that enhance species diversity.

Theme 3: Agriculture & Food Security

While a longer growing season and fewer frost days can have many positive implications for the region's agricultural sector, others will need to be addressed in order to protect from risks to productivity. Later frosts, early budding, severe storms, and drought will all affect the region's local economy, and could even begin to threaten local food security as the viability of global food networks come under increasing pressure. Efforts to protect the integrity of agricultural systems and the production of local food will help to ensure Vernon's community and economy remain strong.

Objective 1: Improve food security, support agriculture, and increase opportunities for local food production.

PRELIMINARY ACTIONS
Protect Agricultural Land Reserve (ALR) land.
In partnership with neighbouring municipalities, undertake a food security assessment to establish institutional needs, including next steps to improve Vernon's food security and access to local food.
Work in partnership with community groups to enhance pollinator habitat throughout the city.
Encourage diversification of local food production including small-scale gardening and investigate the use of public lands (undeveloped lands, municipally-owned lands and boulevard/park areas) for food production.

Theme 4: Built Infrastructure

A changing climate will necessarily impact a city's structures and services. This is largely because while current industry practice is to design infrastructure based on historical climate patterns, these parameters are increasingly irrelevant. As a key service, transportation infrastructure is vulnerable to increasing freeze/thaw cycles and to extreme conditions such as hail and rainstorms. In addition to direct impacts to the infrastructure, transportation is also likely to be more frequently disrupted. Community members with existing mobility challenges may have trouble accessing services, while businesses' supply chains and customers may be impacted.

With respect to water infrastructure, pipes or culverts designed to be "right sized" for historical rainfall patterns will likely be inefficient or insufficient in addressing the climate of the decades to come. Sewer and stormwater infrastructure are commonly impacted by the increased frequency and intensity of rainfall anticipated with climate change. Higher water tables can increase infiltration to the sanitary sewer leading to potential backups, impacts to septic fields and damage caused by localized rainfall-related flooding. More frequent extreme events will also require us to update traditional approaches to maintenance schedules and asset management. Managing both traditional and natural assets with a climate lens, and combining green or natural asset-based solutions with more traditional infrastructure will ensure that investments will be functional throughout their lifespans.

Objective 1: Prepare transportation infrastructure to ensure that mobility is maintained in a changing climate.

PRELIMINARY ACTIONS
Identify vulnerable populations who may have mobility challenges during extreme weather events (e.g. storms, heat waves) and ensure their mobility needs are met.
Identify ideal location and species for shade tree plantings close to active transportation corridors, including the public pedestrian realm.
Initiate and complete a strategy to ensure transit and related infrastructure is resilient to climate change (e.g. all-weather bus shelters).
Increase road maintenance budget and resources for roads, active transportation infrastructure and public spaces in the winter as freeze/thaw events increase in frequency. Investigate alternative asphalt mixes to cover extremes in temperature, looking to the north for examples.
Increase public safety during ice events: • Increase public education on safety during ice events • Increase availability of sand/salt for the public. • Adjust road clearing priorities in terms of transportation hierarchy to ensure pedestrian safety during snowfall/ice events
Use flood hazard mapping to identify roads that may become floodways or flooded during events, and ensure road closure procedures are up to date and shared with emergency management.
Complete cost-benefit analysis of high-friction road surfaces to reduce rear-end collisions and accidents and incorporate results into design standards.

Objective 2: Protect the functionality of sewer and drainage infrastructure from a changing climate.

PRELIMINARY ACTIONS
Increase the resilience of the sewer network by: • Continuing to provide back-up power to the sewer lift stations • Undertaking a sanitary flow monitoring study and creating a plan for capacity improvements • Assessing inflow and infiltration when replacing failing or aging infrastructure Review restrictions on commercial/industrial inputs to the sanitary system.
Increase private side sewer resilience by: • Continuing to provide incentives for landowners to connect to the municipal sewer system • Providing incentives for backflow preventers on private side connections during renovations or street work
Improve functioning of green infrastructure and natural assets (e.g. wetlands) to improve the water quality of drainage-receiving water bodies.
Identify alternative means of on-site drainage and water management. Revise bylaws as necessary and provide homeowner education materials for retrofit projects. Review allowable site coverage levels and consider making a requirement around permeable paving.
Require storm water management plans that take extreme weather events and flood mapping into consideration at time of development permit for all multifamily developments. Enforce water retention for all subdivisions to ensure post-development and pre-development storm water run-off levels are equal.

Theme 5: Community Health & Well-being

As one of the top five risks to the province, human health impacts from heat is of primary concern to municipalities preparing for climate change. Members of the community that are more vulnerable to extreme heat include seniors living alone, children, pregnant women and those with pre-existing medical conditions. Buildings are not always designed with air conditioning making indoor temperatures high as well. Increased health risk during extreme heat and decreased thermal comfort in buildings with implications for health will therefore both be important areas of focus for Vernon.

Alongside heat events, record-breaking air quality alerts around the province due to wildfires have occurred over the last five years, during which time visits to the doctor with asthma or respiratory complaints spiked. Increasing risk to health from smoke, especially for those most vulnerable, will be a priority in protecting the most vulnerable from the impacts of climate change. Repeated extreme events can also put pressure on the mental health of both those impacted and those responding.

Community connections are an important indicator of well-being and are key to improving resilience to climate-related events. Post-event studies continuously illustrate that knowing your neighbours and looking out for each other improves response and recovery from events.

Objective 1: Increase community resilience to high temperatures and poor air quality resulting from a changing climate.

PRELIMINARY ACTIONS
Develop a *Heat Response Strategy* for the community. • Work with seniors housing providers and non-profit housing providers to ensure vulnerable populations have access to cooling and/or cooling centres. • Provide landlords with education on how to assist residents under heat extremes. • Develop a communications strategy for health alerts.
Develop a *Clean Air Space Strategy* within public buildings and private facilities to provide both emergency clean air facilities during poor air quality days, and identified permanent clean air locations. • Work with local health authorities to educate residents on "at home" air filtration treatment options. • Identify means of improving local air quality (e.g. anti-idling bylaw, road dust mitigation). • Support building industry education and capacity in strategies for improved air filtration. • Develop a communications strategy for health alerts.
Using examples from elsewhere, develop a resilient buildings information sheet or checklist for developers, with the longer-term plan to move toward requirements.

Objective 2: Increase community awareness and ability to anticipate and respond to the impacts of climate change.

PRELIMINARY ACTIONS
Develop a *Social Resilience Strategy*, in partnership with local social service organizations and adjacent municipalities. Strengthen neighbourhood connections by fostering peer support systems, to share knowledge of climate action and provide support during and following extreme events.
Coordinate with emergency program preparedness messaging to include awareness building about the impacts of climate change including health and social impacts.

Theme 6: Emergency Response and Preparedness

The frequency and magnitude of natural hazards that cities have been preparing for and responding to historically are both changing as the climate changes. Natural hazards expected to worsen due to climate change include landslides, rainfall-related flooding, storms (wind, hail, heavy rain, etc.) and wildfires. With an increased number of storms also comes the potential for direct impacts, such as power outages and increased closure and disruptions to businesses, institutions, and services. Indirect impacts such as increased boil water advisories and infrastructure impacts from increased stream erosion also of concern. Emergency management needs throughout the emergency management cycle, from preparedness to recovery, may tax municipal capacity. Steps are underway to prepare Vernon for changes to flood hazard and debris flow/landslide hazard and must continue to build resilience to these hazards. Community wildfire planning will continue with a renewed focus given the increasing risk.

Objective 1: Update emergency policies, processes and plans, and improve regional relationships, to ensure that the City is prepared to respond to more frequent and compounding weather-related emergency events.

PRELIMINARY ACTIONS
Update Disaster Response Routes and Emergency evacuation routes and associated mapping. • Complete an analysis of existing infrastructure (unpaved roads and off-road trails) to identify emergency exit routes and incorporate findings into emergency response plans, disaster response routes, and the development approvals process • Complete adoption of amended *Development Cost Charge Bylaw* and prioritized construction of emergency access/recreational trails (for emergency access routes), and establish a timeline for construction • Plan and map evacuation routes and shelter facilities for wildfire risk
Employ best practices for advanced notification of extreme events through communication plan and app deployment. Expand the uptake of the Vernon Connect mobile phone app to a wider audience. Install signage advertising the app and use a media/communications strategy to improve awareness.
Review the existing emergency program with new knowledge about increasing climate-related hazards and compounding events. Consider preparing, responding and recovering from emergency events. • Assess resourcing allotted and new funding or staff needs. • Develop a recovery plan for immediate action following emergency events and integrate with Emergency Operations Centre (EOC) deployment. • Review existing emergency response plan(s) to ensure they cover hazards exacerbated by climate change. Develop initial response guidelines for specific climate-related hazards such as landslides, wildfires and flooding. • Prioritize development of business and social service continuity plans corporately, including plans specific to flooding, and provide template for external use. • Develop a small business preparedness education campaign. • Establish communications protocol to be used in the event of power outages. Incorporate communications protocol into Emergency Operations Centre (EOC) procedures. • Promote personal and business storage of 72 hours of supplies, including potable water • Strengthen communication protocols and relationships for disaster response with regional stakeholders and partner organizations. • Work with BC Hydro to understand system limits and likelihood of power outages. • Promote weather-related contingency plans for event organizers.

Objective 2: Identify and address public and private infrastructure asset vulnerabilities to climate-related hazards such as flooding, landslides and storms.

PRELIMINARY ACTIONS
Complete flood hazard mapping study and overland flow route study that is already underway: • Identify upslope areas with geotechnical risk from increased precipitation and stability issues, updating *Development Permit Areas Guidelines* as necessary • Work with the Province (lake level control) to update flood construction levels • Utilize flood hazard mapping studies to identify specific properties at risk from flooding or landslide, and incorporate into long-term property acquisition strategy • Prioritize high risk areas for implementation of flood mitigation efforts, including changes in zoning and bylaws, ensuring coordination with neighbouring jurisdictions (e.g. RDNO, Okanagan Indian Band (OKIB), District of Coldstream)
Identify critical infrastructure (including facilities) in high risk areas and investigate options for floodproofing or relocation.
Work with Emergency Management BC on relocation or rebuilds of property in locations that have been flooded, along with messaging and options provided to property owners so that they understand risk of replacement in the face of ongoing increases in precipitation and increased flood risk.
Complete a mapping study of landslide vulnerability, risk and flow potentials. Prioritize design build based on high risk areas defined in studies (i.e. soil analysis, conceptual design, groundwater table studies).
Create sediment ponds and catchments on local creeks, such as Oyama Creek, and Coldstream Creek. Note this is already underway at BX Creek.

Objective 3: Improve municipal response preparedness and resilience to wildfires.

PRELIMINARY ACTIONS
Review, update and implement the *Community Wildfire Protection Plan* (CWPP) and update any associated development regulations, including the delineation of interface areas in the DPA as risk increases. • Identify a department to undertake 'ownership and implementation' of the CWPP • Update the CWPP with an eye to inform land use decisions on undeveloped lands • Consider downzoning and OCP amendments to restrict future growth in hazardous areas • Establish formal partnerships with regional organizations and forest harvesting companies to better manage interface fire areas, forest harvesting practices, and processing
Prepare a fuels management plan and program for nearby watersheds. Coordinate with Greater Vernon Water (GVW) for processes that are already underway. • Identify opportunities for volunteer assistance in fuels management on both private and Crown land, and include consideration of liability • Provide an enhanced wood chipping program for fuel loading
Review municipally derived emergency response funding through an equity lens rather than equality lens, as taxation will be inequal throughout the City based upon risk/proximity to wildfire interface.
Advocate to the Province for more easily accessible, multi-year funding to support development and implementation of CWPPs. Identify internal resources to streamline grant application process.
Expand and undertake education and fire prevention programs, including FireSmart, to reduce occurrences of human-caused fires.

Theme 7: Tourism & Economic Development

Supporting the many tourists and visitors who come to enjoy the area's natural assets comprises an important part of the Vernon economy, particularly with respect to opportunities for winter sports. Unfortunately, climate change is threatening the viability of this sector as the winter warms and the season shortens, prompting the need for local service providers to revaluate and perhaps diversify the kinds of activities they offer. The increasing severity and frequency of forest fire events may also threaten local businesses as the prevalence of air quality advisories increase across the region may deter tourism in the summer months. A robust economic development strategy that includes a climate change lens will help to protect Vernon's local economy.

Objective 1: Provide support services to the tourism and recreation sector to build resilience to shifting seasonal climate patterns and ensure viable tourism offerings.

PRELIMINARY ACTIONS
Support efforts of Silver Star and Sovereign Lake Nordic Area to diversify activity offerings.
Review recreation programming using a climate lens to provide suitable recreation options for residents and tourists year-round.
Identify economic opportunities for shoulder season tourism in a future climate scenario.
Promote indoor tourism and recreation opportunities during wildfire smoke events and heat waves.

Objective 2: Integrate economic resiliency into local business and economic development support services, as well as the Economic Development Strategy.

PRELIMINARY ACTIONS
Integrate economic resilience into the *Economic Development Strategy*: • Work with the local insurance industry to identify municipal risk mitigation efforts and provide incentives for owners to reduce their exposure (e.g. mortgage insurance program) • Ensure City staff are up to date on changes in the insurance industry related to flood and fire (for municipal facilities as well as businesses) and able to provide information to homeowners • Provide seminars for real estate professionals to learn about current and future risks, and work the City is doing in response

Theme 8: Corporate Operations

Responding comprehensively to the climate challenge requires incorporating climate-related information into processes, procedures and decision-making across the organization. The Federal Government currently requires application of a "climate lens" prior to funding any infrastructure projects. The lens ensures appropriate questions and assessments are being completed prior to large investments, and is quickly becoming a best practice in climate change governance.

Both the Federal and Provincial Governments have also highlighted the importance of incorporating climate risk into asset management. Maintenance regimes may require changes and renewed assets cannot be planned with historical climate in mind. Another element of building climate resilience is improving awareness and capacity of staff, partners and community. Climate champions or leaders are key to continuing successful implementation of climate adaptation action throughout the organization and community.

Objective 1: Incorporate a climate lens into budgeting, procurement, and asset management.

PRELIMINARY ACTIONS
Add climate variability and unpredictability contingency funds to City budget to account for more frequent extreme events.
Ensure disaster recovery funding is included in Parks Operations budget.
Update asset management policies and procedures to include climate risk: • Include backup power and power supply protection • Use examples and lessons learned from asset management plans that have applied a climate lens • Appoint City staff member to be active in provincial and federal efforts to include climate risk in asset management
Incorporate a climate lens in a review of infrastructure design standards and specifications, as well as regulatory bylaws and development design standards.

Objective 2: Incorporate a climate lens into staff culture and organizational policies and procedures.

PRELIMINARY ACTIONS
Guide population and employment growth to encourage intensification and density, helping to shape complete, compact, mixed-use communities that support public transit.
Encourage development to incorporate passive building design features that keep buildings cool without reliance on air conditioning.
Explore opportunities for green roofs on institutional, commercial, industrial and large residential developments.
Reduce the impacts of surface parking lots by increasing canopy coverage and use of alternative paving surfaces.

Objective 3: Increase staff capacity to address the variability and scope of climate change on municipal operations and services.

PRELIMINARY ACTIONS
Identify staff across departments to initiate a Climate Action staff working group. • The working group will be responsible for tracking implementation of adaptation and mitigation actions and coordinating projects and advocacy with stakeholders
Expand the role of the City's social planning function, including creation of a full-time permanent position for social planner.
Help build awareness and knowledge among staff through prominent information on climate (e.g. projections) and through lunch and learn events.

6. Considerations Moving Forward

Costs & Savings

Climate change has already taken a dramatic toll on communities across Canada. From 2013 to 2019, Canadians have experienced some of the most disruptive and costly climate-related extreme events ever recorded, each resulting in significant economic losses and human harm:

1) **2013 Calgary flood:** Heavy rainfall on the melting snowpack in the Rocky Mountains led to flooding that caused five fatalities and as much as $6 billion in financial losses and property damage[15].
2) **2016 Fort McMurray wildfire:** More than 590,000 hectares of land burned, over 2,400 homes and buildings lost, two indirect fatalities, and a cost of over $9 billion[16];
3) **2017 British Columbia wildfire season:** A total of 1.2 million hectares of land burned, the largest area in BC's history at that time, costing over $649 million in fire suppression and leading to the declaration of a provincial state of emergency[17];
4) **2017 Ottawa River flood:** This one-in-100-year flood caused $223 million in damage and forced approximately 850 people from their homes[18,19];
5) **2018 Eastern Canada heat wave:** The humidex reached 48°C in some locations, with 93 heat-related fatalities reported through Quebec[20];
6) **2018 British Columbia wildfire season:** More than 1.3 million hectares of land burned with a total cost over $615 million, coupled with 22 days of air quality advisories in the Lower Mainland[21]; and
7) **2019 Ottawa River flood:** After several rounds of heavy rain, the Ottawa River reached levels even higher than in 2017, forcing the evacuation of more than 6,000 residents and causing two fatalities[22].

Fortunately, the costs of these extreme events can be offset to a substantial degree through early adaptation actions. Recent studies from leading organizations have observed very high rates of return-on-investment for adaptation action, with cost-benefit rations ranging from 2:1 to 10:1. On a global scale, it is estimated that investing $1.8 trillion between 2020 and 2030 could yield $7.1 trillion in economic benefits[23]. In the North American context:

- The American National Institute of Building Sciences (NIBS) suggests that proactive prevention measures to eliminate, reduce or adapt to climate hazards can generate savings of $6 for every $1 invested, depending on hazard type and location[24];
- The Insurance Bureau of Canada (IBC) and Federation of Canadian Municipalities (FCM) report that the benefits of climate adaptation outweigh costs by a ratio of 6 to 1[25].

[15] City of Calgary. (2018). *The flood of 2013.*
[16] University of British Columbia. (n.d.) *Fort McMurray and the Fires of Climate Change.*
[17] Province of BC. (2019). *Wildfire Season Summary.*
[18] Ottawa River Regulation Planning Board. (2017). *Summary of the 2017 Spring Flood.*
[19] Ottawa Business Journal. (2017). *Ottawa-area Flooding Caused $223M in Insurable Damages: Industry.*
[20] Environment and Climate Change Canada. (2019). *Canada's Top Ten Weather Stories of 2018.*
[21] BC Wildfire Service. (2018). *Wildfire Season Summary.*
[22] CBC News. (2019). *From floods to fires to weird Arctic weather, Environment Canada releases top 10 weather stories of 2019.*
[23] Global Commission on Adaptation. (2019). *Adapt Now: A Global Call for Leadership on Climate Resilience.*
[24] National Institute of Building Sciences. (2017). *Natural Hazard Mitigation Saves: 2017 Interim Report.*
[25] Insurance Bureau of Canada (IBC) & Federation of Canadian Municipalities (FCM). (2019). *Investing in Canada's Future: The Cost of Climate Adaptation.*

Adaptation actions generate these returns based on three components[26]:

1) Avoided and reduced future loses;
2) Economic benefits from reducing risk, increasing productivity, and driving innovation;
3) Co-benefits, or social and environmental impacts of adaptation actions that can help support or advance other community goals and objectives.

In Vernon, these co-benefits might include:

- Reduced energy costs;
- Improved air and water quality;
- Protecting and preserving green spaces and sensitive areas;
- Enhanced livability and services;
- Job creation in emerging sectors; and
- Increased community and neighbourhood level preparedness and connection.

Considering the above factors, climate adaptation represents a very sound investment for the City of Vernon and there is an economic, environmental, and social imperative to taking early action.

Social Equity

A person or a population's vulnerability to the impacts of climate change is a function of their exposure to a hazard, their sensitivity to that hazard, and their capacity and resources to adapt. As the City of Vernon works to implement adaptation actions, it is important to remember that while climate change will impact everyone in a community, some residents will be disproportionately affected and will not be able to adapt or recover from these impacts without additional assistance. These "frontline" communities include:

- Those experiencing systemic inequity, including racialized groups;
- New Canadians, including recent immigrants and refugee communities;
- People with lower incomes;
- Older adults;
- Pregnant women and young children; and
- Those with disabilities and pre-existing health concerns.

As described by the Urban Sustainability Directors Network (USDN), an equitable approach to climate change preparedness planning aims "to fairly distribute the benefits and burdens of climate change and climate action through a community-driven planning process that empowers those most affected to shape the decisions that will impact their lives"[27]. Addressing underlying causes of inequity, empowering communities and groups to develop and shape adaptation strategies, and addressing barriers to adaptation actions are all positive steps to a more equitable climate adaptation effort.

[26] Global Commission on Adaptation. (2019). *Adapt Now: A Global Call for Leadership on Climate Resilience.*
[27] Urban Sustainability Directors Network (USDN). (2017). *Guide to Equitable Community-driven Preparedness Planning.*

7. Conclusion & Next Steps

The City of Vernon is already feeling the effects of climate change and this will continue to intensify in the future. Both City operations and the everyday activities of individuals will all be challenged by projected climatic changes, including hotter and drier summers, warmer winters, more frequent and intense precipitation, and extended growing seasons. Many of the impacts will be difficult to cope with, such as increased wildfire and flooding hazard, but there are also potential benefits for the community (e.g. reduced heating cost, new agricultural opportunities).

Responding to these climate change impacts requires a combination of leadership and partnership. The City of Vernon will need to practice both to enhance climate resilience through the community especially in key areas such as emergency response, food security, transportation, and the provision of services. As a leader, the City must thoroughly integrate adaptation measures into its own policies and operations, while continuing to lead the way on climate mitigation. As a partner, the City will need to coordinate and cooperate on adaptation actions with local businesses, community organizations, neighbouring municipalities, and other levels of government, as well as the residents of Vernon.

Through the *Climate Change Risk and Vulnerability Assessment*, the project team, City staff, and a wide range of stakeholders generated the preliminary adaptation actions presented through this report. Next steps for the City are to:

- Contrast and compare adaptation actions with work that has taken place on climate change mitigation, looking for potential crossover and synergies;
- Identify implementation details and potential indicators of success for each action;
- Reword actions to be more accessible to the public; and
- Use this list of refined actions to form the basis of Vernon's new *Climate Action Plan*.

Acronyms & Glossary

Acronyms

ALR: Agricultural Land Reserve

BARC: Building Adaptive and Resilient Communities

CAAC: Climate Change Advisory Committee

CO_2: Carbon dioxide

CWPP: Community Wildfire Protection Plan

DPA: Development Permit Areas

EOC: Emergency Operations Centre

FCM: Federation of Canadian Municipalities

FLNRORD: Ministry of Forests, Lands, Natural Resource Operations & Rural Development Contacts

GHG: Greenhouse gas

GVW: Greater Vernon Water

HRVA: Hazard, Risk and Vulnerability Assessment

IBC: Insurance Bureau of Canada

ICLEI: International Council for Local Environmental Initiatives

IHA: Interior Health Authority

IPCC: Intergovernmental Panel on Climate Change

OCP: Official Community Plan

OKIB: Okanagan Indian Band

NASA: National Aeronautics and Space Administration

NIBS: National Institute of Building Sciences

PCIC: Pacific Climate Impacts Consortium

RDNO: Regional District of North Okanagan

RCP: Representative Concentration Pathways

USDN: Urban Sustainability Directors Network

Glossary

Adaptation: Adjusting decisions, activities, and actions based on observed or expected climate conditions, with the goal of moderating the negative impacts of climate change and capitalizing on beneficial opportunities.

Adaptive capacity: The ability to prepare for these impacts or respond to the consequences.

Climate: Longer-term trends in atmospheric conditions over years or decades.

Climate change: Variations in climate over long time periods that have been observed and are projected to occur in the future (30-year periods typically).

Co-benefits: Improvements to the community that occur alongside climate mitigation and adaptation actions, such as improved public greenspace or enhanced public transportation.

Consequence: The potential damage, disruption, or strain experienced should a climate-related event occur. Consequence can range from minor (inconvenience) to severe (e.g. loss of life).

Extreme weather: Unpredictable, unexpected, and severe weather for a given location, including occurrences such as heat waves, droughts, storms, and tornados.

Greenhouse gas (GHG): Gases that trap heat in the atmosphere and contribute to climate change by absorbing infrared radiation (e.g. carbon dioxide, chlorofluorocarbons, methane).

Impact statement: A brief summary of potential climate-related impacts to a given climate projection, which should be specific and actionable.

Likelihood: The expected return period or probability of the hazard event or trend occurring.

Mitigation: Measures taken to limit GHG emissions and associated global warming.

Natural assets: Environmental features and ecosystems that provide people with vital services, such as aquifers, forests, streams, and riparian areas.

Resilience: The capacity of a social, environmental, or economic system to cope with a hazardous event, trend, or disturbance, by resisting or changing in a way that maintains an acceptable level of functioning and structure.

Risk: A function of likelihood that a climate-related event will take place, and the consequence of that event should it occur.

Sensitivity: The degree to which people or systems are impacted by changing climate conditions, either positively or negatively.

Vulnerability: The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes.

Weather: The atmospheric conditions at a specific location at a specific time, which generally occur over a short time period and change frequently.

Appendix A: Detailed Climate Projections for Vernon

Climate Parameter	Past (1971–2000)	2050s	2080s	Description
Wettest day	18mm	+12%	+21%	The largest amount of rain that falls on any single day in the year, on average.
Extreme high precipitation over 5 days	37mm	+8%	+16%	Maximum amount of rain over a consecutive 5-day period on an annual basis.
Precipitation on very wet days	22mm	+45%	+89%	Total annual precipitation during heavy events (99th percentile wettest days), which is a combination of both how often these events occur (frequency) and the size of these events (magnitude).
Precipitation on wet days	77mm	25%	44%	Same as above except 95th percentile.
1-in-20 wettest day	28mm	+20%	+29%	The 1-in-20 wettest day is an indicator of extreme weather. It is a day so wet that it has only a 1-in-20 chance of occurring in a given year. That is, there is a 5% chance in any year that a 1-day rainfall event of this magnitude will occur.
Summer precipitation	Summer will remain the driest season across the basin and become drier. By the 2080s, valley bottoms in the RDNO can expect 19% less precipitation during summer months.			

Climate Parameter	Past (1971–2000)	2050s	2080s	Description
Hottest day	35.9°C	+4.5°C	+7.2°C	The hottest daytime high temperature of the year, on average.
Days above 30°C	27 days	32 days	52 days	Days above 30°C indicates how many days reach temperatures over 30°C in any one year.
1-in-20 hottest day	38.9°C	+5.1°C	+7.3°C	A day so hot that it has only a 1-in-20 chance of occurring in a given year.
Cooling degree-days (CDD)	216 degree-days	+342 degree-days	+635 degree-days	Number of degrees that a day's average temperature is above 18°C, summed over all the days in a year, used as a metric of building cooling requirements

Climate Parameter	Past (1971–2000)	2050s	2080s	Description
Coldest night	-21.9°C	+6°C	+10.3°C	Coldest night refers to the lowest nighttime temperature, on average. This indicator reflects winter nights.
Spring Nighttime Low Temperature	3.0°C	+3.1°C	+5.1°C	Average spring nighttime low temperatures
Ice days	36 days	-17 days	-24 days	Ice days are days when daytime high temperature is less than 0°C.
Heating degree-days (HDD)	3640 degree-days	-22%	-35%	An indicator of the amount of energy that it takes to heat buildings to comfortable temperatures. It is a derived variable calculated by multiplying the number of days that the average daily temperature is below 18°C by the number of degrees below that threshold.

Climate Parameter	Past (1971–2000)	2050s	2080s	Description
Frost days	113 days	-47%	-69%	An annual count of days when the daily minimum temperature is less than 0°C, which may result in frost on the ground. Lower elevations will experience this more than higher elevations.
Growing season length	227 days	+39 days	+72 days	An annual measure that counts the number of days between the first span of at least 6 days with a daily average temperature greater than 5°C and the first span after July 1 of 6 days with temperature less than 5°C. It indicates the length of the growing season for typical plants or crops

Appendix B: Climate Change Impacts for Vernon Generated by Workshop Participants

Refer to companion spreadsheet.

Appendix C: Action & Implementation Details

Refer to companion spreadsheet.