Nelson Next:

A Bold and Agile Climate Plan
for a Healthier and Safer City

City of NELSON

Nelson **Next:** a new vision for addressing climate change in Nelson.

A roadmap for:

Safer communities, a more stable economy, and a healthier environment

Connecting to each other and to our local ecosystems

A transition to low carbon resilience that is financially accessible and benefits all citizens

Local action, regional collaboration, and global contribution

Creating a great place to live now, and an even better place to live **next**

Photo: Finlay Burrage

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Letter from Nelson City Council

Dear Nelson residents and visitors,

Nelson City Council acknowledges that reducing our carbon emissions and planning for a changing climate are top priorities for our community.

The good news is we are not starting from zero. In many ways, Nelson Next represents a continuation of the environmental leadership our City was built on. Starting with the development of British Columbia's first hydroelectric power plant in 1896 (purchased by Nelson City Council in 1898), Nelson has long been a leader in creatively and sustainably addressing our city's needs and challenges. Our hydropower operations have since expanded, providing zero-emissions electricity to our residents and regional neighbors, and supporting our leading edge, on-bill energy retrofit program, EcoSave.

We can and will continue to build on our long history of environmental achievements as we embrace our new future, and Nelson Next is our roadmap for doing so. It is a continuation of our existing, comprehensive policy frameworks, our impactful and innovative programming, and our administration's ceaseless commitment to sustainability and environmental protection. It is also a continuation of the environmental leadership we've seen from our nonprofits, businesses and community groups for the past number of decades.

We all want to live in a safe and secure environment, building community prosperity and raising our families with a positive future in mind. Nelson Next creates new opportunities for our administration and community to make even further progress on reducing emissions and addressing our priority climate risks. It also offers a range of thoughtful mechanisms for strengthening relationships, creating a healthier community and capitalizing on new industries and technological innovations.

Built with the helpful input of citizens, business owners, academic institutions, nonprofits and government agencies, Nelson Next is a reflection of our diverse community's collective priorities. It is built by and for a city that already has so much going for it - our compact and livable streets, our extensive heritage preservation efforts, our stunning scenery and our creative and entrepreneurial spirit. Implementing Nelson Next will also rely on these assets, as well as our City's most critical resources – it's enterprising residents, businesses, workforce, community organizations, municipal staff, and Council.

Nelson Next is our bold roadmap to a low emission and resilient future, ensuring that the City of Nelson continues to show ambitious municipal leadership on the issues that matter. We are proud of this Plan, and thank the many organizations, businesses, community organizations, and civic leaders that stepped up to help build it.

It is our hope that Nelson Next leads to increased active and electric transportation, higher efficiency and more resilient buildings, a more diverse energy supply, and improved waste systems. We look forward to implementing it alongside you and working together to strengthen the vibrancy, prosperity, and livability of Nelson.

Let's get started!

Nelson City Council

Acknowledgements

We deeply appreciate and acknowledge the many individuals, organizations and businesses who helped shape and co-create Nelson Next. Your collective spirit and knowledge are part of what makes Nelson such a special place to live and visit.

We look forward to continuing to collaborate with you as we move from planning to action in the coming years.

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Simon Fraser University - Integrated Climate Action for BC Communities Initiative

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Design Credit: **Cam Hoff**

Land Acknowledgement

Nelson Next was researched and developed on the unceded, traditional territory of the First Nations of the Sinixt, the Syilx, and the Ktunaxa, and on land that is now home to the Métis and many diverse indigenous persons. We honour their original and current connection to the land, ecosystems and water bodies that the people of Nelson interact with, enjoy and rely on, and that this plan is working to protect.

Nelson Next:

A New Community Vision for Climate Action

Climate change is a global challenge that requires bold and collaborative action. Every jurisdiction, community and individual has a role to play.

The City of Nelson recognizes the need to further embrace our role and deepen our commitment to climate action. We will do this by consolidating and amplifying current climate initiatives, while also pursuing a range of additional tactics to address emerging risks and opportunities. This new chapter of climate leadership is called *Nelson Next*.

Nelson Next is an action plan and roadmap to a healthier and safer city. It is a comprehensive and dynamic framework aimed at reducing our greenhouse gas (GHG) emissions and our vulnerability to climate change impacts. This complementary approach to climate action planning coordinates and mainstreams low carbon *and* resilient solutions across departments, sectors, and jurisdictional boundaries. Addressing climate change in this integrated way leads to lower costs, stronger relationships and capacities, and maximized benefits to both ecosystems and human society.

Informed by scientific evidence and community experience, Nelson Next is shaped by a robust set of baseline data, and built with the enthusiastic and skilled contributions of countless residents, community organizations, local businesses, and local and regional government staff. It stands on the foundation of our previous work as a city and a community, and identifies new opportunities for increased impact on the issues that matter most to Nelsonites.

Nelson Next is a new vision for acting on climate change and will guide our community toward:

Safer communities, a more stable economy and a healthier environment

Connecting to each other and our local ecosystems

Local action, regional collaboration and global contribution

A transition to low carbon resilience that is financially accessible and benefits all citizens

Creating a great place to live now, and an even better place to live next

Our Climate Future

Nelson Next is a policy document and a dynamic guide for collaborative action. It contains a comprehensive set of solutions with high impact potential, guided by evidence and what we know our city and community can achieve.

Nelson Next includes 7 Aspirations, 23 Strategies, and a wide range of Priority, Medium and Long-Term Tactics. The *Aspirations* describe the future reality that we plan to achieve through sustained climate action, while the *Strategies* and *Tactics* focus on the shorter-term, strategic outcomes we will pursue to make our aspirational future a reality. All of Nelson's priority climate risks and emissions sources were used as inputs to define Nelson Next's direction, alongside continued feedback from the interconnected people, systems and services that define our city.

Nelson Next is guided by the following targets:

To ensure resilience:

- Address priority climate risks
- Protect vulnerable groups from climate impacts
- Integrate climate data and risk assessments into City planning and operations

To accelerate emissions reduction and limit global warming to 1.5ºC:

- A 75% reduction in community-wide GHGs by 2030 and net zero GHGs by 2040
- Net zero municipal operations by 2030

Our Climate Reality

Climate

The effects of climate change are already apparent in our city and region, with observable and increasing shifts in temperature, precipitation and extreme weather events. In the future, Nelson can expect to see higher average annual and seasonal temperatures with an increasing number of heat days, as well as shifting precipitation patterns with increases in annual precipitation and heavy rainfall days. These changing climatic conditions are likely to result in a range of serious impacts, such as wildfire, drought, shifts in local plant composition and increased mental health distress.

Nelson's Climate Future		Low Carbon Scenario (RCP 4.5)	High Carbon Scenario (RCP 8.5)
Variable	**Baseline** (Average Annual b/w 1961-1990)	**Average 2041 to 2071**[1]	
Annual Mean Temperature (°C)	8.3	10.9	11.6
Annual Hot Days (27.7 °C+)	36	62.5	70.5
Annual Extreme Heat Days (30 °C+)	19.4	43.4	52.4
Annual Precipitation (mm)	640.8	666.9	675.4

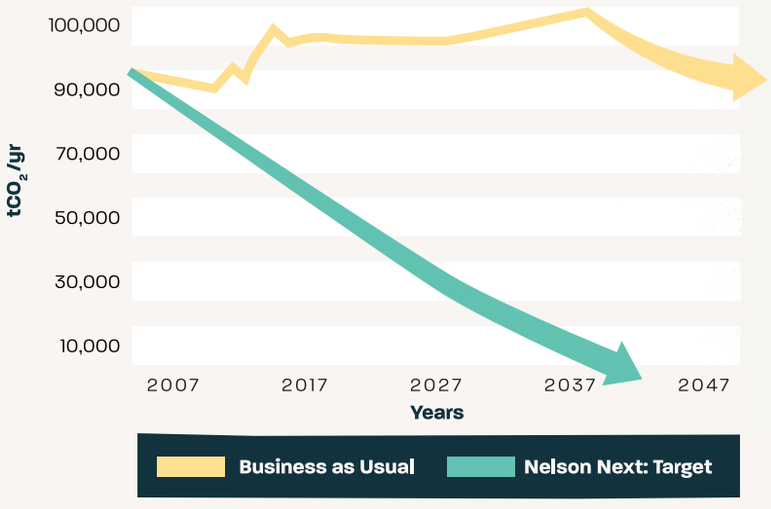
1. Note: Climate projections for the 2050s indicate the modelled average for the 2041-2070 period

Emissions

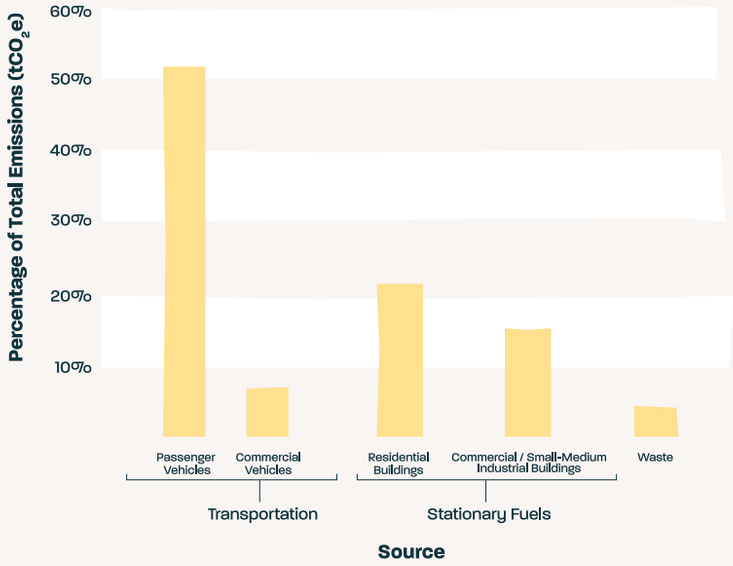
Nelson's GHG emissions are steadily increasing and off track to meet previously set targets. Since 2007, with spikes in passenger vehicle fuel and natural gas consumption, they have risen by 10.8%, and are on a trajectory to be 16.4% higher by 2040 if we continue a 'business as usual' state of affairs.

In 2018, Nelson's community emissions totalled 79,102 tonnes of CO_2e, primarily derived from vehicle use (59% of total emissions), and building heating and cooling (37%).

Historic, Projected and Targeted GHG Emissions (2018)



Nelson's GHG Emissions & Energy Consumption by Source (2018)



The Roadmap

To see the specific Tactics associated with these Aspirations and Strategies, please go to *nelson.ca/climatechange*

Aspiration One

Nelson's residents and tourists conveniently navigate the city and region using the highest per capita rates of public, active, or electric transportation in the country.

Strategies:

- Passenger and public transport is clean, active, and shared.
- Our active and public transportation infrastructure is accessible, connected, and maintained.
- Nelson is congestion and pollution-free.

Aspiration Two

Infrastructure and buildings in Nelson are zero carbon and resilient.

Strategies:

- New buildings are net zero ready, have low embodied carbon, and are resilient against a changing climate.
- Existing buildings are retrofitted to achieve deep energy savings, reduced emissions, and climate resilience.
- Our building sector and academic institutions are leaders in green building research, innovation, and construction.
- Financial barriers to energy efficient and resilient buildings are reduced through a range of support mechanisms.

Aspiration Three

Nelson is a connected community, where all residents are prepared to work collaboratively to prevent or reduce climate change impacts.

Strategies:

- Climate change impacts are integrated into the key planning, operational, and infrastructure-related decisions made in and for our city.
- We work on innovative, creative, and localized climate solutions as a community.
- Nelson contributes to a regenerative, viable, and resilient regional food system.
- Nelson's highest priority climate risks are widely understood and collaboratively addressed.
- All residents—especially those most at risk—have high quality access to information, capacity-building opportunities, and support to better prepare for and respond to climate change.

Aspiration Four

Nelson's natural ecosystems and the services they provide us are healthy, abundant and diverse.

Strategies:

- Essential ecosystem services—such as clean air, clean water, and biodiversity—are accounted for and protected.
- Our water supply is safe, secure, and responsibly used by residents and businesses.
- Our carbon footprint is continually reduced through a range of carbon sequestration and green infrastructure innovations.

Aspiration Five

Nelson is a sustainable economy and renewable energy leader.

Strategies:

- Renewable and low-emission energy is generated locally and consumed responsibly.
- Our local economy is low carbon and prepared to adapt and thrive as the climate changes.
- Our local students and workforce are consistently engaged in capacity building and creative endeavors with positive climate outcomes.

Aspiration Six

Nelson has a thriving circular economy and generates the lowest waste per capita in Canada.

Strategies:

- Our community is committed to the zero-waste hierarchy—prioritizing waste avoidance, reduction, and reuse.
- The circular economy in Nelson is continually growing and evolving through cross-sectoral partnerships and innovation.

Aspiration Seven

We are a model city for integrated climate action and leadership, ensuring all municipal operations are low carbon and resilient, and our priority climate change actions are funded and monitored.

Strategies:

- Progress on Nelson Next is continually monitored and shared in a transparent and accessible way.
- Low carbon resilience principles and requirements are fully integrated into organizational operations and culture.
- Internal capacity development for integrated and sustained climate action and leadership is dynamic and ongoing.

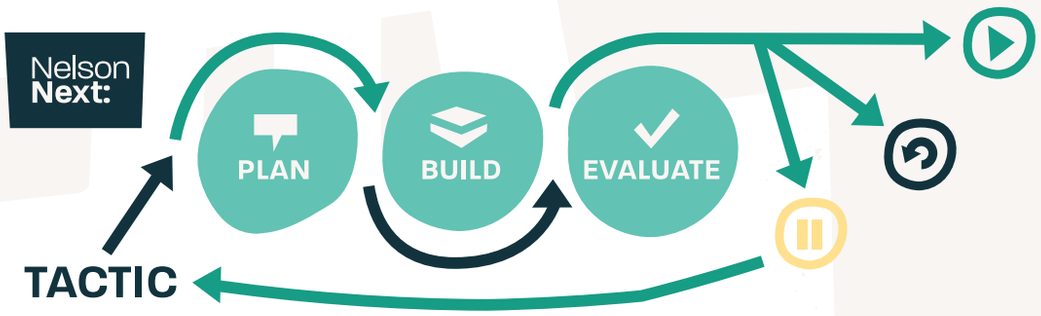
Let's Get Started!

The City of Nelson already knows how to mobilize to achieve ambitious sustainability goals. Nelson Next continues the environmental leadership our city was built on, and acknowledges the new and emerging opportunities we plan to take advantage of.

This is a new and uniquely dynamic policy direction for Nelson. As momentum is built through the delivery of priority tactics, we will monitor the Plan's impact regularly - pivoting to reflect results, and to incorporate new research and emerging technology.

Nelson Next will - and should - evolve over time. This shows we are responding to shifting conditions and changing landscapes.

Our Implementation Framework



Through Nelson Next, we aim to create new jobs, stimulate innovation, and contribute to a stronger, more inclusive, and vibrant city. Implementing this Plan will lead to a win-win scenario for the environment and the community.

Of course, the collective success of Nelson Next will require unprecedented collaboration and action from every resident, organization, business and sector. A healthier and safer Nelson is ours to build and enjoy!

Now is the time to move forward - together. Now is the time to increase our pace of action and embrace the transition required of us. Now is the time to both protect and enhance our beautiful and exciting city.

We are Nelson Now—
and we are Nelson Next.

PART ONE Welcome!

Climate change is a global issue that requires all of us to act.

Cities—which are on the front lines when it comes to climate impacts—have emerged as leaders in the fight against this growing and evolving challenge in recent decades. Uniquely positioned to both require and inspire rapid action, cities —both large and small —are producing policy and clean technology innovations at a fast pace and are achieving substantial and rapid reductions in greenhouse gas (GHG).

Nelson Next represents our city's response to this growing challenge, recognizing that we are facing increasing climate impacts and that our contribution to global emissions must be rapidly reduced. Like all cities facing similar challenges, we are also uniquely well-placed to develop proactive and innovative solutions that work for us.

Photo: Finlay Burrage

Given the urgency of the issue, and on the basis of collective action, the City of Nelson intends to achieve the following climate targets:

▶ To ensure resilience:

- Address priority climate risks
- Protect vulnerable groups from climate impacts

▶ To accelerate emissions reduction and limit global warming to 1.5ºC[1]:

- A 75% reduction in community-wide GHGs by 2030 and net zero GHGs by 2040
- Net zero municipal operations by 2030

Nelson Next is the product of decades of research, knowledge growth and partnership-building and advocacy with regard to environmental health and stewardship. This record of commitment will serve us well in continuing to improve the sustainability and resilience of our city.

This Plan draws from a rigorous set of baseline data, extensive research, and an intensive engagement process. For over a year, members of the public, nonprofit organizations, businesses, stakeholder groups, and sector and climate change experts from across the City and region cooperated to identify the priority challenges and solutions for Nelson Next. The result is a community-focused Plan and set of initiatives that will enhance our quality of life and prosperity, through low carbon innovation and resilience building.

At the core of Nelson Next is a series of bold Aspirations visualizing what Nelson can—and should—look like **'next'**. The Plan's Strategies and Priority Tactics then offer guidance on how we may achieve our desired future.

All of Nelson's priority climate risks and emissions sources were used as inputs to define the Plan's direction, alongside continued input from the interconnected people, systems, and services that define our city.

The collective success of Nelson Next will require action from all residents, all organizations, and all businesses and sectors. While the City of Nelson led the development of the Plan and will continue to steward it's implementation, it is a shared roadmap for change and a call to action for all of Nelson and the region that surrounds us. Residents, businesses, community organizations, institutions, neighbouring local governments, and senior levels of government must all play a role in our transition to a low carbon and resilient future.

Looking beyond our important roles at the local and regional level, Nelson Next is also an acknowledgment of the responsibility we hold as a contributor to this urgent global problem. In 2018, the Intergovernmental Panel on Climate Change reminded the world of the severe global impacts and risks associated with our current trajectory towards a global temperature increase above 1.5ºC. They also gave us hope, showing how emissions can be brought to zero by mid-century if we stay within the small remaining carbon budget we have left[2]. Now, more than ever, bold moves and widespread collaboration are required to reduce greenhouse gas (GHG) emissions and to respond and adapt to the impacts of climate change that have now become unavoidable.

We are excited to work together to harness the collective resources and creativity that already exist within our community to address our local and global climate challenges, and build a prosperous and resilient future for all.

[1] These targets are aligned with the 1.5°C Paris Agreement, which binds the international community to keeping global warming to no more than 2ºC, as well as further effort to limit the temperature increase during this century to 1.5ºC

[2] Intergovernmental Panel on Climate Change. 2018. *Global Warming of 1.5 ºC. Special Report*. Accessed 2020. https://www.ipcc.ch/sr15/

Nelson Next is a Plan for Everyone

Nelson is a city with diverse people, interests and values. These varying points of view are what makes this city so unique and dynamic. A broad range of experiences and ideas have shaped Nelson Next, and will continue to shape our shared response going forward.

While we know that many people in Nelson are very concerned about climate change, some still have questions. This Plan aims to create positive outcomes for the entire community, regardless of your views on this issue or your different priorities. Implementing Nelson Next will be good for the environment and beneficial to the community from a financial and social perspective, making Nelson more resilient and better off.

We don't have to agree about how to feel or think about climate change to implement Nelson Next. What's important is that we agree to listen to and respect each other's perspectives, and to work together to strengthen our community.

> "The best ideas merge when very different perspectives meet." - F. Johansson

Low Carbon Resilience

The core purpose of Nelson Next is to guide our city toward a reduction in both our vulnerability to climate change impacts (adaptation) and our greenhouse gas emissions (mitigation). Adapting to climate change requires efforts that minimize and/or reduce the harmful effects of current and predicted climate impacts, so that a community is able to cope and thrive over time. Climate change mitigation, on the other hand, is achieved through efforts that reduce or prevent GHG emissions, limiting the magnitude and rate of climate change. Both responses are necessary complements for addressing climate change and for seizing new opportunities in community resilience-building and in changing global and regional economic markets.[3]

This complementary approach to climate action planning is referred to as 'low carbon resilience'; a framework that coordinates and mainstreams mitigation and adaptation solutions concurrently, as well as across departments, sectors, and jurisdictional boundaries. With a focus on integrating and achieving co-benefits and synergies between a wide range of climate goals, low carbon resilience is a strategy that leads to reduced costs, strengthened relationships and capacities, and optimal results for both ecosystems and human society.[4]

What is a 'Co-Benefit'?

Co-benefits are improvements that can arise from action taken to mitigate or adapt to climate change - above and beyond the numerous benefits expected to result from a more stable climate. Climate initiatives with co-benefits result in 'win-win' scenarios for the environment and the community, and can often save money and time when planned and implemented integratively. In some cases, the cost savings from a co-benefit may even surpass the cost of the climate action it led to.

For example, cleaner air and increased physical fitness resulting from the use of active transportation infrastructure vs personal cars, may result in health outcome-related savings that far surpass the initial investment in the infrastructure.

[3] Harford, Edward Nichol and Deborah. 2016. Low Carbon Resilience: Transformative Climate Change Planning for Canada. Simon Fraser University.

[4] Simon Fraser University, ACT Team. 2020. Integrated Climate Action for BC Communities Initiative. Accessed 2020. https://act-adapt.org/icabcci/

Photo: Rob Richardson

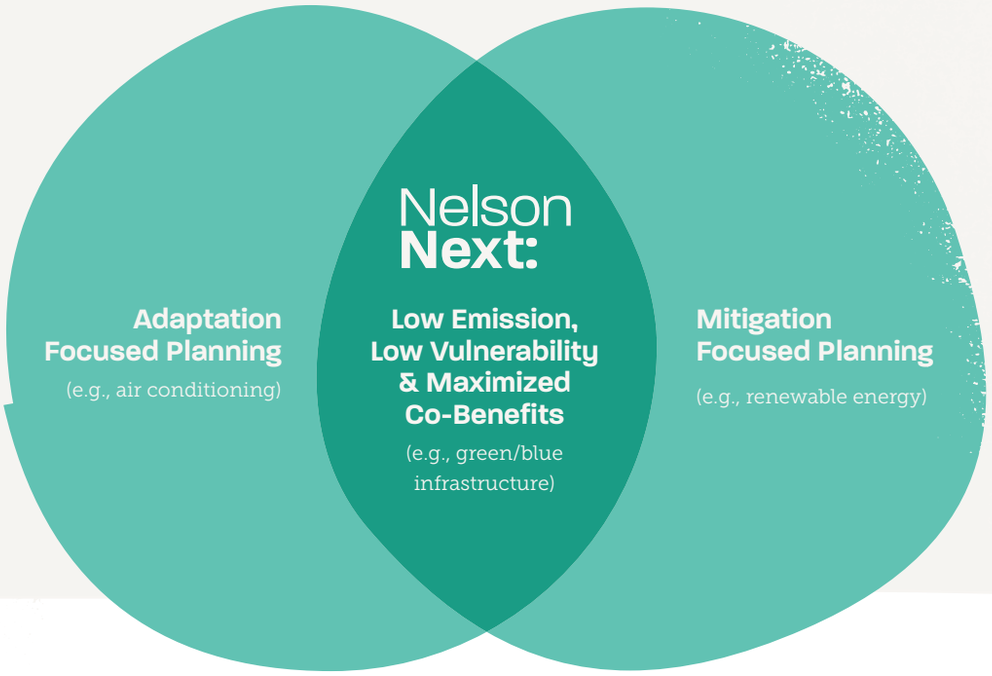
Low Carbon Resilience

Low Carbon Community—a community that strives for low carbon achievements in all aspects of daily living and future planning, including housing and development, transportation, health, and culture. They draw on less carbon-intensive or zero-carbon energy sources and consider ways to minimize the embodied carbon of their goods and infrastructure.

Resilient Community—a community whose residents, institutions, businesses, and systems maintain the shared capacity to survive and adapt, regardless of the acute shocks and chronic stressors that may transpire, such as a large flood or wildfire event, or a pandemic.

Nelson **Next** aims to make Nelson **low carbon and resilient.**

Figure 1: Low Carbon Resilience Framework



Credit: ICABCCI, adapted from Cohen & Waddell, 2009

Our City

History & Current Context

Nelson is nestled in the West Kootenay region of British Columbia, on the traditional territories of the Ktunaxa, Syilx, and Sinixt peoples. Incorporated in 1897 following the discovery of gold and silver in the late 1800s, Nelson sits on the south-eastern boundary of the Interior Cedar Hemlock zone, surrounded by inland temperate rainforest, the Selkirk Mountain range, and Kootenay Lake—the source of the City's most widely used renewable energy source[5].

Now part of the Regional District of the Central Kootenay (RDCK), Nelson is home to a growing population of 10,664 residents and thousands of daily regional commuters[6]. An increasingly popular destination for tourists, our city is also a thriving cultural, entrepreneurial and recreational hub in the Kootenay region, with a uniquely active, connected and community-conscious population. People who live and work in Nelson are consistently invested in maintaining its contagious energy, its friendly and creative culture, and its ecological beauty.

[5] City of Nelson. 2020. *A Brief History of Nelson*. Accessed 2020. https://www.nelson.ca/491/A-Brief-History-of-Nelson & Meidinger, D. and Pojar, J. 1991. Ecosystems of British Columbia. British Columbia Ministry of Forests. Accessed 2020. http://www.for.gov.bc.ca/hfd/pubs/Docs/Srs/SRseries.htm

[6] Statistics Canada. 2016. *Census Profile, 2016 Census: Nelson, British Columbia*. Accessed 2020. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.

"We are such a unique and beautiful place. I love the diversity and open-mindedness of the community and the awesome natural landscape that surrounds us."

Quote from Engagement

Photo: Finlay Burrage

Previous Climate Leadership & Accomplishments

The City of Nelson has a history of leadership when it comes to reducing emissions and building resilience to climate change, proving we are up to this growing challenge. Borne out of various initiatives and a wide range of climate leadership partnerships, Nelson Next acts to chart an even more ambitious and unified path toward low carbon resilience for our city.

> "I love our compact size! We're a very walkable city with lots of great infrastructure and options for buying local."
>
> Quote from Engagement

In a recent assessment of climate change-related action led by the City of Nelson to date, over 100 distinct climate actions were identified, ranging from large-scale infrastructure projects to strategic plans and research studies, to specific programs and strategic partnerships. We are proud of the achievements already accomplished in reducing emissions and protecting our community from extreme weather and wildfire.

Photo: Finlay Burrage

Nelson's Climate Leadership History

Low carbon resilience isn't a new path for Nelson; it's something we've been building toward for decades. Our history of launching, strengthening, and adopting green initiatives goes back to our beginnings:

1896 First hydroelectric plant in BC on Cottonwood Creek

1899 Nelson Electric Tramway Ltd. First Electric Streetcar

1995 Integrated Transportation Study

2002 Inaugural Nelson Farmers Market

2006 Water Master Plan

2007 BC Climate Action Charter

2008 Community Wildfire Protection Plan

2010 2040 Pathway to Sustainability Strategy

2010 Corporate Greenhouse Gas Reduction Plan

2011 Community Energy & Emissions Action Plan and Sustainable Waterfront & Downtown Master Plan

2013 First Annual Green Home & Energy Show

2014 EcoSave Energy Retrofits Program

2016 Hall Street Stormwater Infrastructure Upgrade

2017 First public electric car charging station

2018 Commitment to 100% Renewable Energy by 2050

2018 Canada's first Community Solar Garden

2018 Early adoption of Energy Step Code 1 of BC Building Code

2019 Corporate Electric Bike Program

2019 Electric Vehicle Charging Requirement for new buildings

2019 FireSmart requirements for landscaping and new buildings

2019 Plastic-Free Nelson campaign

2020 Construction of Third Street Bicycle Corridor

Community Leadership & Collaboration

The exceptional leadership shown by Nelson's committed community members, nonprofit organizations and small businesses also continue to be a key success factor in terms of progress on low carbon resilience. With a shared understanding of our region's rapidly shifting climatic conditions and increasing greenhouse gas emissions, a wide range of distinct and impactful community actions are ongoing in and around Nelson-ranging from regional plans and programs, to grassroots, hyper-local initiatives, and advocacy. We are fortunate to have a strong foundation of sustainability leaders and groups in our city and region that have dedicated their time and energy to solving our climate challenges and building a resilient future.

The key community and institutional partnerships and collaborations that have informed and supported Nelson Next over the past year, include:

- West Kootenay EcoSociety's 100% Renewable Energy Plan (see summary below)
- Selkirk College's Climate Adaptation and Innovation Project
- Simon Fraser University's Integrated Climate Action for BC Communities Initiative (ICABCCI); and
- British Columbia Institute of Technology's ecoCity Footprint Tool Pilot Project

Nelson is also fortunate to be located in a region and province with a long history of innovative and effective climate policy and programming. We look forward to continued alignment and partnership with the Provincial Government, the RDCK and our regional partner municipalities as we implement our interconnected climate visions and policies.

West Kootenay 100% Renewable Energy Plan

Nelson's City Council committed to a '100% renewable energy by 2050' target in Jan 2019. Since then, the City has been an active member in the 100% Renewables Working Group for the West Kootenay Region and part of the development, planning, and implementation of a West Kootenay Renewable Energy Plan. This collaborative work - led by the West Kootenay EcoSociety - has allowed us to strengthen our regional and local relationships, and align our policies and climate responses with other communities in the West Kootenay Region.

While the boundaries and scope of Nelson Next and the West Kootenay Renewable Energy Plan differ, the importance of focusing on priority emissions and achieving several 'Big Moves' to address key issues is consistent. We must shift— as a region and as individual jurisdictions—how we move, what we consume, and how we generate and use energy, in order to achieve cleaner and more resilient communities.

The City of Nelson will remain a partner in the 100% Renewable Kootenay collaboration and in the implementation of the West Kootenay Renewable Energy Plan, working both locally and regionally to achieve shared climate change goals and targets.

West Kootenay
100% Renewable Energy Plan

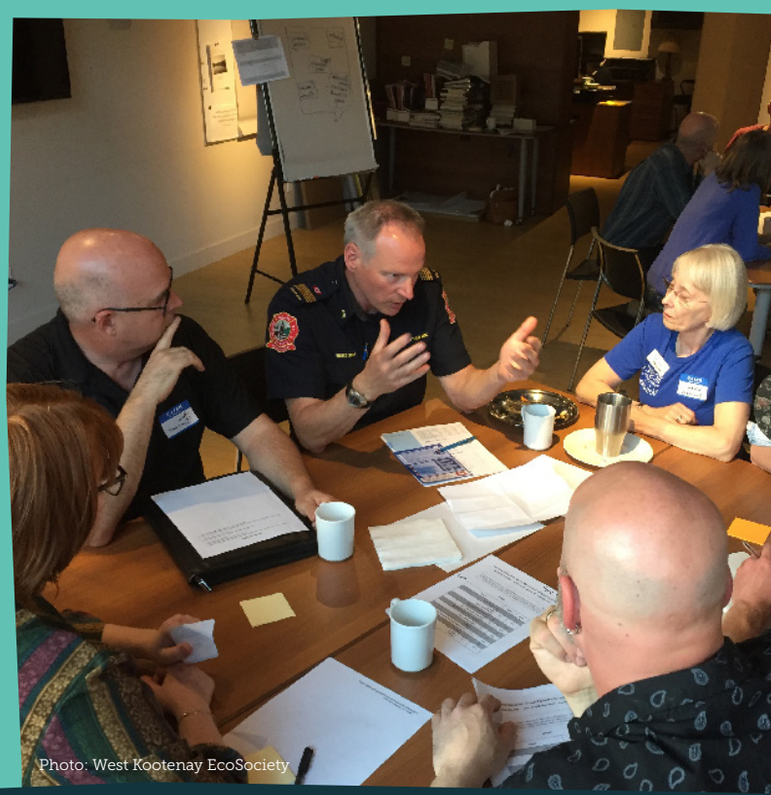


Photo: West Kootenay EcoSociety

Policy Foundation

Nelson Next provides an overarching policy direction to increase our resilience to climate impacts and achieve our GHG targets—but it does not exist in isolation. It reinforces sound data and direction from international, federal, provincial and regional policy, and from key local policies, while also identifying new opportunities and initiatives that will broaden and amplify our impact.

In the early 2000's the City of Nelson began assessing the impact of its activities in terms of sustainability and GHGs, informing our Path to 2040 Sustainability Strategy in 2010 and our Official Community Plan in 2013. Nelson Next was formulated in direct support of these two policies, and towards our city's overall vision: *a prosperous and resilient community with robust ecosystems and safe, welcoming neighbourhoods where diversity, history and culture are celebrated.*

Nelson Next aligns with the five sustainability principles that formed the foundation of our Path to Sustainability, and that acts as overarching pillars of our municipal vision:

- **Cultural Strength**
- **Healthy Neighbourhoods**
- **Robust Ecosystems**
- **Prosperity**
- **Resilience**

Nelson Next also builds on the success of our Corporate GHG Plan (2010) and Community Energy and Emissions Action Plan (2011); two comprehensive climate mitigation plans that have been guiding our emissions reduction and energy efficiency programing in the community and corporately over the past decade.

Photo: Finlay Burnage

Climate Leadership by Numbers

To date, the City of Nelson's climate change related policies and programs have led to:

- 1000+ EcoSave registrations and 108 loans
- 231,300 KWh Solar Kwh (CSG)
- First 2km of our primary bike route developed
- 62 E-Bike loans
- 6 electric charging stations installed since 2017
- 21.4% increase in density since 2006
- Approx. 15 single family Step Code builds & 150 multi-family units
- 100% of City flood-mapped
- 22.8% reduction in water use since 2009
- Approx. 1000 FireSmart assessments since 2005
- 20,364.7 m of water main pipe replacements since 2010
- Stormwater capacity on Hall Street increased by 4x

Finally, Nelson Next intersects with a range of other subject and service-specific plans and policies that already support low carbon resilience in Nelson, including the Active Transportation Plan, the Downtown Urban Design Strategy, the Community Wildfire and Protection Plan, and the Water Master Plan. The direction outlined here was informed by these foundational policy documents, and built to align with and support their implementation as much as possible.

Moving forward, Nelson Next will act as an 'umbrella policy' for integrated, strategic climate action in Nelson, working alongside a broad diversity of existing policies, while also enabling a more coordinated response and efficient system for environmental progress monitoring, budgeting and fund development. This way, community, Council and municipal climate aspirations and targets will be pursued via a unified climate action strategy that spans across all City departments and policies.

Our Approach

Recognizing the interconnectedness of issues and systems in our community, Nelson Next is the result of a robust, cross-sectoral, and inclusive research and engagement process. We consulted a broad and diverse range of stakeholders and sources, to define our shared challenges and explore feasible and impactful solution options for the community.

With co-benefits as a direct focus, Nelson Next will assist in guiding our community toward systemic solutions that address our climate change priorities while also advancing other community needs, such as economic development and diversification, improved health, and increased social connection.

The following process model describes the stages of work and associated activities that led to the development of Nelson Next:

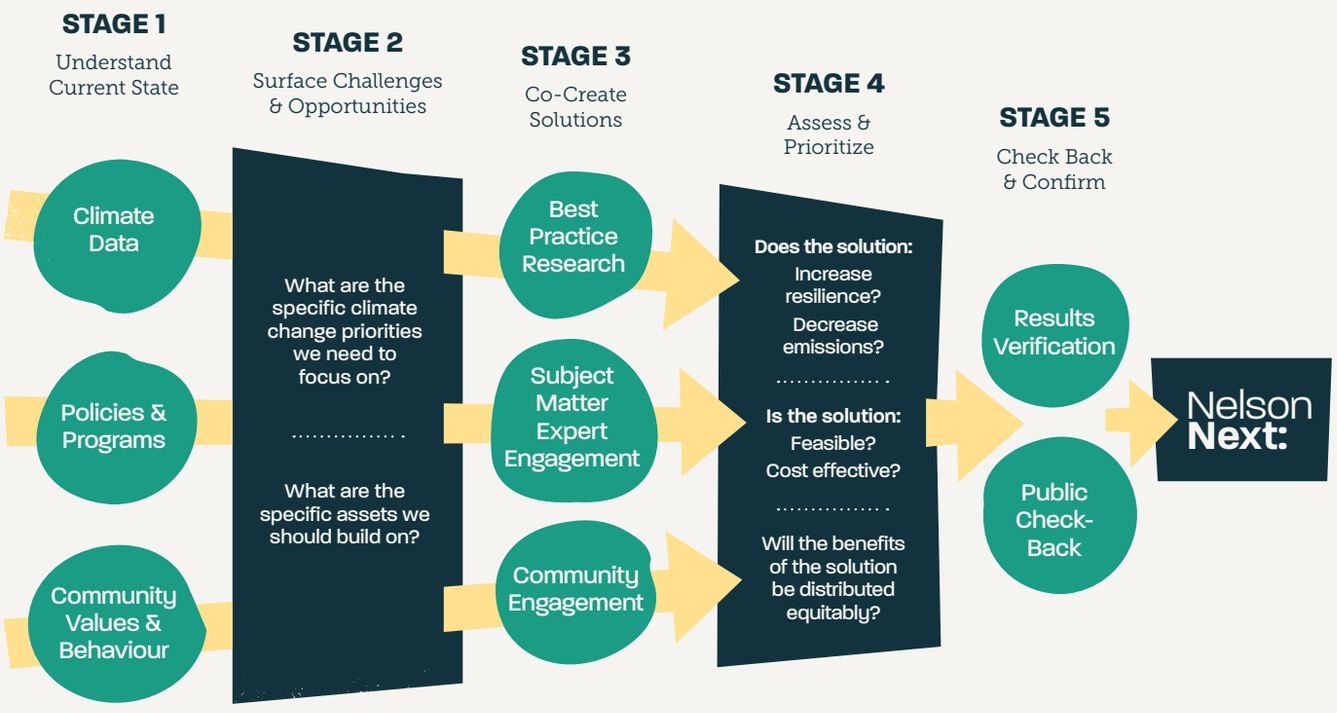


Figure 2: Nelson Next Process Map

Plan Scope

Time

We have a small window of time for focused action, and only 10 years[7] to substantially reduce emissions, according to global climate projections and targets set by our provincial and federal governments and the Intergovernmental Panel on Climate Change. That is why, while we are projecting climate and emissions trends across 30 years to 2050, our priority tactics focus on what can be initiated and/or completed in the next five years.

Geography

The overarching geographic scope for Nelson Next is the municipal boundaries of the City of Nelson, but we know emissions and extreme weather don't have borders—and neither do ecosystems. This means we have to also consider wider geographic scales in terms of challenges and solutions, and recognize the need to connect and align with regional and provincial partners to achieve common goals.

People

We know that our changing climate poses complex challenges, and that rising to these challenges and achieving our goals will require openness to profound change and intensive collaboration. We are all stakeholders in mitigating and adapting to climate impacts. Widespread participation and cooperation is the path to real resilience, and will ensure integrated, solution-focused action that aligns with who we are and what we want to become.

7 Intergovernmental Panel on Climate Change. 2018. *Global Warming of 1.5 ºC. Special Report*. Accessed 2020. https://www.ipcc.ch/sr15/

Our Shared Challenge

To define the specific and foundational climate change priorities from which to anchor our search for solutions, Nelson Next considers the following baseline evidence and contextual inputs:

Climate Trends, Impacts & Risks

The current and expected future impacts of climate change in Nelson

Emissions Sources

The local activities and habits that contribute to climate change

Environmental Behaviour and Knowledge

The environmental behaviour patterns, knowledge, and values shaping Nelson's current response to climate change

Climate Trends, Impacts and Risks

Trends

There is broad scientific consensus that our global climate is changing, evidenced by rising temperatures, increased precipitation, and an increase in the frequency of extreme weather events—with Canada warming twice as quickly as the rest of the world.[8]

Here in Nelson and the surrounding region, evidence of climate change is already apparent (see the Columbia Basin Rural Development Institutes's 'State of the Climate Report' in Appendix A), with historical and projected data showing trends toward:

- Higher average annual and seasonal temperatures with an increasing number of hot days and extreme heat days; and
- Shifting precipitation patterns with increases in annual precipitation and heavy rainfall days.[9]

Temperature and precipitation are considered key aspects of climate and key drivers of environmental and social impacts, and are accordingly our central focus with regard to Nelson's changing climate. Temperature shifts can dramatically affect our everyday lives—and the planning and policy decisions we make locally, regionally and globally. Precipitation patterns are also critical for understanding current and future water availability, crop yields, electricity generation potential, wildfire suppression needs, flooding likelihood and short-and long-term drought risk.[10]

Figure 3: Nelson's Climate Future [11]

Variable	Period	Baseline (Average Annual b/w 1961-1990)	Low Carbon Scenario (RCP 4.5) Average 2041 to 2071[12]	High Carbon Scenario (RCP 8.5) Average 2041 to 2071[12]
Mean Temperature (°C)	Annual	8.3	10.9	11.6
	Spring	7.9	10.4	10.9
	Summer	18.3	21.3	22.3
	Fall	8.1	10.4	11.2
	Winter	-1.4	1.3	1.7
Hot Days (27.7 °C+)	Annual	36	62.5	70.5
Extreme Heat Days (30 °C+)	Annual	19.4	43.4	52.4
Growing Season Length (Days)	Annual	222	245.3	252.7
Precipitation (mm)	Annual	640.8	666.9	675.4
	Spring	140	158.1	158.5
	Summer	126.4	107.5	107
	Fall	193.4	204.3	202.9
	Winter	179.1	191.7	191.2

[8] Environment and Climate Change Canada. 2019. *Canada's Changing Climate Report.* Accessed 2020.

[9] Selkirk College, Columbia Basin Rural Development Institute. 2020. *State of Climate Adaptation Report:* City of Nelson

[10] Climate Atlas of Canada. 2020. *Climate Variables.* Accessed 2020. https://climateatlas.ca/variable

[11] All data in table taken from Selkirk College, Columbia Basin Rural Development Institute. 2020. *State of Climate Adaptation Report:* City of Nelson

[12] Note: Climate projections for the 2050s indicate the modelled average for the 2041-2070 period

Representative Concentration Pathways (RCPs)

Climate change scenarios are often delineated according to Representative Concentration Pathways (RCP's). RCP's are essentially greenhouse gas concentration scenarios informed by historical data and assumptions about policy, population, consumption habits, lifestyles, and land use. They are used worldwide for consistent and comparable emissions projections and associated climate impact assessments, and are organized according to a high carbon scenario (RCP8.5), two intermediate scenarios (RCP4.5 and RCP6.0), and a low carbon scenario (RCP2.6). [13]

The high carbon scenario (RCP8.5) is the concentration pathway and associated temperature increase we can expect to see if global society does not make concerted efforts to cut greenhouse gas emissions. The low carbon scenario, on the other hand, is considered very optimistic and will require immediate, substantial and sustained GHG reductions, as well as international cooperation and commitment that exceeds current pledges to the Paris Climate Agreement. [14]

Temperature and Heat Days

Analysis of modelled historical climate data for Nelson shows increasing temperatures since the 1950s, rising by approximately 2.4°C per century. By the 2050s, it is expected to be hotter at all times of the year, following a 3.6°C per century rate of change increase under a low global emissions scenario, and a 7.1°C per century rate of change increase in a high carbon scenario. [15]

Temperature extremes in Nelson have also increased over the last century and are projected to continue. Hot days (i.e. above 27.7°C) will likely increase by 26.5 to 34.5 days per year by the 2050s (under low and high carbon scenarios, respectively). Extreme heat days (temperature above 30°C), are projected to increase from an average of 19.4 days per year, to 24 days in a low carbon scenario and 33 days in a high carbon scenario. [16]

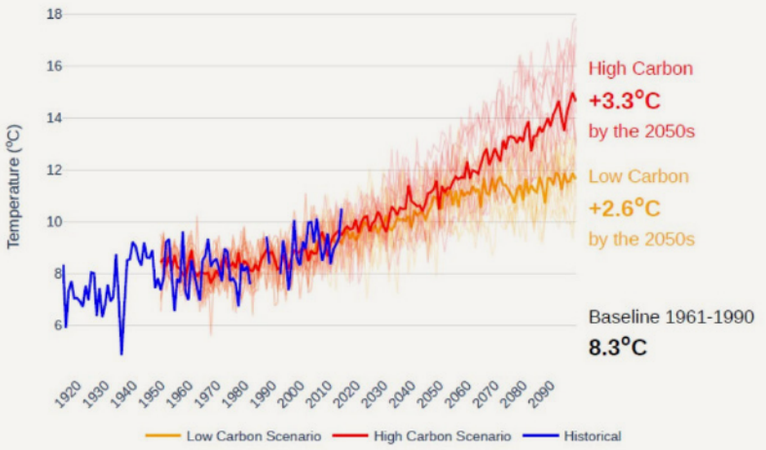


Figure 4: Annual Average Temperature for Nelson (Historic & Projected) (2020)

Credit: Selkirk College, Columbia Basin Rural Development Institute, 2020

▸ High temperatures can determine if plants and animals will thrive, they can limit outdoor activities, and they can define how we design transportation and energy use systems. Persistent high temperatures can also lead to increased heat exhaustion, and increase the risk of drought and wildfire. [17]

Precipitation and Stream Flooding

Nelson's seasonal data shows that precipitation has been decreasing in the winter and fall and increasing in the spring and summer. Projections to the 2050s in a high carbon scenario show significantly more precipitation falling in spring and fall and less in summer. We can also expect overall annual precipitation and heavy rain events to increase in both low and high carbon scenarios. [18]

▸ Precipitation patterns are critical for maintaining reliable water availability, crop production, and electricity generation, and for supporting planning efforts related to wildfire suppression, seasonal flash-flooding, and drought. [19]

[13] Intergovernmental Panel on Climate Change. 2014. *IPCC's Fifth Assessment Report.* Accessed 2020. https://ar5-syr.ipcc.ch/topic_summary.php.

[14] Intergovernmental Panel on Climate Change. 2014. *Climate Change 2014: Synthesis Report.* Accessed 2020. https://www.ipcc.ch/site/assets/uploads/2018/05/SYR_AR5_FINAL_full_wcover.pdf

[15] Columbia Basin Rural Development Institute. 2020. *State of Climate Adaptation Report*: City of Nelson. Columbia Basin Rural Development Institute.

[16] Selkirk College, Columbia Basin Rural Development Institute. 2020. *State of Climate Adaptation Report:* City of Nelson.

[17] Selkirk College, Columbia Basin Rural Development Institute. 2020. *State of Climate Adaptation Report:* City of Nelson & Climate Atlas of Canada. 2020. Climate Variables. Accessed 2020. https://climateatlas.ca/variables

[18] Selkirk College, Columbia Basin Rural Development Institute. 2020. *State of Climate Adaptation Report*: City of Nelson.

[19] Climate Atlas of Canada. 2020. *Climate Variables.* Accessed 2020. https://climateatlas.ca/variables

Other Significant Climate Trends

- Stream flow volume and timing changes → Trend toward higher peak flow volume (since 1995) and earlier average peak flow for Anderson Creek (since 1990).
- Freeze-thaw cycle frequency and timing shift → Trend toward decreasing cycles in the winter, spring, and fall, and shift in the overall timing of cycles.
- Increases in stream flooding frequency → Upward shift of the frequency distribution of floods on Anderson and Five Mile Creeks.
- Growing degree day increase → Trend toward higher frequency of days with heat energy sufficient for plant growth.
- Increase in 'High Fire' Danger ratings → Trend toward higher number of days classified as 'High or Extreme' Fire Danger rating (at Smallwood, Nelson's nearest fire weather station). [20]

Impacts and Risks

Changing climatic conditions result in climate impacts, which are either occurrences of weather-related events (i.e. a flood or a wildfire) or a gradual change in circumstances (i.e. shift in local tree and plant composition).

A climate risk, on the other hand, is an expert and data-informed value judgement placed on an impact, related to its potential consequences as well as the likelihood of those consequences occuring.[21]

It is important to note that climate risks can have consequences for people, the built environment, natural systems and resources, economies, livelihoods, and safety - especially for more vulnerable populations. This includes the elderly, socially isolated, chronically ill, and infants, all of whom may be disproportionately affected by climate change due to increased exposure and sensitivity to climate risks and/or limited coping capacity.

▸ Using up-to-date climate data and qualitative information concerning Nelson's population, infrastructure and current capacities, city staff and key community stakeholders developed an assessment of Nelson's key climate impacts and then ranked them according to the level of risk they likely present to the community. Based on this assessment,[22] the following priority climate risks emerged:

Figure 5: Nelson's Climate Risks (2020)

Extreme Risk	Interface wildfire
High Risk	Water supply shortage Ecosystem Shift Mental health stress Summer heat wave Prolonged drought Increase is pests, invasive species, and animal and plant disease Accelerated infrastructure degradation Windstorm Reduced winter tourism and recreation Decreased water quality from flood events and erosion
Medium Risk	Creek flooding Lake flooding Shifting freeze/thaw cycles Stormwater flooding
Low Risk	None identified

[20] Selkirk College, Columbia Basin Rural Development Institute. 2020. *State of Climate Adaptation Report: City of Nelson.*

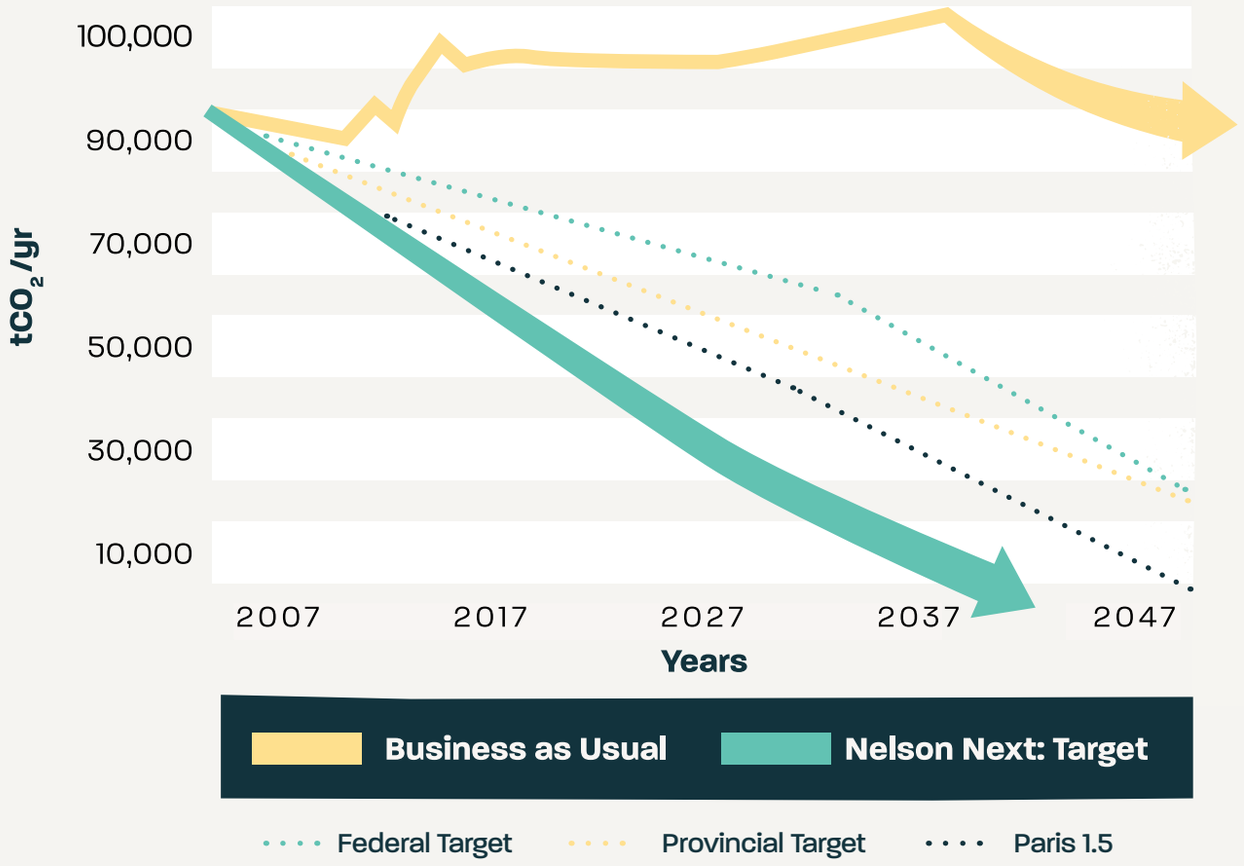
[21] All One Sky Foundation. 2016. *Climate Resilience Express Action Kit.* Accessed 2020. https://www.allonesky.ca/climate-resilience-express

[22] Note: More details related to the Nelson's Risk Assessment can be found in Appendix B

Emissions Sources

GHG emissions are primarily produced by the combustion of fossil fuels and decomposing organic matter. They trap heat and make the earth warmer. The three types of GHGs of primary concern when it comes to climate change are carbon dioxide, methane, and nitrous oxide.

Figure 6: Historic, Projected and Targeted GHG Emissions (2018)



Nelson's total yearly GHG emissions in 2018 were 79,102 tonnes of $C0_2e$. Since 2007, our emissions have risen by 10.8%, and are on a trajectory to be 16.4% higher by 2040 if we remain in a 'business as usual' state of affairs (see 2018 GHG Inventory Report in Appendix C for more details). GHG emissions released in Nelson are primarily derived from burning fossil fuels to power how we move (passenger and commercial vehicles) and where we live (residential and commercial buildings).

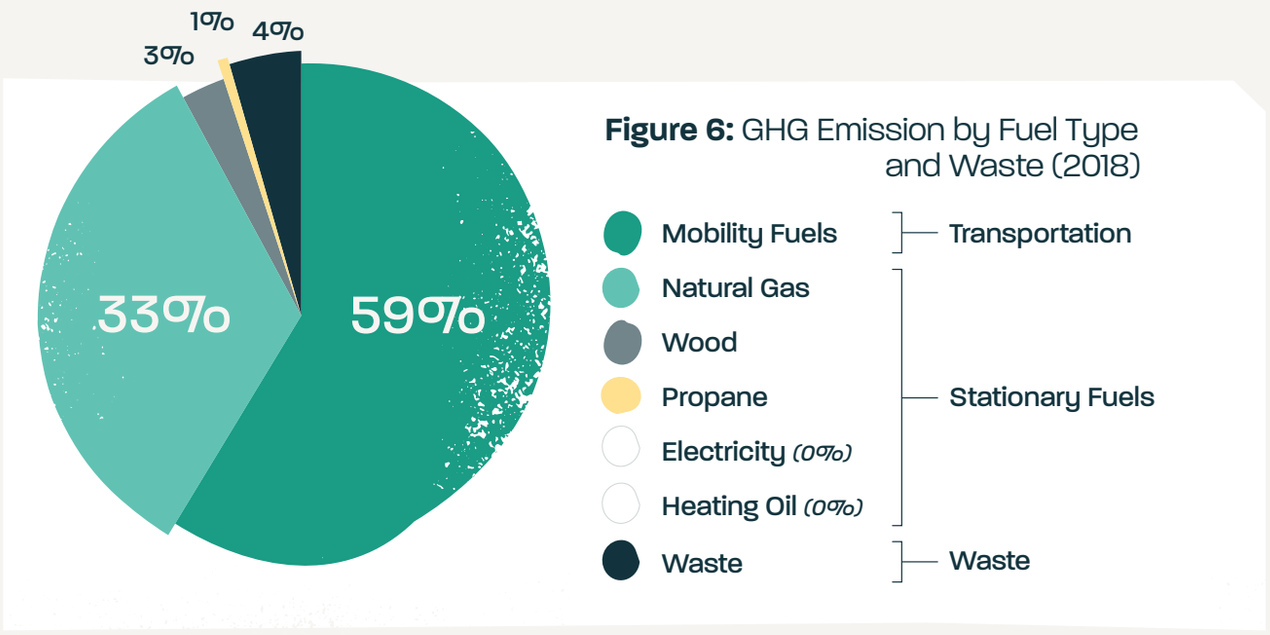
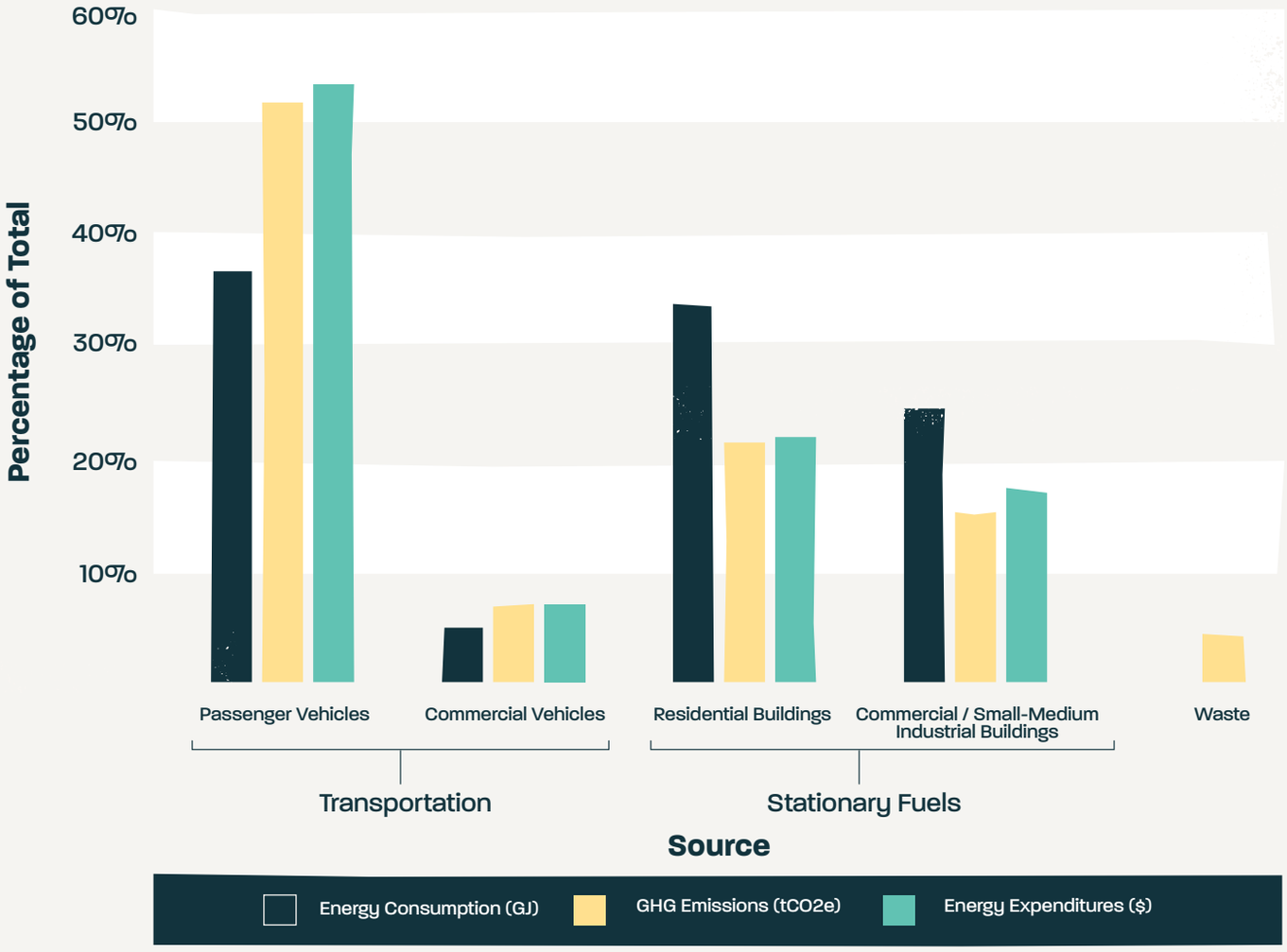


Figure 6: GHG Emission by Fuel Type and Waste (2018)

Figure 8: Nelson's GHG Emissions & Energy Consumption by Source (2018)



Passenger vehicles contribute the largest proportion of all three mobility categories, representing 53% of total cost, 52% of total emissions, and 37% of total energy consumption. Residential buildings contribute a sizable proportion of energy consumption at 34%, while also contributing 22% of emissions and cost. Given this reality, rapidly curbing these two fuel sources is a priority for Nelson.

Consumption-Based Emissions

The products and foods we consume also contribute to climate impacts. When we purchase, use, and/or dispose of products made in other cities, provinces or countries—such as furniture, food and electronic equipment—we are contributing to emissions that are occurring elsewhere, also known as 'consumption-based emissions'. There are also emissions 'embodied' in all of the infrastructure we depend upon—the houses, buildings, roadways, etc.—associated with their materials and construction.

Consumption-based emissions can be modelled and measured through a Consumption Based Emissions Inventory (CBEI). A CBEI estimates the emissions related to heating, cooling, and powering our buildings and vehicles, as well as the emissions that were generated in *producing* our buildings, vehicles, and the goods we consume. To illustrate the difference, the transportation emissions shown in a traditional GHG inventory refer to emissions resulting from the use of vehicles only, whereas the transportation emissions shown in Nelson's CBEI below also include those emissions associated with producing and transporting the car itself, and the materials used to build the roads it drives on.

A CBEI was completed for the first time in Nelson in 2020[23] as a means to inform Nelson Next and act as a decision-making and progress measurement going forward. The data shows that Nelson's two largest sources of consumption-related emissions are still transportation and buildings (same as the findings from the traditional GHG inventory summarized on pages 20 and 21), making those sources an even clearer priority.

[23] Note: This CBEI was made possible through Nelson's participation in the British Columbia Institute of Technology's ecoCity Pilot Project. It was developed in 2020 using a 2016 baseline year (to align all Pilot cities using the most common, up to date data set available), from a range of data sources including Statistics Canada, local data sources (when available) and proxy data (when required). Key data limitations include the use of national average proxy data for food consumption and 'food miles' and conservative air travel estimates as they do not include the second-leg of flights, and are also based on proxy data from Vancouver International Airport.

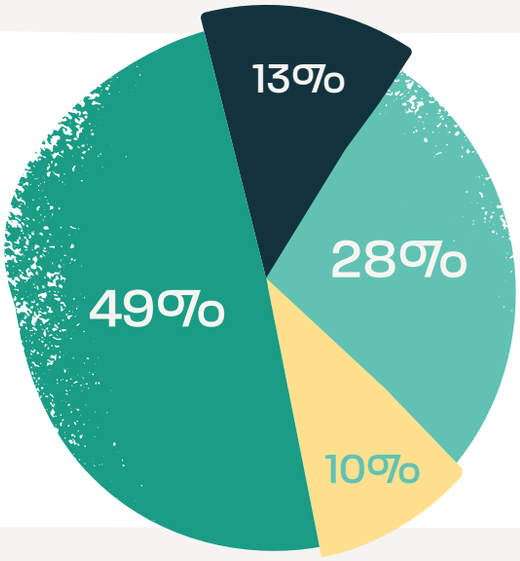


Figure 9: Consumption-Based GHG Emissions (2016)

- Transportation
- Food
- Buildings
- Consumables & Waste
- Water (0%)

Behaviour and Knowledge

Human behavior—influenced by experiences, values, social norms, and motivating responses (i.e. rewards or punishment)—is the driver of our natural resource use and our consumption patterns. Because environmental systems and human systems are inextricably interconnected, we are also making efforts to better understand and track progress on how behavior and knowledge relates to climate change in Nelson. [24]

Key patterns related to Nelson's climate change behaviour and knowledge, as derived from the 2020 Citizen Survey [25] on Climate Change are as follows:

Most common household-level actions taken to mitigate climate change

- Recycling *(96% of Respondents)*
- Shop locally *(81% of Respondents)*
- Household compost *(77% of Respondents)*

Most common household-level actions taken to adapt to climate change

- Living space and valuables located in areas with low/no risk of flooding *(71% of Respondents)*
- Connecting with neighbors and asking for help when needed *(62% of Respondents)*
- Growing food for personal consumption *(59% of Respondents)*

Self-reported participation in City of Nelson programs with a climate change focus

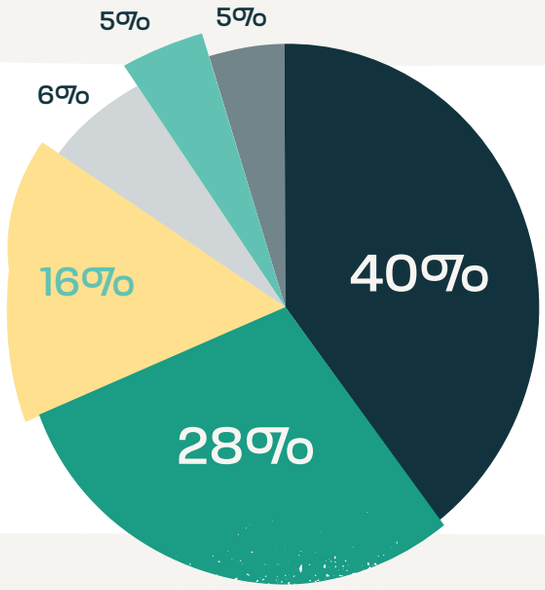
Top 5 in descending order:

- Curbside Recycling *(91% of Respondents)*
- Emergency Alert Service *(50% of Respondents)*
- Single-Use Plastic Challenge *(45% of Respondents)*
- EcoSave *(36% of Respondents)*
- Water conservation measures *(36% of Respondents)*

[24] Robert Gifford, Christine Kormos, and Amanda McIntyre. 2011. Behavioral Dimensions of Climate Change: Drivers, Responses, Barriers, and Interventions. John Wiley & Sons.

[25] Note: this survey was voluntary and contains self-reported responses from 627 respondents

Photo: Finlay Burrage



Climate Action Barriers

- Unsure what actions will have impact
- No barriers - sufficient action taken
- Unable to afford the cost of action
- Not willing to prioritize climate action
- Not convinced climate action is required
- Lack of opportunities to get involved

A snapshot of climate change related values in Nelson

Respondents ranked climate change as the societal issue of most importance to them *(48%),* followed by health care *(16%)* and cost of living *(12%)*

I am concerned about climate change

- 88% Agree / 12% Disagree

We need to act now to address climate change

- 87% Agree / 13% Disagree

We should be doing more to...

prevent climate change

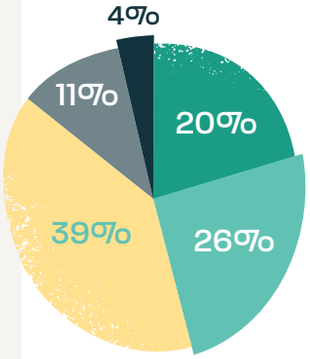
- 84% Agree / 16% Disagree

reduce our vulnerabilities to climate change

- 89% Agree /11% Disagree

Self-reported climate change knowledge

- How much knowledge do you feel you have about:

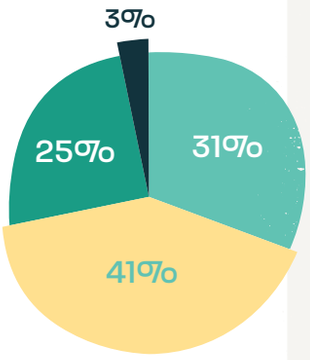


The impacts of climate change?

- A lot
- A fair amount
- A moderate amount
- Very little
- None at all

The causes of climate change?

- A lot
- A fair amount
- A moderate amount
- Very little
- None at all



Nelson's Climate Change Priorities

A collaborative and balanced assessment of Nelson's baseline scenario with regard to climate change—as summarized above—was performed alongside a consideration of existing policies and programs, and community concerns as identified by engagement. This dynamic and multi-layered analysis surfaced a preliminary list of specific climate change priorities for Nelson, and a jumping-off point for solution development:

ADAPTATION

- Interface Wildfire
- Water Supply Shortage
- Ecosystem Shift
- Mental Health Stress
- Summer Heat Wave

MITIGATION

- Passenger vehicle emissions
- Natural gas heating and cooling - residential
- Commercial vehicle emissions
- Natural gas heating and cooling - commercial
- Consumption-based emissions

Our Shared Solutions

Extensive cross-sectoral outreach and engagement efforts were made in 2019 and 2020—focused both on generating suitable and contextually appropriate climate change solutions, and on developing collaborative and balanced decision-making systems.

Nelson Next's search for tactical solutions that would lead to a shared strategic framework for action, extended from baseline scenario research and analysis, and was further informed by best practice and contextual inquiry, ongoing stakeholder consultation and collaborative decision-making processes.

Regularly connecting with the community and involving key stakeholders in Plan development allowed for strengthened and higher potential policy outcomes, while also increasing the awareness and understanding of our local climate challenges, and strengthening relationships and networks.

> "Let's work collaboratively to create a vibrant, environmentally healthy future. The more perspectives we have at the table, the better we'll be able to identify obstacles and come up with realistic solutions."
>
> Quote from Engagement

Photo: Byran Webb

Involving Community

Supported by a foundational understanding that climate change solutions are more likely to be successful when the local community plays a meaningful role in the deliberations, discussions and decision-making that shape them, Nelson Next is a people-based action plan. It was built with the enthusiastic and skilled contributions of countless residents, community organizations, local businesses, and local and regional government staff.

Over the course of 15 months, over one thousand community touchpoints occurred to inform and shape Nelson Next, ranging from public surveys, to continued strategic guidance from a cross-sectoral Working Group on Climate Action, to regular input from the RDCK and the local environmental sector.

Specific engagement activities included:

- Bi-monthly working group on climate action
- City-wide citizen survey on climate change
- Public Thoughtexchange on Plan vision
- Stakeholder mapping session with climate change actors
- 'Climate Change Trends, Impacts and Strategic Actions' workshops series with community experts and leaders
- Public Thoughtexchange on priority actions for Plan
- First Nations engagement inquiry and protocol survey
- Nest Lab: A social innovation lab to support community climate action
- Earth-Based Art Therapy sessions with key stakeholders
- Council updates and workshops
- Public and organizational check-back surveys on draft actions

Photo: David Gluns

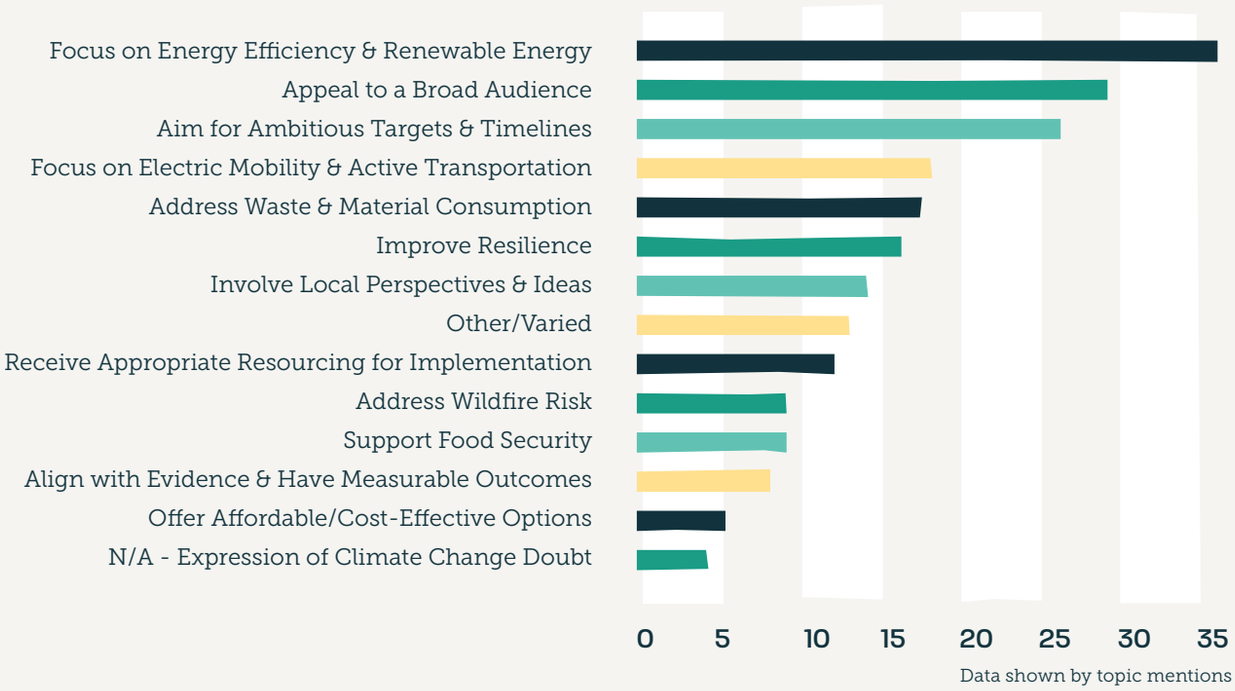
Nest Lab

Convened by the City of Nelson, Nelson at its Best, and Interior Health, Nest Lab is a social innovation lab launched to unearth and integrate a wider and more diverse range of community perspectives and ideas than would emerge with more conventional engagement methods.

First-phase Nest Lab participants came from a range of sectors and backgrounds, including food security conservation, the arts, forestry, and construction. They met for a series of in-depth, workshops and skill building sessions over a period of 5 months, working collaboratively to devise, test and continually improve innovative climate change solutions. Their important work informed Nelson Next's policy direction from a number of different angles, ranging from engagement and partnership-building tactics, to specific, on-the-ground innovations to explore. The Lab also produced a series of experimental project ideas designed for community use and benefit, as well as a number of new network connections and relationships between people and organizations that don't typically work together.

What We Heard

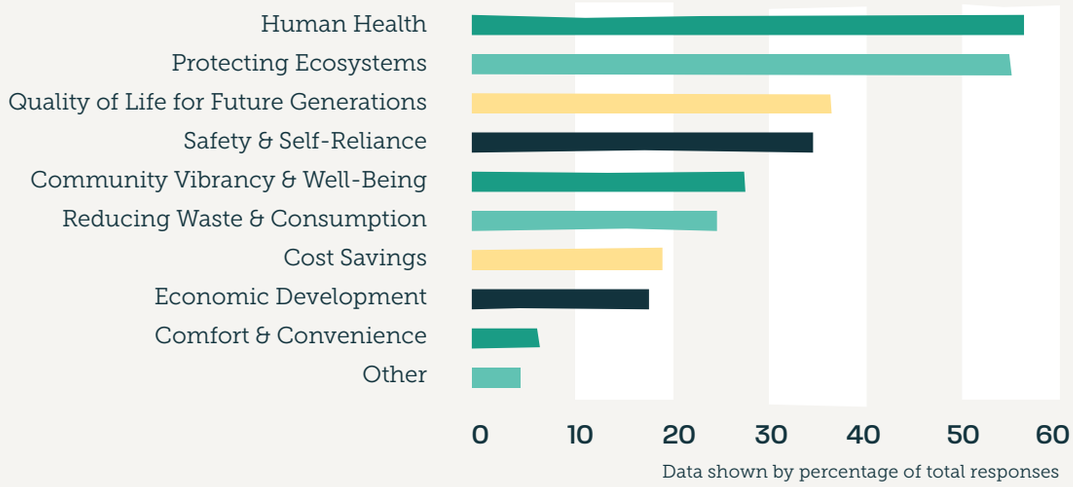
1 A successful climate change plan for Nelson will focus on:



> "Be bold and courageous! Plan to do whatever needs to be done to reach science-based targets!"
>
> Quote from Engagement

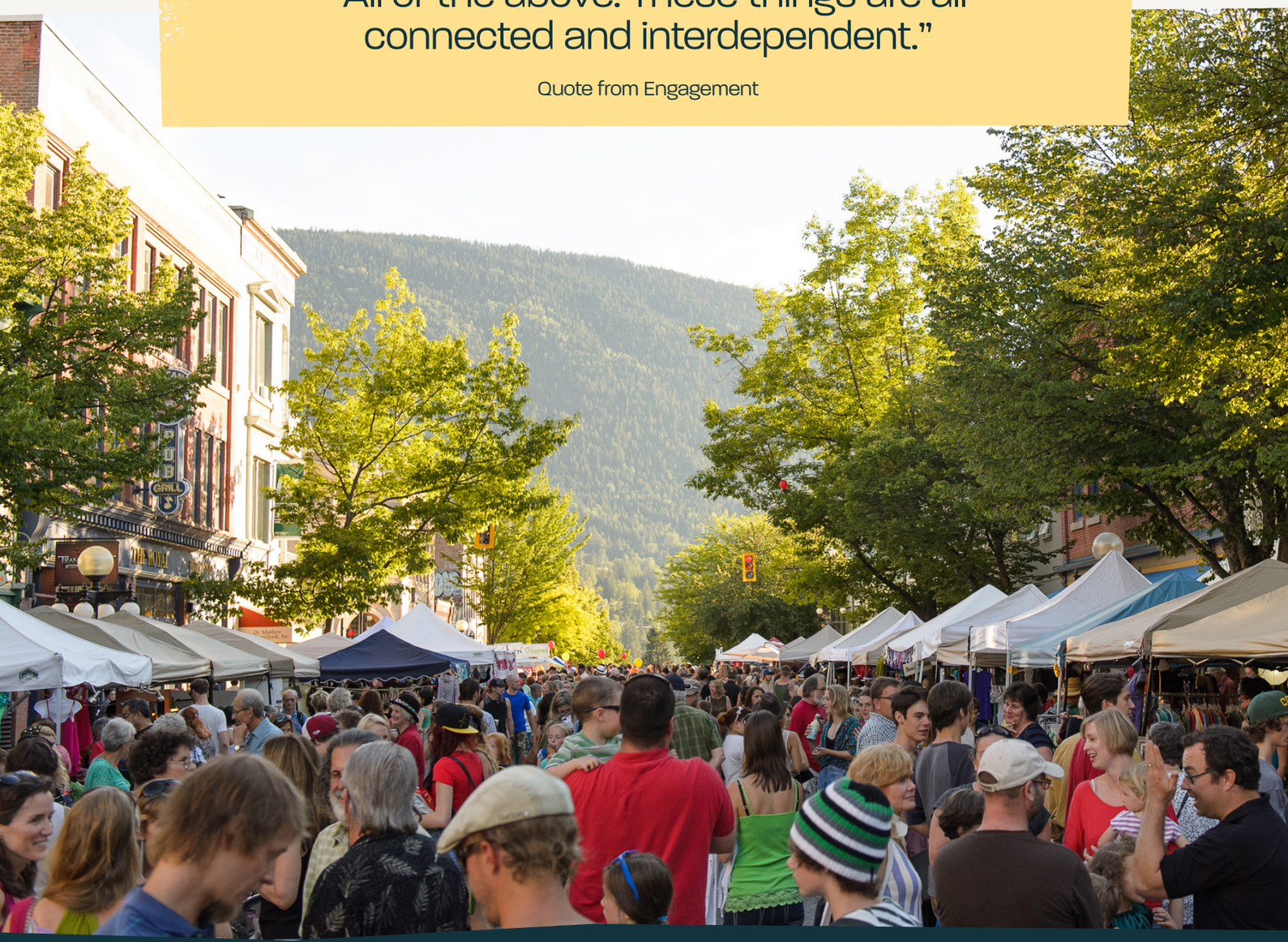
Photo: Finlay Burrage

2 The priority co-benefits to climate action for Nelsonites are:

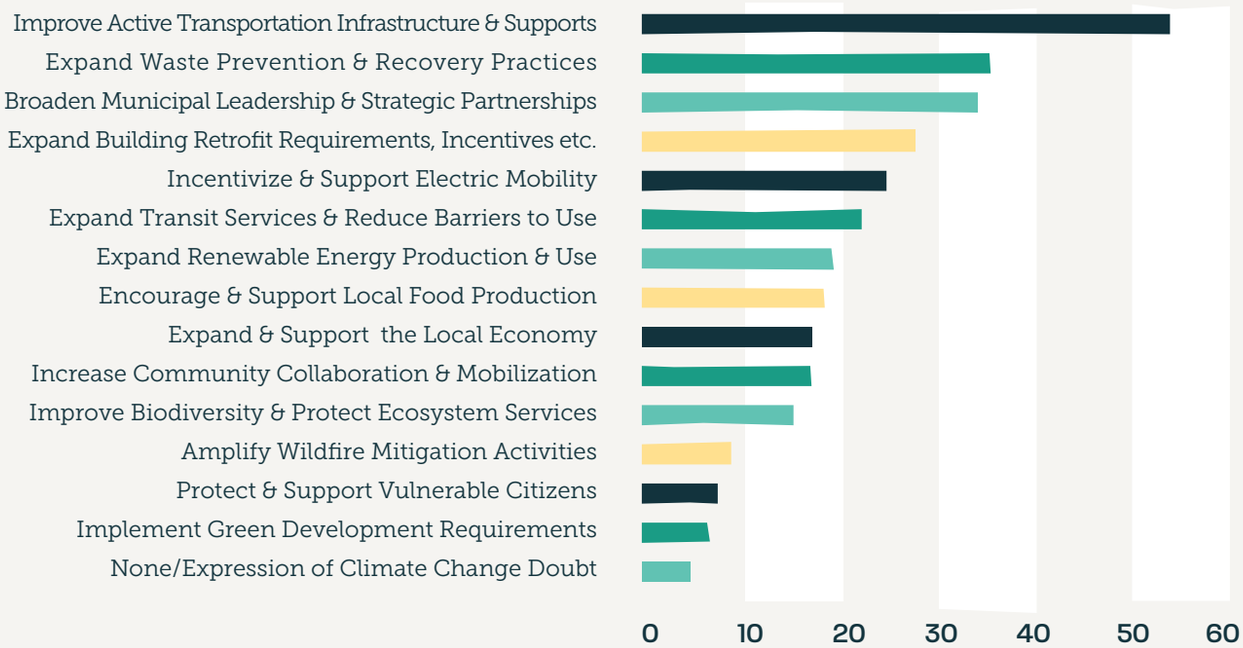


Data shown by percentage of total responses

> "All of the above. These things are all connected and interdependent."
>
> Quote from Engagement



3 To respond to climate change as rapidly and effectively as possible in Nelson, we must:



Data shown by percentage of total responses

4 To be an effective collaborator on climate action, Nelsonites need:

- Financial support (24% of respondents)
- New knowledge and capacities (18% of respondents)
- Inspiring and tangible examples (16% of respondents)
- Opportunities to network/build stronger connections with other community members (15% of respondents)

> "We need more opportunities to collaborate with organizations and community members to make things happen. And more information about how to get involved and really do something."
>
> Quote from Engagement

Finding Balance

The actions emerging from research and engagement were assessed, adapted, and prioritized according to a set of balanced and standardized criteria—as well as ongoing feedback from stakeholders, subject matter experts, and the public. These criteria were designed to reduce bias and offer consistent strategic direction. Decisions related to potential actions were informed by their perceived potential to reduce vulnerabilities and emissions in both the short and long-term, while also considering their cost-effectiveness, feasibility, alignment with other community priorities, and the equitable distribution of benefits.

Priority was assigned to potential interventions that scored highest on following measures:

Category	Criteria		
Reduces Vulnerabilities	Infrastructure	Ecosystems	Social Vulnerabilities
Reduces Emissions	GHG Emissions	Energy Use	Avoided Emissions
Resilience	Robustness	Flexibility	Co-Benefits
Feasibility	Internal Implementation Capabilities	Public Acceptability	Stakeholder Alignment
Cost	Existing Budget	Start Up Investment	Operating & Maintenance Costs
Equity	Procedural		Distributional

Figure 12: Nelson Next Decision-Making Criteria[26]

The result—outlined in Part Two of this document— is a response to climate change that will act to mainstream and integrate effective and feasible climate action, while also advancing a range of co-benefits that are important to our local community.

[26] Adapted from Simon Fraser University ACT Team's 'ICABCCI LCR Criteria Decision Matrix' and informed by City of Edmonton & All One Sky Foundation (Richard Boyd). 2019. *A Just and Equitable Transition*. Accessed 2020. https://www.edmonton.ca/city_government/documents/PDF/JustAndEquitableTransition.pdf

PART TWO

Nelson Next:

A Bold and Agile Climate Plan for a Healthier and Safer City

Photo: Finlay Burrage

How this Plan Works

Nelson **Next** is a policy document and a dynamic guide for collaborative action. We have aspired to build a comprehensive set of solutions with high impact potential, guided by science and what we know our city and community can achieve.

Focused simultaneously on mitigating and adapting to climate change, this Plan is built to guide us toward the achievement of our targets, and organized according to a series of connected **ASPIRATIONS, STRATEGIES** and **TACTICS**. Alongside medium and long term options, specific priority tactics are highlighted for action within the next five years. While the timeline and goals in this Plan are ambitious, they also align with evidence, and the ever-growing capacity, energy and ability of our community.

Nelson Next is also aligned with a recognition that climate change is a complex and rapidly expanding field of inquiry. Some strategies in the Plan today may not be relevant or feasible in two to three years, just as some of the tactics we think are impossible today may emerge as a feasible option sooner than imagined. To respond to this dynamic, Nelson Next is built to be flexible and responsive to the changing needs and opportunities we expect to see in the future.

ASPIRATIONS

The desired future state we plan to achieve. These are overarching vision statements inspired by the community, our ambitious targets and our pursuit of low carbon resilience.

STRATEGIES

The strategic outcomes we will accomplish. These are the focused action areas we need to make measured progress on, to move us closer toward our aspirational future.

TACTICS

The specific activities we will explore and kick-start in the next five years. These are the 'do now' actions that we have the current capacity and will to acheive, and that will speed up the pace and breadth of our ongoing impact on climate change.

Photo: Finlay Burrage

Plan Vision & Targets

Plan Vision

Nelson Next is a new vision for addressing climate change in Nelson. It is a roadmap for:

- Safer communities, a more stable economy and a healthier environment
- Connecting to each other and to our local ecosystems
- A transition to low carbon resilience that is financially accessible and benefits all citizens
- Local action, regional collaboration and global contribution
- Creating a great place to live now, and an even better place to live **next**

Plan Targets

On the basis of collective action, Nelson intends to achieve the following

To ensure resilience:

- Address priority climate risks
- Protect vulnerable groups from climate impacts

To accelerate emissions reduction and limit global warming to 1.5ºC:

- A 75% reduction in community-wide GHGs and net zero GHGs by 2040 [27]
- Net zero municipal operations by 2030

Co-Benefits to Climate Action

Climate solutions often have the added benefit of solving multiple problems with a single investment of time and resources. [28]

Nelson Next considers a number of co-benefits that add value to the investments in climate outcomes, and make it more compelling for City Departments and community members with different priorities to work collaboratively. The co-benefits that have been identified as important to Nelsonites and are thus focused on in this Plan are as follows:

- Sustainable Behaviour
- Improved Resource Efficiency
- Enhanced Resilience
- Public Health
- Economic Growth
- Community Cohesion
- Cost Savings
- Biodiversity

See Appendix D for more detail.

[27] Note: The baseline year for this target is 2007, when Nelson was responsible for 66,753 tonnes of greenhouse gas emissions. This means that by 2030, Nelson must not exceed 16,688 tonnes of CO2e.

Net zero emissions refers to a scenario with zero emissions, or where any greenhouse emissions emitted within Nelson's municipal boundaries are offset through carbon credits or carbon sequestration

[28] Carbon Disclosure Project. 2020. *The Co-Benefits of Climate Action.* Accessed 2020. https://www.cdp.net/en/research/global-reports/co-benefits-climate-action

The Roadmap

Nelson Next represents the beginning of a new, active process rather than a static milestone or event. Using a building block approach, it is a dynamic and agile document that lays out our collective aspirations, and the priority tactics needed to reach them. Implementing this Plan will require an unprecedented level of agility and flexibility. We will need to maintain a shared focus on what can be done right now, an eye on the prize in terms of the end goal, and remain consistently open to experimentation, new research, and new technologies.

Nelson Next has 7 Aspirations, 23 Strategies and 108 Priority Tactics.

Nelson **can do this.** As the Plan builds momentum and creates positive change, we will pay attention to the science on global limits, our shifts in behaviour and interests, and check in regularly on progress toward our evolving path to sustainability and resilience.

The City of Nelson will steward the implementation of Nelson Next and commit to supporting and helping the community access the information and tools they need to assume ownership of the Plan, and collaborate with us to achieve the following...

Aspiration One

Nelson's residents and tourists conveniently navigate the city and region using the highest per capita rates of public, active, or electric transportation in the country.

Build zero-carbon, pollution-free mobility options and systems that are affordable, convenient, and accessible for all of Nelson's residents and visitors. Reducing transportation emissions is a top priority for achieving Nelson's climate goals and targets.

Co-Benefits
Sustainable Behaviour | *Improved Resource Efficiency* | *Public Health*

Strategies

1. Passenger and public transport is clean, active, and shared.
2. Our active and public transportation infrastructure is accessible, connected, and maintained.
3. Nelson is congestion and pollution-free.

Priority Tactics

- Develop and implement a comprehensive 'Low Carbon Mobility Strategy' and education campaign to support a community transition toward electric, shared, and active transportation modes
- Expand electric vehicle (EV) charging infrastructure to align with current and future demand
- Develop an accelerated electrification plan for public transportation in partnership with BC Transit
- Support Micro-EV adoption (bikes, mopeds, neighborhood EVs etc.) and pedestrian safety by reducing the speed limit to 30 km city-wide
- Offer a limited-time free parking pass for EVs registered in Nelson
- Establish an annual 'Electric Downtown' event on Baker Street to encourage EV adoption and active transportation
- Work with local nonprofits and associations to develop an EV Showcase and Testing Centre to engage and educate residents on EV options and charging solutions
- Advocate for increased EV and bicycle rebates and incentives from other levels of government
- Expand the E-bike loan program to non-property owning, long-time residents in good standing with Nelson Hydro
- Explore internal combustion engine (ICE) to electric motor conversion opportunities with local academic institutions, industry, and trades

- Invest annually in the design and construction of new walking and cycling infrastructure as set out in the City's Active Transportation Plan
- Prioritize and improve major pedestrian and cycling route maintenance procedures
- Develop a pilot program for offering free transit in off-peak hours and when air quality is above a '6' on the Provincial Air Quality Health Index
- Require large subdivisions to contribute to an active transportation fund earmarked for active transportation infrastructure, upgrades, and connectivity

- Apply up-to-date climate data to future active transportation planning and programming

- Implement and enforce an anti-idling bylaw for the public
- Increase the parking rate in the designated downtown area (to reduce congestion, traffic noise, and pollution) and allocate a portion of the parking meter revenues to an Active Transportation Fund
- Explore the feasibility of an on-demand, electric microtransit shuttle to move residents and guests through downtown and surrounding areas on a continuous service loop
- Eliminate parking minimums

Mid to Long-Term Tactics

- Establish a 'Low Emissions Zone' AKA a defined area where access by certain types of fossil-fuel vehicles are prohibited
- Develop level-2 EV charging hubs in residential areas to support the charging needs of residents without garage parking
- Develop more and better bus shelters that include seating, lighting and a range of measures to protect users from the elements
- Collaborate with regional and provincial partners to assess the feasibility of active transportation corridors between Nelson and its commuter cities and towns

Climate Action Underway

- Construction of the High Street-Third Street bicycle corridor
- Minimum requirements to make all new buildings EV charging-ready
- Installation of four public Level-2 EV charging stations and two fast-chargers
- Bicycle and e-bike financing program for City of Nelson staff and homeowners
- Partnership with BC Transit to develop the Kootenay Lake West, Castlegar & Nelson Transit Future Service Plan

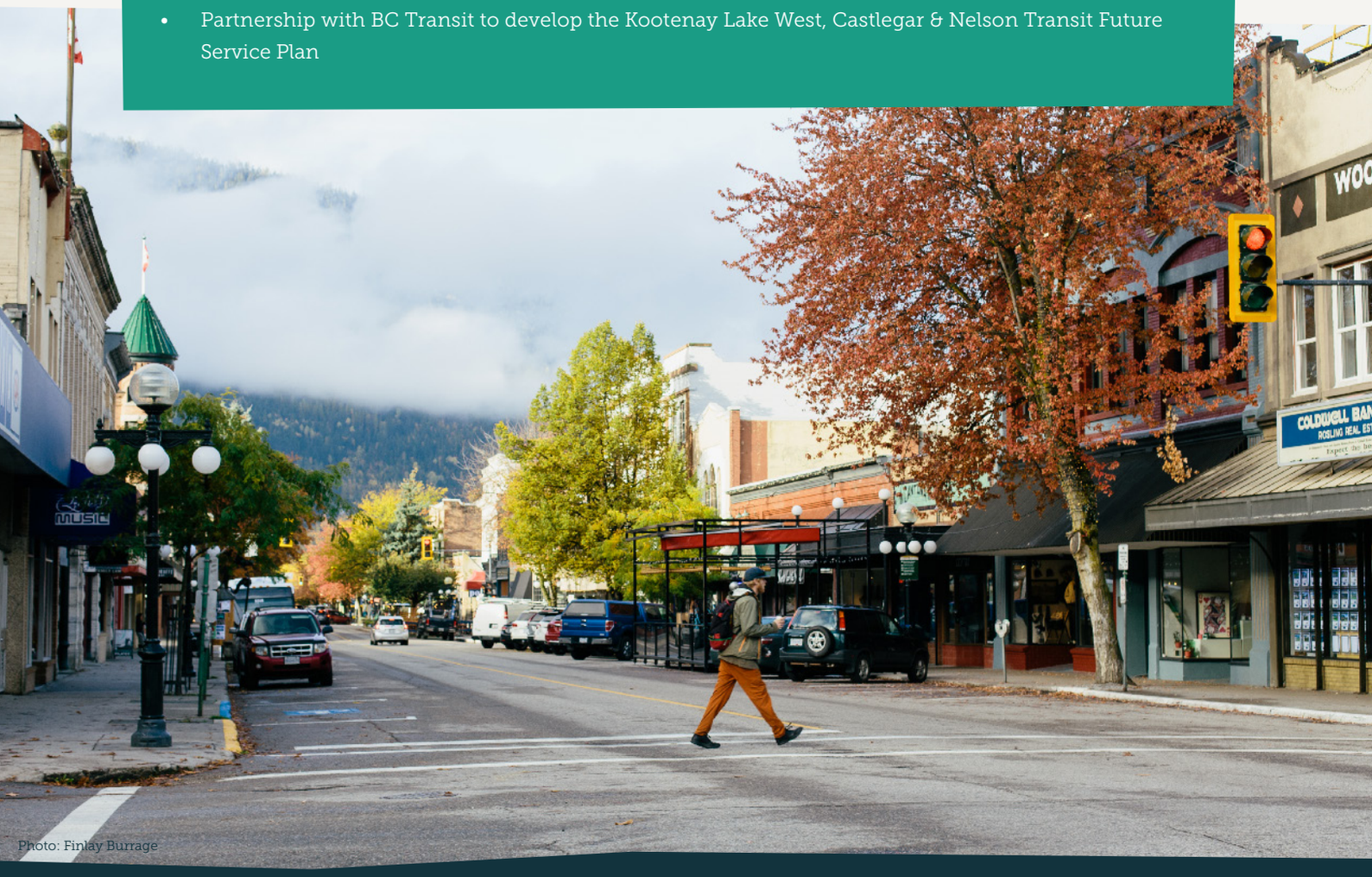


Photo: Finlay Burrage

Aspiration Two

Infrastructure and buildings in Nelson are zero carbon, and resilient.

Kick-start and support a rapid transition to zero-emission and disaster-resilient homes, buildings, and communities, and lower-impact development and construction. Reducing building emissions is a top priority for achieving Nelson's climate goals and targets.

Co-Benefits
Sustainable Behaviour | Improved Resource Efficiency | Public Health

Strategies

1. New buildings are net zero ready, have low embodied carbon, and are resilient against a changing climate.
2. Existing buildings are retrofitted to achieve deep energy savings, reduced emissions, and climate resilience.
3. Our building sector and academic institutions are leaders in green building research, innovation, and construction.
4. Financial barriers to energy efficient and resilient buildings will be reduced through a range of support mechanisms (i.e. grants, targeted programs, specialized support services, etc.).

Priority Tactics

- Develop 'Resiliency Design Standards' for new and substantially renovated buildings, informed by regionally-specific climate projections
- Further accelerate the adoption of the BC Energy Step Code beyond Provincial requirements
- Explore low embodied carbon development incentives and local replacement options (i.e. mass timber) for construction materials that have the highest carbon footprint
- Implement a voluntary energy disclosure program and advocate for a compulsory Canada/BC-wide home energy benchmarking and labelling program
- Develop a solar-ready bylaw to advance solar hot water systems
- Complete a city-wide retrofit needs assessment (residential and commercial), and develop a corresponding support program and implementation plan
- Establish a program to lease residential heat pumps, with rental fees on a sliding scale based on household income
- Explore opportunities for topping up provincial incentives for heat pumps
- Complete a detailed risk and vulnerability analysis of municipally-owned and/or operated critical infrastructure
- Incentivize the switch from wood burning stoves to low carbon heating

- Launch a retrofit accelerator program that centralizes and streamlines retrofit support mechanisms and workforce training, and advances related construction practices
- Work with local institutions to develop training opportunities for youth and students in smart, green, and resilient design and construction
- Collaborate with local nonprofits and businesses to construct innovative, green building demonstration projects, and share plans and learnings with industry and other local governments
- Promote and support natural, carbon-negative building initiatives that utilize local, renewable resources

- Incentivize landlords to complete energy efficiency upgrades through reduced permitting
- Provide grants for home energy audits on a sliding scale
- Amend OCP to allow for row housing throughout the City
- Continue to promote increased density through the expansion of laneway housing, zoning amendments, and development incentives

Mid to Long-Term Tactics

- Require zero carbon/low carbon construction sites
- Develop a low carbon cement and concrete policy and include embodied carbon requirements in new construction standards for buildings
- Obtain ENERGY STAR certification for all ice rinks in Nelson
- Complete a Prefabricated Exterior Energy Retrofit (PEER) pilot and study on a suitable municipal building
- Explore the addition of a PACE (Property Assessed Clean Energy) financing option to EcoSave to provide financing for deep energy retrofits that are tied to the property
- Develop a "Cool Nelson" program to prevent the risk of heat island effect, with a focus on rooftop interventions that reduce building temperatures and energy needs/costs associated with cooling
- Work with social services agencies to develop a low carbon affordable housing project that showcases local building materials and building innovation.

Climate Action Underway

- Early and accelerated adoption of the BC Energy Step Code
- EcoSave Retrofit Program
- Annual Green Home and Energy Show
- Sustainable Design Guidelines

Photo: Finlay Burrage

Aspiration Three

Nelson is a connected community, where residents are prepared to work collaboratively to prevent or reduce climate change impacts.

Integrate a climate lens into planning and asset management, and foster community connection and cooperation to fuel our collective ability to prevent, withstand, and recover from the potential severe impacts of a changing climate. This ensures our city is set up to adapt and thrive regardless of the shocks and chronic stresses we may experience in the coming decades.

Co-Benefits
Sustainable Behaviour | *Enhanced Resilience*
Public Health | *Community Cohesion*

Strategies

1. Climate change impacts are integrated into the key planning, operational, and infrastructure-related decisions made in and for our city.
2. We work on innovative, creative, and localized climate solutions as a community.
3. Nelson contributes to a regenerative, viable, and resilient regional food system.
4. Nelson's highest priority climate risks are widely understood and collaboratively addressed.
5. All residents—especially those most at risk—have high quality access to information, capacity-building opportunities, and support to better prepare for and respond to climate change.

Priority Tactics

- Develop a tracking and reporting system to quantify likelihoods of priority climate impacts and outcomes, to support asset management and emergency response planning
- Develop policies and related interventions to address future energy demand and disruptions due to climate change impacts
- Continue to integrate climate risks into emergency preparedness and recovery planning
- Develop a holistic, integrated, and climate-informed water supply strategy

- Pilot a micro-grant program that supports residents to develop neighborhood-level climate solutions
- Work with local associations to pilot a community carbon offset program that directs offset dollars toward local projects that reduce GHGs and/or climate risks
- Partner with local arts organizations to pilot a climate change-focused public art program that embeds artists in municipal climate change projects to heighten public awareness and enhance public spaces

- Investigate opportunities to expand local food cultivation, processing, and distribution capacity in Nelson and Area
- Work with local nonprofit and associations to update Nelson's 2014 Food Security Assessment, and develop a resulting action plan to address the priority risks that climate change poses to Nelson's food security
- Pilot a public urban food forest initiative within Nelson City limits
- Incentivize multi-unit residential developments that include food gardens with sufficient space for all residents
- Collaborate with local organizations and other levels of government to develop agroforestry projects in high risk wildfire areas directly surrounding Nelson

- Continue implementing the high priority actions from Nelson's Community Wildfire Protection Plan and lobby other levels of government for increased support
- Develop a disaster recovery framework with event-specific considerations to be employed when disasters occur
- Engage and collaborate with private landowners surrounding Nelson to ensure shared climate risks are understood and addressed in a mutually beneficial and constructive way
- Develop and share a yearly 'Changing Climate Report' to track Nelson's current and shifting climatic conditions and its effects on our natural ecosystems and assets

- Work with local social services organizations and other levels of government to explore and map location options for extreme weather shelters sufficient to meet the needs of vulnerable populations
- Engage school-aged youth in a localized disaster preparedness and resilience education program
- Expand communication and community engagement related to the impacts of climate change and the connections between resilience and emergency preparedness
- Engage with the Regional Health Authority and other relevant partners to develop a plan for monitoring the effects of climate change on residents' mental and physical health over time

Mid to Long-Term Tactics

- Explore mobile app options for offering residents extreme weather notifications and related guidance
- Develop Emergency Water Supply Plans for drinking water and Fire and Rescue Services use
- Investigate the feasibility of a publicly-accessible flood risk mapping and labelling program that monitors flood vulnerability in real time
- Expand Nelson's DP Area 3 Zone (Wildfire Design Guidelines) to include all buildings and structures within City limits (new and additions)
- Implement local air quality monitoring and consistent air quality communication in the public realm

Climate Action Underway

- Wildfire Interface Design Guidelines for landscaping and new construction for properties adjacent to forested lands
- FireSmart Home/Property Assessments
- Ongoing forest fire fuel mitigation
- Nelson Farmers Market, Food Security Ambassador and Food Security Resource webpage
- Ongoing Emergency Preparedness support (i.e emergency alert service and Emergency Preparedness Kit instructions)
- Emergency Management Coordinator and Emergency Operations Centre
- Flood Inundation and Hazard Mapping and Hall Street stormwater upgrades

Aspiration Four

Nelson's natural ecosystems and the services they provide us are healthy, abundant, and diverse.

Prioritize biodiversity and the evolving needs of our natural ecosystems, which play a vital role in decarbonization and resilience. Ensuring nature's ability to support and enhance human and animal life also safeguards our health, our livelihoods, and our well-being.

Co-Benefits
Sustainable Behaviour | *Enhanced Resilience*
Public Health | *Biodiversity*

Strategies

1. Essential ecosystem services—such as clean air, clean water, and biodiversity—are accounted for and protected.
2. Our water supply is safe, secure and responsibly used by residents, and businesses.
3. Our carbon footprint is continually reduced through a range of carbon sequestration and green infrastructure innovations.

Priority Tactics

- Perform a natural asset inventory to account for the proximate value of ecosystem services and use corresponding data to inform planning and asset management procedures
- Develop and implement an Urban Forest & Biodiversity Master Plan
- Regularly update Landscaping Bylaw to specifically name and prohibit all relevant invasive plant species
- Develop and maintain an invasive species inventory and management plan

- Review the Water Master Plan every two years to ensure it aligns with the climate change targets and aspirations set out in Nelson Next
- Develop and implement residential and commercial water conservation targets and a related plan that aligns with current climate projections
- Explore opportunities to convert a public space in Nelson into a 'Water Square' (tiered rainwater collection pool) that doubles as an outdoor arts and recreation venue

Photo: Finlay Burrage

Climate Action Underway

- Knotweed control and outreach partnership with Central Kootenay Invasive Species Society (CKISS)
- Invasive species and noxious weed ban
- Watering restrictions
- Ongoing water pipe relining and leak detection
- Green roof incentives

- Implement a residential rainwater harvesting rebate program
- Assess the potential water savings to be gained through universal water metering and pay-for-use billing, taking into account estimated potential water savings and operational costs and benefits

- Adjust land management practices to enhance carbon sequestration and storage on city-owned land and explore options for supporting similar practices on private land
- Explore carbon sequestration and green infrastructure opportunities for all city-owned buildings
- Pilot a model green roof initiative on a community building

Mid to Long-Term Tactics

- Formalize current biodiversity corridors and develop and connect additional corridors
- Provide incentives for landowners to maintain and protect trees of a specific size and age on private property
- Implement a Green Roof and Walls bylaw and/or incentive
- Implement a Citizen Science Program that guides and compensates community organizations and residents to collect a range of ecosystem health and climate change data that will contribute to progress monitoring
- Establish a Nelson and District Community Forest that prioritizes sustainable forestry and carbon banking for municipal emissions

Carbon Sequestration

Carbon dioxide is the world's most commonly produced GHG. It is a heat trapping gas produced both in nature and by human activities, such as burning coal, natural gas, and oil to produce energy. Carbon sequestration is a process that captures carbon dioxide from the atmosphere and stores it in a) vegetation, soils and oceans (biological), b) underground geologic formations, or rocks (geological) or c) using various technical/chemical processes (technological). Carbon sequestration is increasingly viewed by the scientific community as an essential part of solving climate change, alongside emissions reduction activities such as energy conservation and the use of renewable energy.[29]

[29] UC Davis. 2020. Carbon Sequestration. Accessed 2020. https://climatechange.ucdavis.edu/science/carbon-sequestration/

Aspiration Five

Nelson is a sustainable economy and renewable energy leader.

Initiate and advance localized, climate-resilient economic growth and diversification through sound policy and renewable energy innovation. Prioritizing participation, ownership, and sharing of collective benefits from the transition to a low carbon economy will strengthen our communities and create new opportunities.

Co-Benefits
Sustainable Benefits | *Improved Resource Efficiency* | *Enhanced Resilience* | *Economic Growth* | *Cost Savings*

Strategies

1. Renewable and low-emission energy is generated locally and consumed responsibly.
2. Our local economy is low carbon and prepared to adapt and thrive as the climate changes.
3. Our local students and workforce are consistently engaged in capacity building and creative endeavors with positive climate outcomes.

Priority Tactics

- Complete a comprehensive renewable energy study that identifies viable supply sources—both micro and community—and a prioritized list of initiatives
- Explore municipal incentives for high impact renewable energy installations
- Develop localized 'information toolkits' for renewable microgeneration opportunities
- Collaborate with regional energy providers to explore new, renewable and alternative energy production opportunities, such as renewable natural gas (RNG)
- Implement a District Energy System in Nelson
- Insert energy consumption grades and comparison data on electricity and gas bills

- Collaborate with local organizations and institutions to develop a green economy hub to help businesses take action on climate change through GHG management across their operations
- Integrate a climate change lens into the Nelson and Area Economic Development Partnership
- Work with relevant partners to grow shoulder season tourism opportunities to mitigate against possible climate change impacts to winter and summer tourism (i.e decreased snowpack and wildfire smoke)
- Offer resilience-focused education and capacity-building opportunities to local businesses
- Commit to regularly sharing local climate change data with the business community to support resilient business development and decision-making

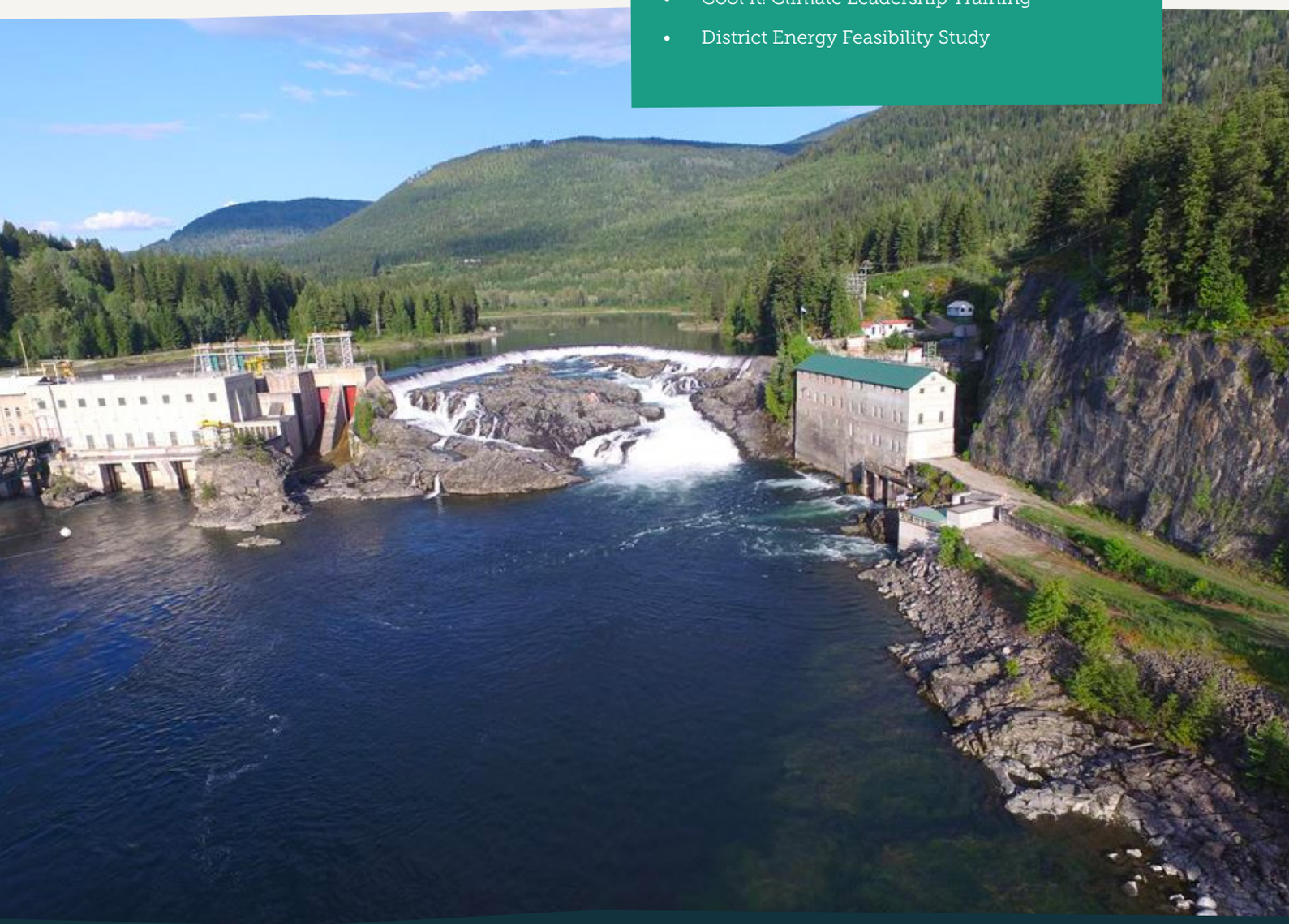
- Pilot a 'Nelson Next Design Competition' that invites local and international students and professionals to submit creative solution designs to different climate challenges in Nelson
- Collaborate with the business sector to develop programming that pairs students with local businesses to develop customized climate action plans
- Partner with local associations to set up an Accelerator Program that support local tech and social innovations that align with Nelson's climate priorities

Mid to Long-Term Tactics

- Develop and launch a second large scale community solar installation
- Develop and implement a coordinated 'Green Growth' Strategy for Nelson, focused on fostering economic growth opportunities aligned with the reduction of emissions, pollution, and/or waste
- Transform Baker Street or Railtown into an 'Eco-Business Zone' —an area of employment and commercial activity that promotes the collaborative attainment of environmental sustainability, economic vitality, and social benefits

Climate Action Underway

- Provision of hydroelectric energy via Nelson Hydro
- Community Solar Garden
- Cool It! Climate Leadership Training
- District Energy Feasibility Study

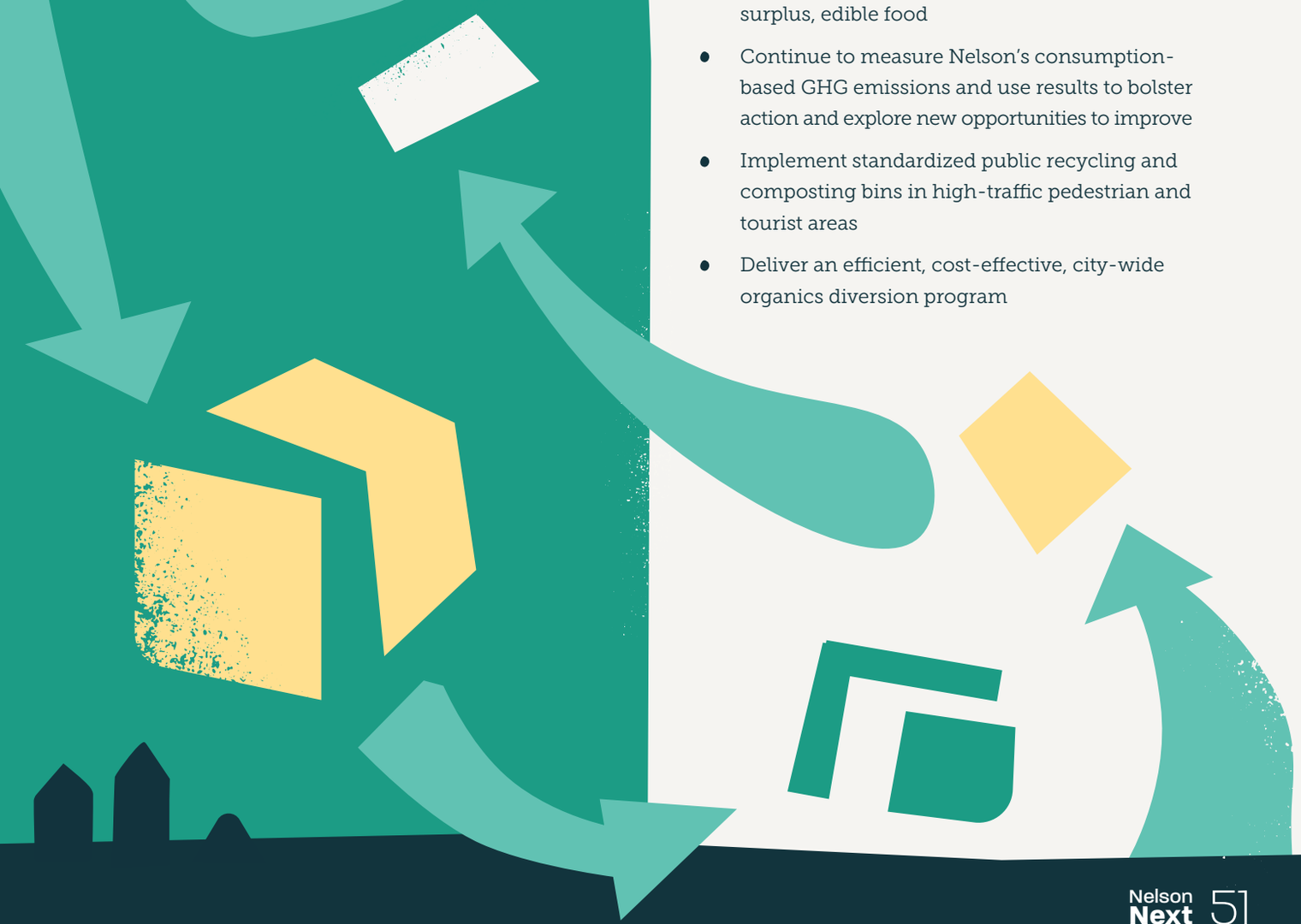


Aspiration Six

Nelson has a thriving circular economy and generates the lowest waste per capita in Canada.

Prioritize the prevention and creative management of waste to create new business opportunities and a robust sharing and circular economy. This will decrease our waste production and consumption-based emissions, reduce the need for raw materials to create new products, advance skill development and social connections, and support the thriving marketplace culture of Nelson.

Co-Benefits
Sustainable Behaviour | Public Health
Improved Resource Efficiency
Economic Growth | Community Cohesion



Strategies

1. Our community is committed to the zero-waste hierarchy—prioritizing waste avoidance, reduction, and reuse.

2. The circular economy in Nelson is continually growing and evolving through cross-sectoral partnerships and innovation.

Priority Tactics

- Work with our regional partners to develop a 'Zero Waste Plan' and timeline for Nelson, focused on phasing out 100% of divertable materials from our waste stream
- Collaborate with the food service sector to explore the viability of a food waste prevention network of businesses and nonprofit organizations that recover and redistribute surplus, edible food
- Continue to measure Nelson's consumption-based GHG emissions and use results to bolster action and explore new opportunities to improve
- Implement standardized public recycling and composting bins in high-traffic pedestrian and tourist areas
- Deliver an efficient, cost-effective, city-wide organics diversion program

- Work with regional partners to undertake a mapping of local material and energy flows to better understand key waste prevention and circular economy opportunities
- Engage the local and regional community, tech and business sectors in circular economy solution development and experimentation.
- Explore the feasibility of a collaborative repair and reuse centre for Nelson

Mid to Long-Term Tactics

- Support trade co-ops and manufacturing spaces that can receive diverted waste streams such as forestry by-products
- Develop and implement a 'Deconstruction Strategy' with regional partners that supports and/or requires construction and demolition waste reuse and recycling
- Develop a 'Sharing Economy Action Plan' to enable the city, businesses and residents to reap the benefits from sharing platforms.

Climate Action Underway

- Curbside recycling
- FoodCycler Pilot
- Plastic Free Month

Photo: Sprout Plant Based Eatery

Aspiration Seven

We are a model city for integrated climate action and leadership, ensuring all municipal operations are low carbon and resilient, and our priority climate change actions are funded and monitored.

Commit to an all-of-government approach that integrates climate action into every facet of our operations, and pursue innovative tools and mechanisms for supporting, financing, and monitoring our corporate and community transition.

Co-Benefits
Sustainable Behaviour | *Improved Resource Efficiency* | *Enhanced Resilience*
Community Cohesion | *Cost Savings* | *Biodiversity*

Strategies

1. Progress on Nelson Next is continually monitored and shared in a transparent and accessible way.
2. Low carbon resilience principles and requirements are fully integrated into organizational operations and culture.
3. Internal capacity development for integrated and sustained climate action and leadership is dynamic and ongoing.

Priority Tactics

- Undertake a GHG Modelling exercise of the priority tactics in this Plan and explore a carbon budgeting process for future planning, decision-making, and progress measurement
- Launch a local, mobile app and education tool that supports Nelson residents to track climate change-related behaviour and data to help monitor Plan progress
- Engage in annual progress reporting to council and community on Nelson Next's implementation progress and key performance indicators

- Replace Corporate GHG Strategy with a comprehensive Corporate Energy and Emissions Strategy, that includes updated emissions targets, a long-term facilities vision, and an electrification timeline
- Develop a comprehensive green building standard for all new municipal buildings
- Develop and implement a Corporate Zero Waste Policy
- Develop a Hot Weather Response Protocol that includes specific protections for outdoor workers
- Update City procurement policy with sustainability-focused guidelines that require the prioritization of products and vendors that are local, low-emission, and low/zero waste

- Develop a green fleet policy to accelerate electrification opportunities for all City fleets and equipment
- Require standardized climate change assessments to accompany applicable council repo
- Write standardized climate change responsibilities and behaviours into job descriptions
- Initiate and manage expert and citizen committees—including diverse and typically marginalized voices—to support and inform Nelson Next implementation
- Allocate annual funding in the City budget tc support staff positions and programs focused on delivering Nelson Next

- Mainstream climate action in roles, policies, and practices by launching an internal clima change training and leadership course
- Develop an internal recognition and reward program for staff members who show exemplary climate change leadership
- Require and support yearly 'smart driver' training for City of Nelson staff that regularly operate City vehicles

Climate Action Underway

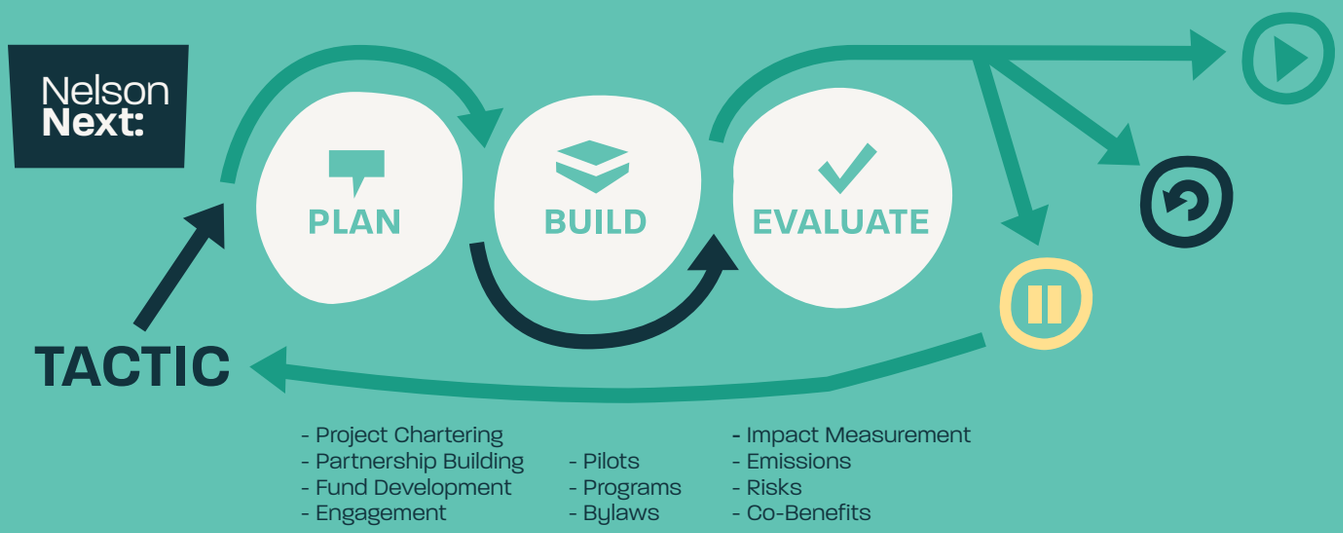
- Climate-focused social innovation lab (Nest Lab)
- Sustainability objectives required for staff reports to Council
- Ongoing corporate energy efficiency upgrades in municipally-owned facilities
- Participation in BCIT's ecoCity Footprint Tool Pilot Program
- Local Government Partner with Simon Fraser University's Integrated Climate Action for BC Communities Initiative (ICABCCI)
- Partner on West Kootenay Renewable Energy Plan

Photo: Finlay Burrage

Implementation & Integration

Nelson Next proposes a range of strategies and tactics to achieve its vision, targets and aspirations. To support collaborative, results-based, and flexible implementation of this Plan, an agile and adaptive framework will be employed:

Figure 13: Nelson Next Implementation Framework



Through the use of this framework, the Plan you see today will—*and should*—evolve and change over time. This is a sign that we are responding to outcomes and aligning with shifting local and global conditions.

Implementation Principles

The implementation of Nelson Next will also be influenced by research and common success principles and factors we've seen emerge from other cities and communities:

- Commit to this future
- Build strong, mutually beneficial partnerships
- Prioritize community inclusion and explore diverse perspectives
- Make balanced decisions and seek equitable benefits
- Use best available evidence to broaden and speed up impact
- Pursue multiple funding pathways and sources
- Assess and adapt
- Don't give up

We Can't Do it on Our Own

Everyone in Nelson has the potential to lead the way in creating our low carbon resilient future, and we want to encourage your participation in this transformative vision.

Reaching the ambitious targets and milestones set out in Nelson Next will require unprecedented collaboration and action from every resident, organization, business, and sector in Nelson. The level of success we achieve will greatly depend on the strength and depth of commitments we are willing to make to one another, and in service to the vision and aspirations set out in this community-informed Plan.

Thankfully, years of ambitious and successful stewardship and climate action positions us well to launch into new initiatives as a collective. While the City of Nelson pledges to lay the groundwork, there are numerous ways in which Nelson's residents can and should be involved in Nelson Next's implementation.

We need everyone.
Where do you fit in?

Milestones

Key milestones that will occur to kick-start and facilitate the implementation and integration of Nelson Next are as follows:

Build a Detailed Implementation Matrix

Work collaboratively to build a detailed timeline and matrix for implementation; including a range of indicators and milestones to track progress, budget and resource estimations, and implementation partners with specific roles and responsibilities.

This matrix will form the basis for coordinating collaborative efforts and communicating how Nelson Next will be applied. It will also act as a tool for measuring progress and informing future Plan iterations.

Develop a Financing Strategy

Funding for Nelson Next will be procured via multiple sources and using multiple stages and financing mechanisms. Research will be completed at this stage to develop a flexible and innovative funding strategy that considers all possible options. Every effort will be made at this stage to ensure the funding solutions that emerge are stable, sustainable, and equitable.

Examples of funding opportunities that may be explored include grants, green bonds, environmental impact bonds, revolving funds, and increased or expanded service fees/eco-fees.

Develop an Engagement Plan

Meaningfully involving the community in the implementation of Nelson Next will be a critical success factor in achieving timely and sustainable impact.

Beyond formal working groups (outlined below), the following avenues and programs for increased and continued engagement with this Plan and its tactics will be considered and developed as engagement planning occurs:

- Interactive online engagement activities
- Regular public events, networking and capacity building opportunities
- Targeted workshops and focus groups
- NEST Lab
- Project-specific engagement

Develop Working Group

A diverse range of community members, City staff, and subject matter experts will be invited to contribute their time, expertise, passion, and lived experiences to help implement Nelson Next, in the form of a dynamic working/doing group.

The overarching goals of this group will be to:

- Provide guidance
- Support current and future actions and performance measurement
- Cultivate further community involvement and ownership
- Mobilize resources for Plan implementation
- Hold the City and other actors accountable to progress

Impact Evaluation and Plan Iteration

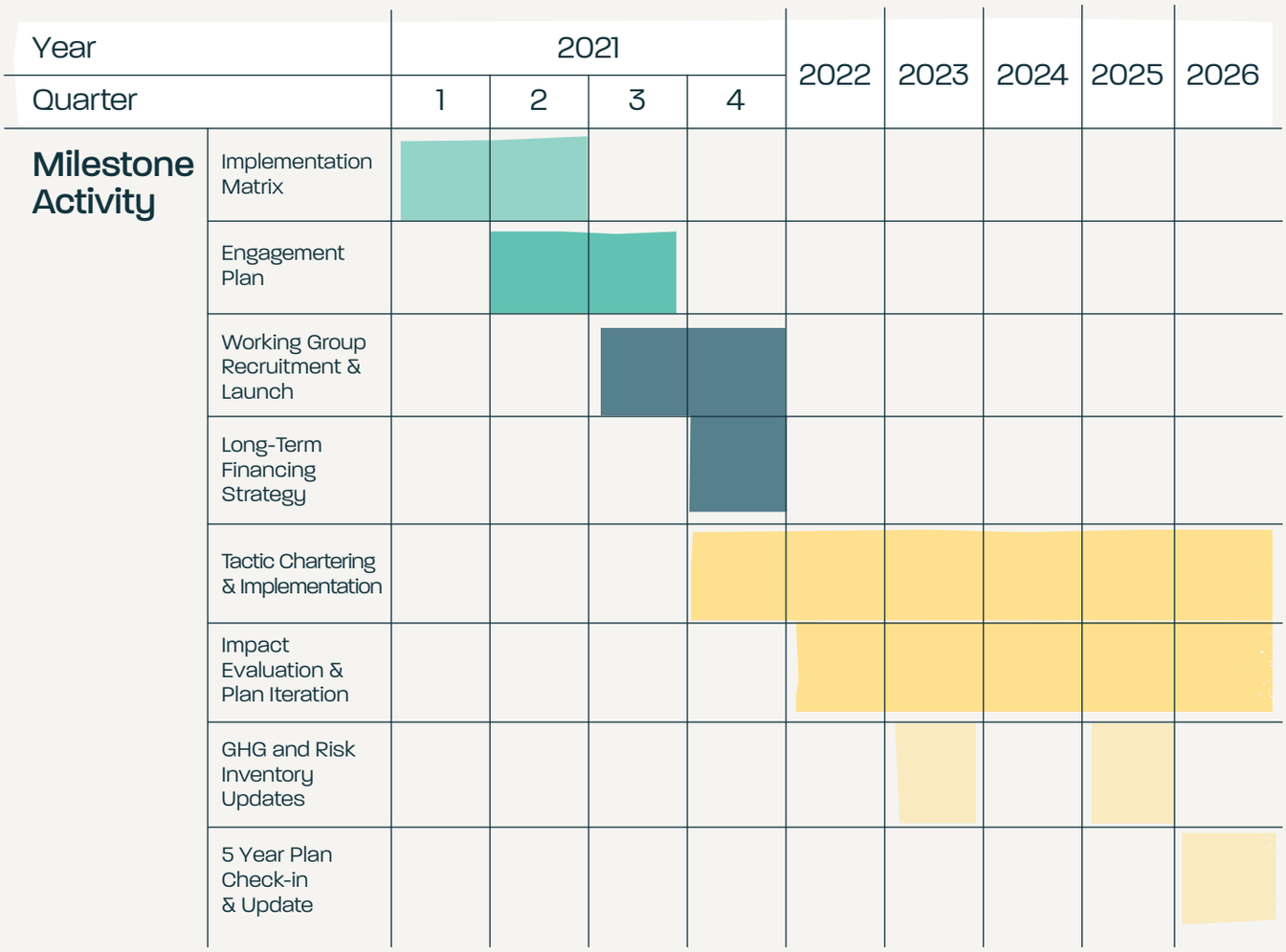
The City of Nelson intends to regularly monitor the impact of Nelson Next, and engage in a Plan review process on a yearly basis to reflect evaluation findings, new learnings, technologies, financial resources, staff capacity and community involvement. We will also aspire to conduct biennial greenhouse gas inventories and climate risk assessments to evaluate Plan effectiveness, as well as engage in an in-depth Plan update in 2025.

By reporting regularly on appropriate measures and indicators, the City of Nelson will be able to understand and communicate progress and apply the approach of adaptive management to evolving climate impacts and risks. Yearly monitoring and reporting will focus on the following information:

- Implementation status
- Climate trends and events
- Measurable impact to date (emissions, risks, co-benefits, and other key indicators)
- Public perception and involvement

Progress reports will be made public and accompanied by a 'Pause/Pivot/Pursue' matrix that outlines required tactic shifts to respond to the performance data and other relevant shifts in social, economic and environmental conditions.

Figure 14: Nelson Next Implementation Milestones



Let's Get Started...

We are at the dawn of a new and determined decade with regard to climate change, and Nelson Next is our response. This Plan continues the environmental leadership our city was built on, and outlines the new and emerging opportunities we plan to take advantage of. Through Nelson Next, we aim to create new jobs, stimulate innovation, and contribute to a more inclusive and vibrant city.

Now is the time to move forward - together. Now is the time to increase our pace of action and embrace the transition required of us. Now is the time to both protect and enhance our beautiful and exciting city.

We are Nelson Now—
and we are Nelson **Next.**

Photo: Lisa Seyfried

State of Climate Adaptation

City of Nelson

July 2020

Photo: Jesse Schpakowski

COLUMBIA BASIN RDI RURAL DEVELOPMENT INSTITUTE
Selkirk College
City of NELSON
FCM FEDERATION OF CANADIAN MUNICIPALITIES FÉDÉRATION CANADIENNE DES MUNICIPALITÉS
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ACROYNMS

AHCCD	Adjusted and Homogenized Canadian Climate Data
ALR	Agricultural Land Reserve
BWN	Boil Water Notice
CL	Confidence Level
CMIP5	Coupled Model Intercomparison Project Phase 5
GDD	Growing Degree Days
GIS	Geographic Information Systems
DPA	Development Permit Area
EMBC	Emergency Management British Columbia
EOC	Emergency Operations Centre
GCM	Global Climate Model
IHA	Interior Health Authority
NTU	Nephelometric Turbidity Units
OCP	Official Community Plan
$PM_{2.5}$	Fine Particulate Matter
RCP	Representative Concentration Pathways
RDCK	Regional District of Central Kootenay
RDI	Columbia Basin Rural Development Institute
SoCARB	State of Climate Adaptation and Resilience in the Basin
SWE	Snow Water Equivalent
UBCM	Union of British Columbia Municipalities
WQA	Water Quality Advisory
WUI	Wildland Urban Interface

DISCLAIMER

The data for State of Climate Adaptation indicators has been collected and analyzed by a team of qualified researchers. A variety of municipal, regional and provincial data sets informed the indicator findings. In some cases, community-specific data is not available. State of Climate Adaptation indicator reporting should not be considered to be a complete analysis, and we make no warranty as to the quality, accuracy or completeness of the data. The Columbia Basin Rural Development Institute and Selkirk College will not be liable for any direct or indirect loss resulting from the use of or reliance on this data.

The preparation of this report was carried out with assistance from the Government of Canada and the Federation of Canadian Municipalities. Notwithstanding this support, the views expressed are the personal views of the authors and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them.

INTRODUCTION

Purpose

Welcome to the City of Nelson 2020 baseline report for the State of Climate Adaptation and Resilience in the Basin (SoCARB) indicator suite. SoCARB indicators were designed by a team of climate change professionals to provide data and insights relating to climate change, including local environmental impacts and community impacts (e.g., economic impacts), as well as information to help build adaptive capacity and track local actions. Originally developed in 2015, the SoCARB indicator suite measures community progress on climate adaptation across five climate impact pathways: extreme weather and emergency preparedness, water supply, flooding, agriculture, and wildfire.

Figure 1: *City of Nelson*

Climate-related impacts like flooding, drought and high temperatures can be critical events for communities and are examples of events that are projected to occur with greater frequency and/or intensity as the climate gets warmer. Flooding poses a risk to water infrastructure and public safety, and contributes to turbidity in surface sources. Drought has implications for water supply, local food production, and increasing wildfire risk. Higher temperatures can impact vulnerable populations, including the elderly, socially isolated, chronically ill, and infants.

The information presented in this report is to be used as a reference document for the City of Nelson, intended to highlight trends and impacts related to the local climate and surrounding environment, and to inform local planning and decision-making. While focused on Nelson, this report includes changes in indicators outside of the City of Nelson jurisdiction, such as wildfire starts, recognizing that a better understanding of trends associated with these indicators can help the community prepare for current and future changes. The data for some indicators, such as per capita water consumption and FireSmart uptake, come directly from City of Nelson staff, as they are best positioned to identify and track potential opportunities for increasing community climate resilience in their own community.

The full SoCARB indicator suite includes 58 climate adaptation indicators. This report, however, excludes indicators that the City of Nelson has not identified as a priority or where sufficient data was not available, as well as all indicators from SoCARB's Community Resilience Index. In addition, the evolution of adaptation practice since 2015 and learnings from pilot implementation in 2016-2017 with four communities within the Columbia Basin resulted in minor updates to the suite in spring 2019.

Report Highlights

- The climate in the Nelson area is changing, with data showing trends toward higher average annual and seasonal temperatures. This upward trend is expected to continue with an increasing overall rate of warming and shifts in precipitation, resulting in warmer, wetter winters and hotter, drier summers. There is also a trend toward more extreme heat days, a longer growing season and more growing degree days. Historical trends for precipitation do not present a clear signal/trend, and future projections indicate increases in both annual precipitation and heavy precipitation.
- Climate change is becoming evident through some noticeable changes in Nelson's environmental conditions. For example, air quality issues resulting from wildfire are increasing, and the amount of heat energy available for crop growth is on the rise. Several environmental impact indicators lack sufficient data to infer trends and could be focal points for efforts to enhance climate adaptation monitoring, planning and action.
- The City of Nelson is actively taking steps to adapt to changes that have already happened and to prepare for future changes, including the current development of a comprehensive climate change action plan focused on mitigation and adaptation priorities. Other actions include having an emergency preparedness plan with key elements in place or in progress, having a Water Master Plan that considers climate change, showing success in reducing per capita water consumption, and having a strong commitment to adoption of FireSmart principles in policy and planning. Opportunities exist to further Nelson's readiness to adapt, which include additional actions on water conservation, especially around water loss, and promoting community-based efforts to adapt (e.g., through programs aimed at enhancing personal and household emergency preparedness).
- While some datasets are not lengthy or complete enough to evaluate trends in the City of Nelson's adaptation, the analyses conducted for this project provide a valuable baseline assessment against which future progress can be compared.

Methods

The State of Climate Adaptation and Resilience in the Basin (SoCARB) indicator suite was released in 2015 by a team of climate change professionals. The full suite separates indicators into two instruments:

1) a set of five thematic pathways (wildfire, water supply, agriculture, flooding, and extreme weather) that, through 50+ indicators, measure climate change, climate change impacts, and climate change adaptation; and
2) a Community Resilience Index that uses an additional 20 indicators to provide insights on socio-economic conditions in the community that contribute to its capacity to adapt.

The Water Supply pathway (Figure 2) illustrates how SoCARB conceptualizes the relationships between categories of indicators. Climate changes have direct and indirect impacts on communities. Indirect impacts are experienced through both environmental and community impacts. Impacts can be addressed through adaptation actions and capacity building, and the results of such efforts improve adaptation outcomes.

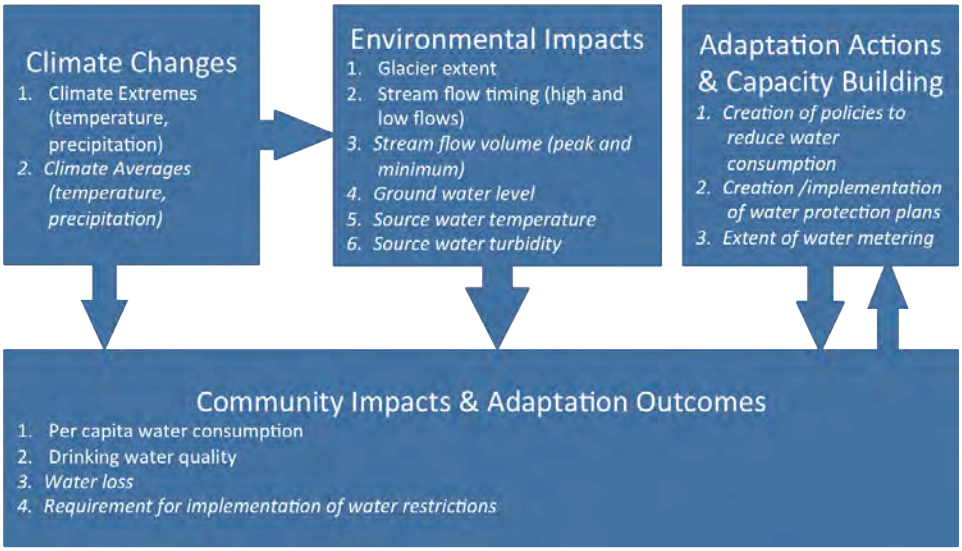

Figure 2: *Water supply pathway from the SoCARB indicator suite*

For this report, City of Nelson personnel identified indicators reflecting local priorities. Community Resilience Index indicators were not assessed as part of this report; however, many of these indicators can be found in the Columbia Basin Rural Development Institute's (RDI) State of the Basin reports and Community Profiles. The Community Resilience Index presents an opportunity for further applied research to inform local climate adaptation and resilience efforts.

This report includes an introductory climate section, which presents climate change indicators common to all five pathways, followed by pathway-specific sections following the same structure as Figure 2 .

Notes to the Reader

The indicators and their related data sets range from simple to complex. Additional detail on any of the datasets or analytical methods is available from the RDI. Understanding the data and its limitations is important for many reasons. Related to this, the points below should be considered while reviewing the report.

- **Climate trends are complex**. It is difficult to look at climate trends over the short or medium term because there are other factors beyond climate change that can influence trends. Climate science experts were consulted when analysing and interpreting data for this report.
- **Use of proxy data**. For some indicators, there is no local data source. Where feasible and appropriate, proxy (or stand-in) data sources were used.
- **Confounding factors**. An indicator can be influenced by several factors, making it difficult to distinguish the cause of a change. For example, trends in water consumption may be influenced by water conservation initiatives, but other factors (e.g., anomalous weather) must also be considered.
- **No obvious trend**. Some data may show no obvious trend. However, this data still has value as a trend may eventually emerge, and the information can still help inform decision making.
- **Trend that is not statistically significant**. Due to high variability in the data and / or short time periods, some data trends fall below 95 per cent confidence levels (i.e. not statistically significant). This does not nullify the presence of a trend; it highlights that there is less than 95 per cent confidence that the trend captures the true average.

About the Climate Data

Climate data for the City of Nelson was provided by Climatic Resources Consulting, Inc. and comes from two main modeling sources. Technical information is presented below. Climate projections for the 2050s in this report include two scenarios: low carbon and high carbon, delineated according to Representative Concentration Pathways (RCP's), which are greenhouse gas concentration trajectories used worldwide for consistent and comparable climate modeling. Climate projections for the 2050s indicate the average for the 2041-2070 period. The low carbon scenario (RCP4.5) is considered to be optimistic and, although insufficient to maintain global temperatures to below 2°C warming above pre-industrial temperatures, would require significant international cooperation that exceeds current commitments of signatories to the Paris climate agreement.[1] The high carbon scenario (RCP8.5) is also referred to as 'business as usual'. Global emissions are still moving along a trajectory that could lead to 3 to 5°C of global warming by the end of the century.[2] Consequently, it is important to also consider the high global emissions scenario (RCP8.5) in planning for climate change in the Columbia Basin and Boundary regions. Climate trends, i.e. rates of change, are expressed in units per century, meaning the change per 100 years.

Technical Information

Historical climate data was prepared using climate reanalysis ERA5.[3,4] Climate reanalyses combine past observations with models to generate consistent time series of multiple climate variables.[5] They provide a comprehensive description of the observed climate as it has evolved during recent decades, on 3D grids at sub-daily intervals. The estimates are produced for all locations on earth, and they span a long time period that can extend back several decades or more. Adjusted and Homogenized Canadian Climate Data (AHCCD) from Environment Canada provides long-term (since the early 1900s) observed data. Climate projections are based on output from an ensemble of 12 statistically downscaled Global Climate Model (GCM) projections[6] from the Coupled Model Intercomparison Project Phase 5 (CMIP5),[7] and downscaled using Bias Correction/Constructed Analogues with Quantile mapping recording[8] to a resolution of 10 km by 10 km.

CLIMATE

Four climate change indicators are common to most pathways: climate averages and extremes for both temperature and precipitation. They are presented first since changes in temperature and precipitation are key drivers of both environmental and community impacts. These four indicators encompass both historical trends and future projections for the City of Nelson.

The Overall Picture

Both annual and seasonal average temperatures are rising in the Nelson area and are projected to continue rising through the 2050s. Annual average temperature has been rising 2.4°C per century. By the 2050s, this is projected to go to 3.6°C per century under a low global emissions scenario and 7.1°C per century in a business as usual scenario. Total annual precipitation has decreased over the last century, but this trend is not consistent across seasons. Total annual precipitation is projected to increase over the coming decades, with less precipitation during the summer under a high carbon scenario. Temperature extremes have increased over the last century and are projected to continue increasing.

Average annual and seasonal temperatures

Analysis of modelled historical climate data for Nelson shows increasing temperatures since the1950s. There has been a statistically significant warming trend of +2.4°C per century in average annual temperature (Table 1). The 1961-1990 baseline for annual average temperature is 8.3°C.

Average seasonal temperatures have also increased in Nelson. Winter temperatures have increased at the highest rate, with trends calculated at +2.6°C per century (Table 1). Projections for the 2050s indicate that summers will be warming faster than other seasons in both low and high carbon scenarios (up to 10.7°C per century in a high carbon scenario). Average annual temperature is projected to increase 2.6°C to 3.3°C by the 2050s relative to the 20th century baseline (Figure 3). This would result in average annual temperatures of 10.9 °C and 11.6 °C, respectively, under low and high carbon scenarios.

***Table 1**: Annual and seasonal average temperature trends for Nelson in degrees Celsius per century.*

	Annual	Winter	Spring	Summer	Fall
Historic (1901-2018)	+2.4ºC per century	2.6	2.0	1.9	1.6
2050s (low carbon)	3.6	1.6	3.1	3.7	2.9
2050s (high carbon)	7.1	7.6	5.0	10.7	6.7

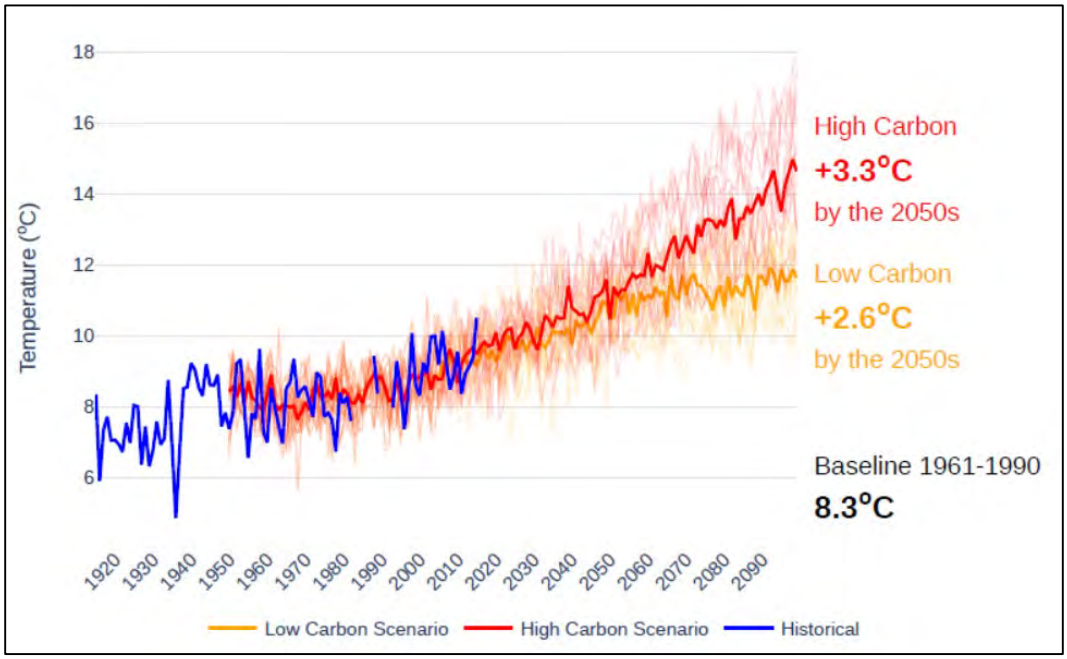

Figure 3: *Historic and projected average annual temperature for Nelson*

Precipitation trends

Average annual precipitation trends are not as clear cut as those for average temperature (Table 2, Figure 4). The dataset shows a decreasing trend in historic average annual precipitation of -232 mm per century at a 94% confidence level. Nelson's baseline annual precipitation for the 1961-1990 period is 640.8 mm. Seasonally, Nelson's historical data show that winter and fall precipitation has been decreasing, whereas precipitation has been increasing in spring and summer.

Table 2*: Annual and seasonal total precipitation trends for Nelson, in millimetres per century. Results that are not statistically significant (< 95% confidence level) are in italics.*

	Annual	Winter	Spring	Summer	Fall
Historic (1901-2018)	*-232 mm/century*	-253	*55*	69	-109
2050s (Low carbon)	*66*	*28*	*39*	*5*	*30*
2050s (High carbon)	190	*46*	67	*-91*	*78*

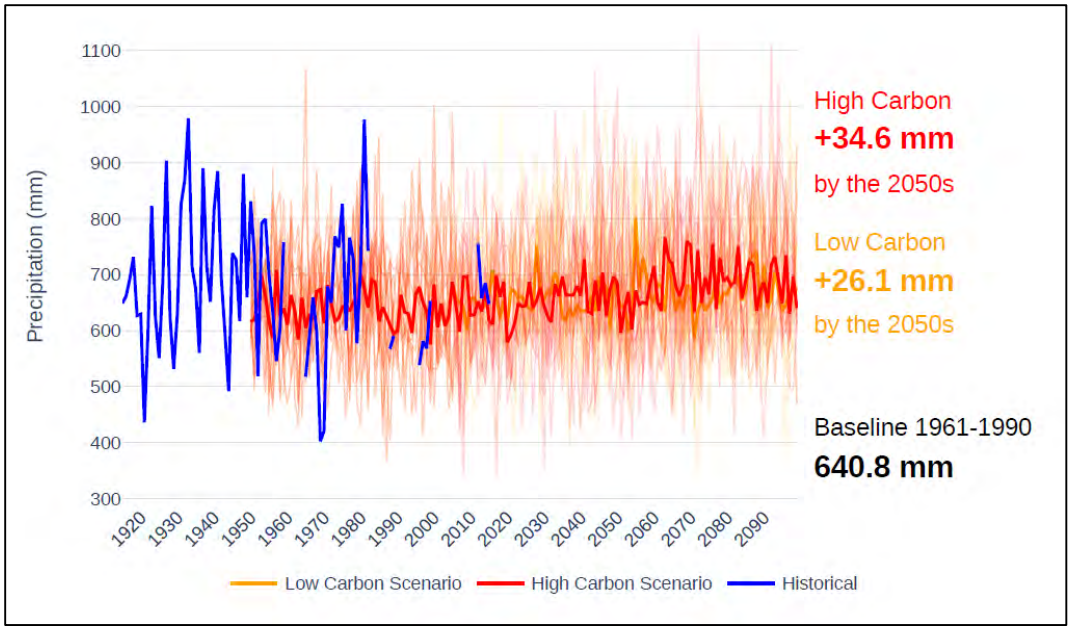

Figure 4: *Total annual precipitation for Nelson*

Precipitation projections indicate increases of approximately 4% to 5% in average annual precipitation by the 2050s, with significantly more precipitation falling in spring and fall (94% confidence level), and less precipitation falling in summer in a high carbon scenario. Precipitation has considerably more variability than temperature, thus confidence levels for some projections fall below 95 per cent, identified by italics in Table 2.

Frequency of hot days

This extreme temperature indicator measures the number of days when the temperature exceeds the 90th percentile for the baseline period (1961-1990). For Nelson, this translates into a baseline of 36 days above 27.7°C. Hot days (i.e. above 27.7°C) are projected to increase from 26.5 to 34.5 days per year by the 2050s under low and high carbon scenarios, respectively, and the warming trend could go as high as 100 days per century by the 2050s in a high carbon scenario.

Amount of precipitation falling during heavy rainfalls / More days with heavy rainfall

The extreme precipitation indicator measures the annual sum of precipitation exceeding the 95th percentile for the baseline period (1961-1990) and can be described as the amount of rain that falls during very heavy rainfall days. For Nelson, the threshold for very heavy rainfall is 7.8 mm (95th percentile). During the baseline period, Nelson received a total of 101.2 mm annually based on the sum of days when precipitation exceeded this threshold. Since 1950, this annual total has been declining by 12 mm per century. Projections for the 2050s indicate an increase of 33 mm in annual 95th percentile precipitation, falling primarily in spring and fall seasons.

EXTREME WEATHER AND EMERGENCY PREPAREDNESS

Extreme weather events, such as extreme precipitation, windstorms and heat waves, can have significant impacts on communities. This was underscored by an independent review of BC's historic flood and fire events of 2017 commissioned by the BC government. This review noted, "A range of data from reputable sources points to growing challenges with respect to heat, drought, lightning and intense rains intersecting with snow melt, underlining the imperative for government to respond in new, different or better ways." [9] The review produced over 100 recommendations to improve emergency preparedness and disaster response in British Columbia. Future projections suggest an increase in some extreme weather events, such as extreme heat days and extreme wet days. Communities can prepare for the immediate short-term demands of extreme weather events with adaptations such as emergency preparedness plans, backup power sources, and home emergency preparedness kits.

The Overall Picture

The City of Nelson is experiencing a higher number of extreme heat days than in the past. Other indicators of extreme weather in the area are either lacking long-term datasets or not yet showing the trends that have been identified at larger scales. The City of Nelson's Emergency Preparedness Plan will help mitigate the impacts of extreme weather events on residents and businesses. The number of residents with emergency preparedness kits is low, suggesting a need for further supporting information and awareness of personal emergency preparedness opportunities.

Climate Changes

As discussed in the Climate section, Nelson's annual and seasonal average temperatures have increased over the last century. The frequency of hot days has increased and will continue to increase, and a similar but less pronounced trend is occurring in respect of the amount of rain falling on heavy rainfall days. Additional climate indicators related to the Extreme Weather pathway are discussed below.

Extreme heat days

Temperature data for Nelson shows a clear upward trend in frequency of days over 30°C, increasing at a rate of 12.9 days per century. During the 1961-1990 baseline period, Nelson experienced an average of 19.4 days per year above 30°C (Figure 5). By the 2050s, this is projected to increase by 24 days in a low carbon scenario and 33 days in a high carbon scenario. This translates to approximately 43 to 52 days per year above 30°C, more than double what was experienced during the baseline period. Heat waves and heat extremes have negative health impacts on vulnerable populations including the elderly, socially isolated, chronically ill, and infants.

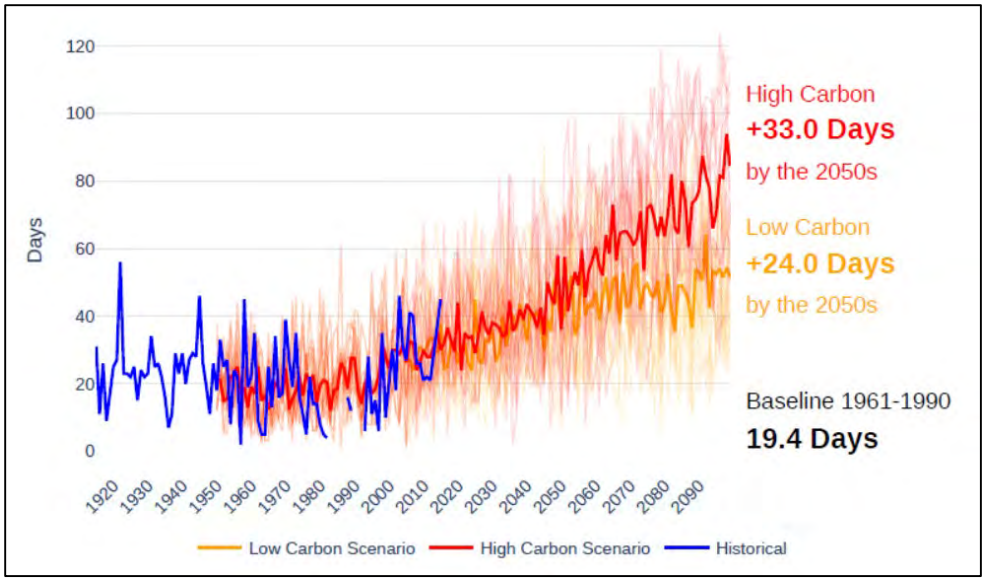

Figure 5: *Extreme heat days (above 30°C) in Nelson*

Fewer heavy snowfalls

Heavy snowfall days are defined as those receiving 15 cm or more over 24 hours. These events can pose challenges to the regular operations of businesses and local governments and may affect the movement of people throughout the region. Snowfall records from Environment and Climate Change Canada's weather station in Nelson show an average of 2.7 heavy snowfall days per year from 1904 through to 2019. Although the trend is not statistically significant, a downward trend is visible in the number of heavy snowfall days (Figure 6). It is important to note variations in data quality from discontinuous station records. Three stations have existed in Nelson since 1904 - all with different locations and elevations. This makes the data variable and difficult to compare.[10]

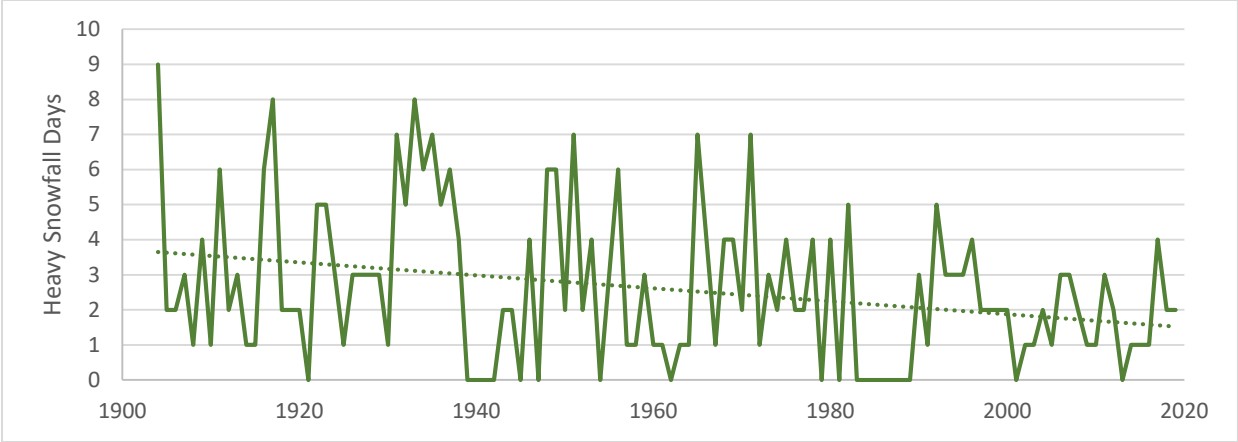

Figure 6: *Number of heavy snowfall days (>15 cm over 24hours) in Nelson, trend is not statistically significant*

The same data was used to assess annual maximum one-day snowfall; there is no significant trend for this indicator either. The average maximum one-day snowfall in Nelson between 1988 and 2019 was 23 cm.[11]

Poor data for strong wind events

Windstorms can damage infrastructure, bring down power lines and cause power outages. A strong wind event is defined as a day with sustained winds of 70 km/h or more and/or gusts to 90 km/h or more. Wind data is not well recorded in the Columbia Basin and the only consistent data available near Nelson comes from BC Wildfire Service weather stations. These stations provide an hourly reading of sustained wind speed over a ten-minute period, which means 83% of wind behaviour is unrecorded. [12] Analysis of the Smallwood station near Nelson, which has data from July 1991 to the present, revealed no records over the 70 km/h threshold.[13] Records of maximum daily wind gusts are also available from the Environmental and Climate Change Canada weather station in Nelson, but this dataset has large gaps that make the identification of extreme wind events unreliable.

Maximum 1-day rainfall

Heavy rainfall is a major cause of flooding of creeks and rivers and can cause stormwater management issues, erosion and debris slides. A warming climate generally increases the risk of extreme rainfall events because a warmer atmosphere can carry more water vapour, which can fuel more intense precipitation events. Historic data for Nelson indicates 18.5 mm as the 1961-1990 baseline for maximum 1-day rainfall. There is no clear trend up or down since the 1950s. It should be noted that this indicator does not capture the intense micro-burst precipitation events (i.e. high volume/short duration) that have caused overland flooding in Nelson in the past decade. Future projections show an increase in maximum 1-day rainfall by the 2050s under low and high carbon scenarios, of approximately 17% and 19%, respectively.

Adaptation Actions and Capacity Building

Emergency Preparedness Plan

Up until 2018, emergency planning for the City of Nelson was done through the Regional District of Central Kootenay (RDCK). In 2018, the City of Nelson *Emergency Management Program Bylaw No. 3431* was passed, moving emergency planning responsibility from the RDCK to the City of Nelson.[14] The full transition of emergency planning responsibilities from RDCK to City of Nelson will take three years and will take place through phased implementation. As a result, many emergency preparedness plan components were still in progress when this report was prepared. As an example, emergency procedures are in place from the RDCK emergency planning, while the City of Nelson is building plans for each hazard with the goal for this to be done within three years. The first version of a comprehensive Hazard Risk and Vulnerability Assessment was completed in 2019.[15]

Table 3: *Emergency preparedness plan components for the City of Nelson*

	Included in Emergency Preparedness Plan?			
Component	Yes	In Progress	No	N/A
Hazard risk assessment	☑	☐	☐	☐
Emergency procedures	☐	☑	☐	☐
Municipal business continuity plan	☐	☑	☐	☐
Community evacuation plan	☐	☑	☐	☐
Public communication plan	☐	☑	☐	☐
Designated emergency response centre	☐	☑	☐	☐
Emergency program coordinator	☐	☑	☐	☐
Designated emergency response team	☐	☑	☐	☐
Identified emergency roles and responsibilities	☐	☑	☐	☐
Action list for each type of hazard	☐	☑	☐	☐
Designated emergency/reception shelter	☐	☑	☐	☐
Plan for shelter stocking	☐	☑	☐	☐
Training and emergency exercise plan for response personnel	☐	☑	☐	☐
Contact list for all response personnel	☑	☐	☐	☐
Fan-out call list or emergency alert system	☑	☐	☐	☐
Mutual aid agreements with any agencies helping in response (e.g. neighbouring municipalities, school board, local service groups)	☑	☐	☐	☐

Essential backup power in place

The City of Nelson has backup power in place for its Emergency Operations Centre (EOC), City Hall, and fire halls. All sanitary sewer lift stations, except Lakeside Park and Tyler Park stations have backup power. Nelson's drinking water system is gravity-fed, so only the treatment plant needs and has backup power. The water system has a supervisory control and data acquisition (SCADA) system that sends alarms to operators who are available 24/7. There are several reception centres and group lodging facilities that would be activated during an emergency. It is unknown if these facilities have backup power.[16]

Few residents have emergency preparedness kits

Having an emergency preparedness kit can help alleviate some of the difficulties caused by an extreme weather event or wildfire. Out of the 132 Nelson residents who completed a voluntary survey in the summer of 2019, only 32% of respondents reported having 72-hour emergency preparedness kits in their homes. Of those, 67% reported having them in an easy-to-access location. Table 4 shows the percentage of respondents having important items in their kit. Many

residents could better prepare for extreme weather events by compiling complete kits and storing them in a single accessible location. In the case of an evacuation, 66% of respondents said they would stay with out-of-town friends or relatives or at a summer home, while 18% said they would go camping and 16% said they had no place to go.

***Table 4**: Percentage of respondents from the City of Nelson with emergency kits indicating the presence of important items in their kit*

Item	Yes
Drinking water (2-3 litres of water per person and pets per day, for 3 days)	81%
Foods that will not spoil (minimum 3-day supply)	90%
Manual can opener	81%
Flashlight and batteries	93%
Candles and matches/lighter	95%
Battery-powered or wind-up radio	58%
Cash in smaller bills and change	44%
First aid kit	98%
Special items such as prescription medications, infant formula or equipment for people with disabilities	49%
Extra keys that you might need (e.g. for your car, house, safe deposit box)	60%
A copy of your emergency plan including contact numbers (e.g. for out-of-town family)	34%
Copies of relevant identification papers (e.g. licenses, birth certificates, care cards)	59%
Insurance policy information	59%
Mobile phone charger	76%

Community Impacts and Adaptation Outcomes

No trend in weather-related highway closures

Between 2006 and 2017, there have been six weather-related highway closures near Nelson. This number comes from Drive BC records that report closures on major highways only. For Nelson, this is Highway 6 to Salmo and Highway 3A from Castlegar to the Kootenay Bay Ferry at Balfour.[17] Half of weather-related highway closures on these roads are due to downed power lines. A washout near the Kootenay Bay Ferry caused the longest closure of 20 hours in 2012.

Nelson is also impacted by closures on Highway 3 over Kootenay Pass and the Blueberry-Paulson Pass. Avalanche control is the main cause of closures on these passes, though other weather-related events have closed these highways in the past. Between 2006 and 2017, Kootenay Pass has had five weather-related closures, the longest being a mudslide that closed the road for 13 hours. The Paulson Pass has only two recorded closures from rock slides in 2008 and 2009 that stopped traffic for less than 2 hours.[18] Avalanche-related activities have accounted for an average annual closure time of 93 hours over 37.6 closures at Kootenay Pass (2003-2019) and 4.7 hours over 1.5 closures at the Paulson Pass (1989-2019). No trends are evident in the number or duration of avalanche-related closures at this time.[19]

Power Outages

Longer-duration power outages caused by extreme weather events can have significant impacts on local economies, health and quality of life. Nelson Hydro provides power for the City of Nelson.

Power outage data for the Nelson Hydro area is available for 2012 to 2019 for the service sub-regions of North Shore, South Shore and City. An analysis of outages caused by fire, lightning, snow, trees, and wind in these sub-regions resulted in an average of 91 outages per year. Of these outages, most are due to trees. Trees are included in list, as it is assumed most trees fall due to extreme weather, such as high winds or high snow load. The average outage length is five hours, while the median outage length is two hours. The longest outage for the City of Nelson was three days in October 2017.[20] Media reports from this time indicated a major wind event knocked down trees causing power outages for most Nelson Hydro customers.[21]

Provincial emergency assistance

Monitoring emergency assistance funding issued by the province can provide some measure of the economic impact of disaster and associated recovery over time. There has been no provincial emergency assistance for any extreme weather events paid to Nelson in the last five years.[22]

WATER SUPPLY

Projected changes to the climate could influence both the supply of and demand for fresh water for human use. Shifts in temperature and precipitation together with decreased forest cover due to pests and wildfire could change the amount of water stored as snowpack and the timing of surface water availability. The water supply pathway focuses on the quality and quantity of water available for consumptive use and adaptation actions that help to conserve and protect the water supply. The City of Nelson's primary water source is Five Mile Creek, which is transported through a 7.5 km pipeline to the Mountain Station Reservoir. Secondary seasonal sources include Anderson Creek and Selous Creek.[23]

The Overall Picture

Nelson appears to be in a relatively strong position with respect to water supply. Stream flow volumes for its two main water sources, Anderson and Five Mile Creeks, appear stable, but it should be noted that the timing of flows have changed. Anderson Creek maximum daily flows are occurring earlier in the year and this shift to earlier snowmelt runoff is also seen in the timing of half-flow volumes. The timing of runoff on Five Mile Creek does not show a consistent trend and there is increased variability in the date of return to summer low flows. Ongoing monitoring of Anderson Creek and re-establishment of flow monitoring in Five Mile Creek is recommended and would add valuable information to Nelson's understanding of its water security. The City of Nelson Water Master Plan considers the impacts of climate change.

Climate Changes

As discussed in the Climate section, average annual and seasonal temperatures are increasing, and are projected to continue increasing over the coming decades. Total annual precipitation has been decreasing over the last 100 years. Future projections indicate an increase in total annual precipitation by the 2050s under both low and high carbon scenarios, with less rain falling in summer under a high carbon scenario.

Environmental Impacts

Stream flow volume

The stream flow volume indicator measures trends in annual maximum and minimum daily discharge. Nelson's main water sources, Anderson Creek and Five Mile Creek, have discharge records of 56 and 33 years respectively.[24] Continuous gauging on Five Mile Creek, the larger of the two watersheds (47.7 km^2), began in 1983 and was discontinued in 2015. Continuous gauging on Anderson Creek (9 km^2) began in 1966 and is ongoing. Five Mile Creek is characterized as a moderate-sized alpine watershed with headwaters above 2000 metres elevation. In contrast, Anderson Creek is a small, low elevation watershed with headwaters below 2000 metres elevation.

No statistically significant trends exist for annual peak or summer low flow volumes for Anderson or Five Mile Creeks (Figure 7, Figure 8) although a visual inspection of the time series of maximum annual peak flows for Anderson Creek suggests a trend to higher peak flows since 1995 (Figure 7).

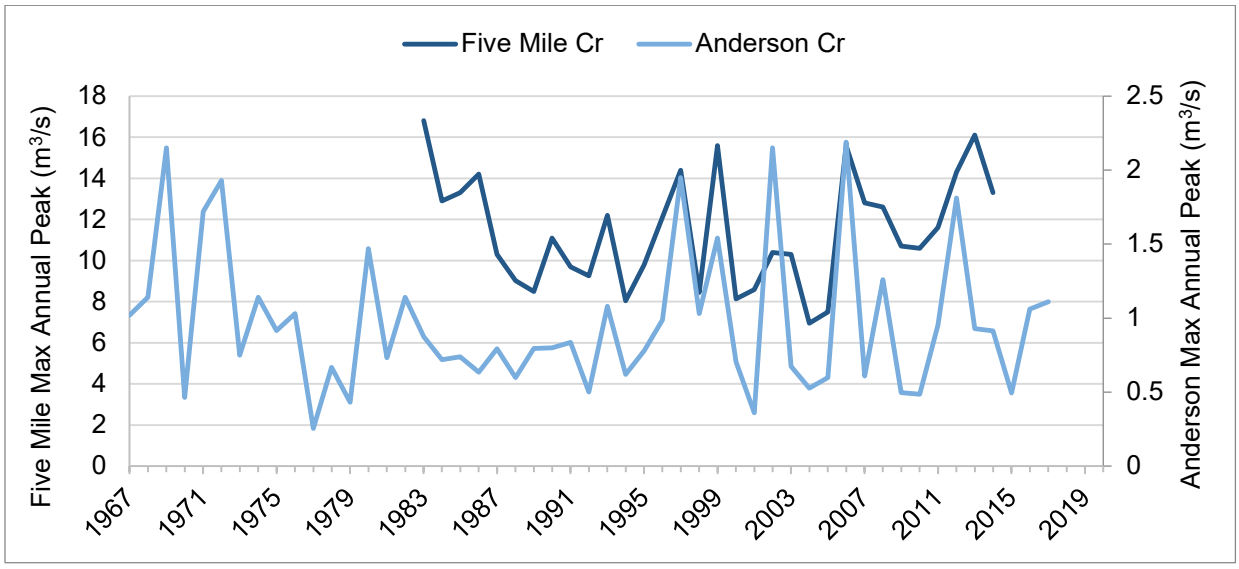

Figure 7: *Maximum daily discharge for Anderson Creek and Five Mile Creek for the period of continuous gauging*

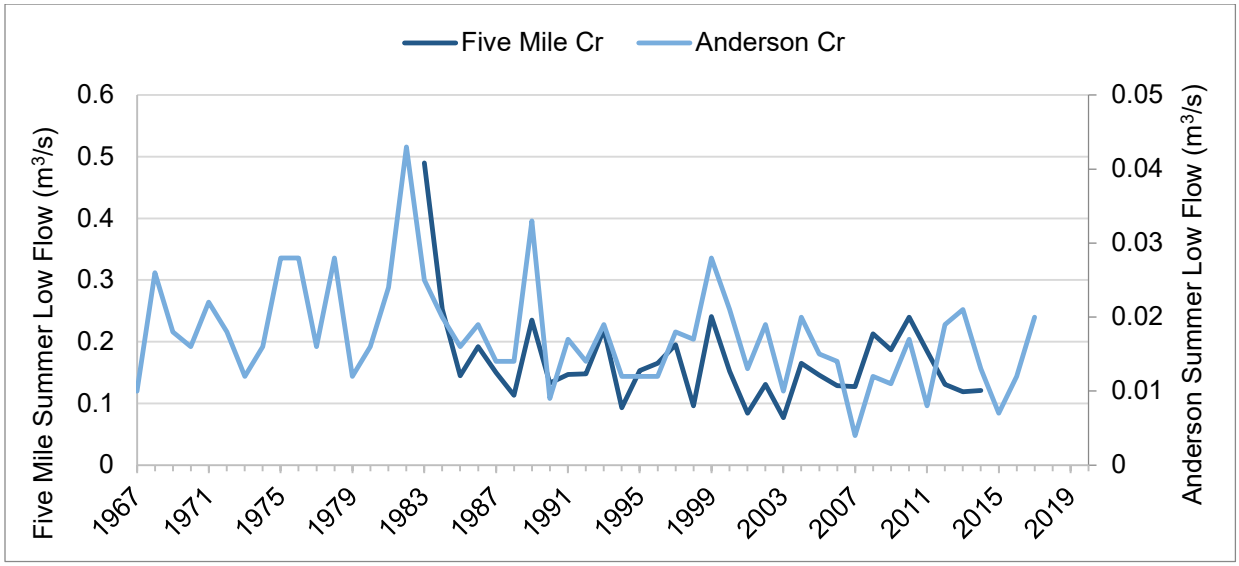

Figure 8: *Minimum daily discharge for Anderson Creek and Five Mile Creek for the period of continuous gauging*

Stream flow timing

Using Environment Canada data,[25] changes in the timing of peak flows are apparent for Anderson Creek (Figure 9). Excluding the outlier of 2015, the timing of annual peak flows after 1990 is, on average, 6.3 days earlier than the timing of peak flows preceding 1990. With the 2015 outlier included, the timing of peak flows has shifted over eight days earlier in Anderson Creek. Although this trend is visually apparent, it is not statistically significant. A weak positive

trend in the timing of the date of maximum peak flow is present for Five Mile Creek but is not statistically significant.

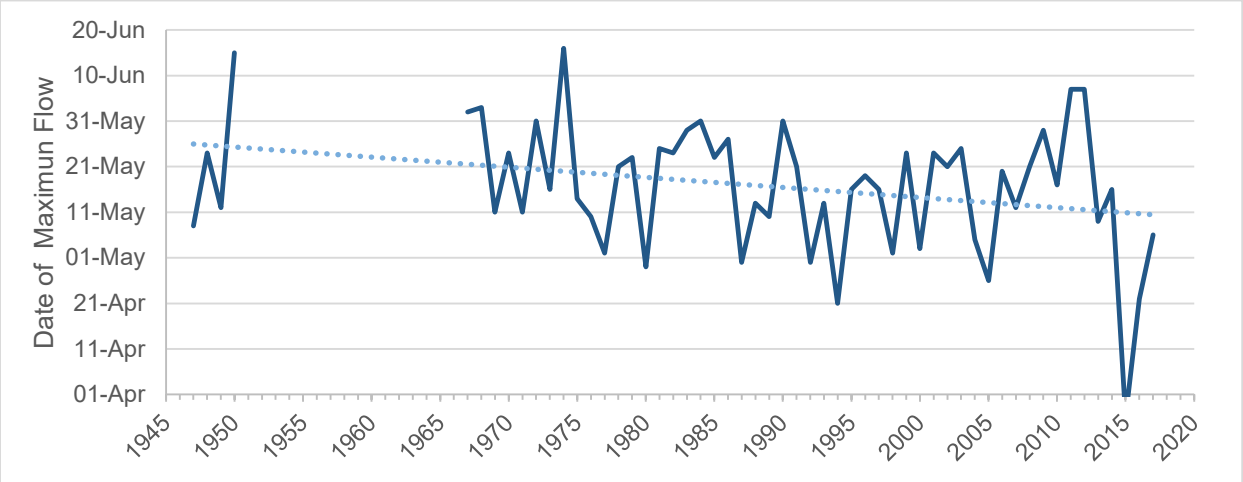

***Figure 9**: Maximum daily discharge date and trend line for Anderson Creek, trend not statistically significant*

No trends are evident in the timing of summer low flows for either Anderson Creek or Five Mile Creek; however, a visual inspection of the Five Mile Creek data (Figure 10) shows a change in variability in the timing of summer low flows after 2000. In the period between 2000 and 2015 the variability in the timing of summer low flow, as measured by the standard deviation of the sample, increased by 29% compared to the pre-2000 period. A more detailed investigation is needed to determine if the increased variability of summer low flows in Five Mile Creek is due to alterations in land cover or climate or a combination of both.

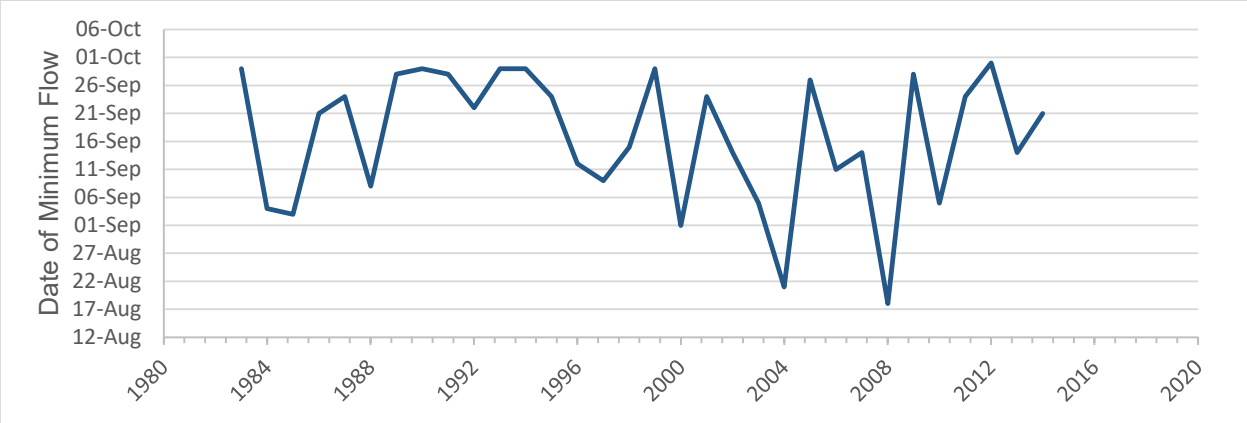

***Figure 10:** Minimum daily discharge date for Five Mile Creek.*

The half-annual flow variable provides a metric to investigate changes in the annual distribution of flow volume. Trends observed in half-annual-flow timing for Anderson Creek are consistent with those observed for maximum daily flow timing. In Anderson Creek, the date of half-annual-flow volume has advanced so that it is occurring, on average, four days earlier now than when continuous gauging began in 1967 (Figure 11). This trend is not considered statistically

significant at the 95% confidence level. There is no obvious trend in the timing of half-annual-flow in Five Mile Creek.

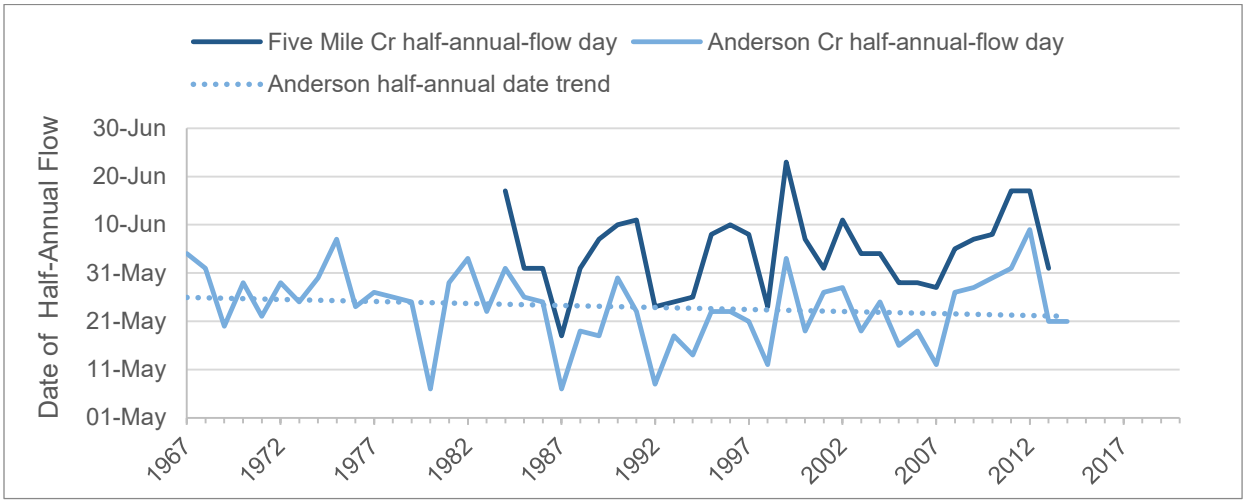

Figure 11: *Date of half-annual flow for Anderson Creek and Five Mile Creek, with trend line for Anderson Creek, trend not statistically significant*

Source water temperature

Temperature can be an important determinant of water quality. Water temperature should be below 15ºC - an aesthetic drinking water objective set by Health Canada.[26] Daily temperature data for the Mountain Station reservoir was provided for the years 2013 and 2014.[27] This data provides a look of the temperature variation in the reservoir over the course of each year. In 2013, 23 days exceeded 15ºC, while 30 days exceeded 15ºC in 2014. Not surprisingly, these days occurred during July and August.

Source water turbidity

Higher turbidity can result in boil water notices or water quality advisories. Turbidity becomes a concern when it rises above one (1) Nephelometric Turbidity Units (NTU). A turbidity reading between one to five NTU is considered fair quality, while a reading greater than five NTU indicates poor drinking water.[28] For the Mountain Station reservoir providing drinking water to the City of Nelson, the 2018 data shows that the turbidity typically varies between 0.08 NTU and 0.86 NTU throughout the year (Figure 12).[29]

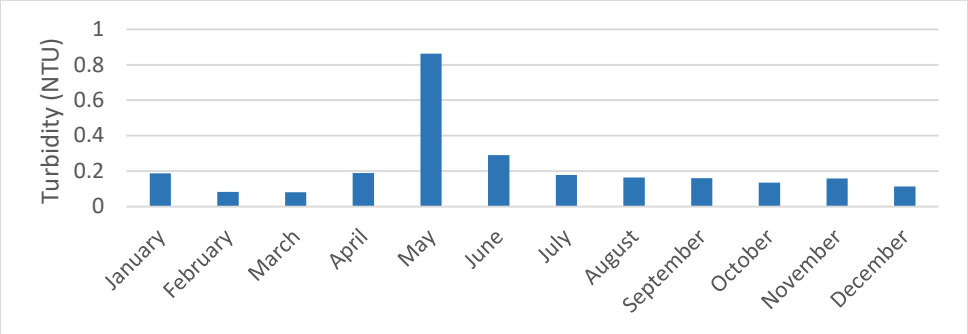

Figure 12: *Turbidity for the City of Nelson throughout the year in 2018*

Adaptation Actions and Capacity Building

Policies to reduce water consumption

The City of Nelson has implemented many water conservation initiatives, ranging from legislative to educational (Table 5: *Implementation of policies to reduce water consumption for all the City of Nelson.* The *Waterworks Regulations and Rates Bylaw No. 3293*, for example, addresses water meters and water restriction stages and enforcement.[30] Nelson currently has district water meters on their four water zones. Water meters are only mandatory on institutional, commercial and industrial properties. However, some other properties have water meters, such as the Rosemont Trailer Park. Public education on water conservation has been delivered by summer students in five of the last six years, including one year-long student placement. This outreach was targeted to high water users.

Table 5: *Implementation of policies to reduce water consumption for all the City of Nelson.*

	Level of Implementation			
Policy/Practice	Full	Moderate	Minimal	None
Universal water metering[i]	☐	☐	☑	☐
Public education and outreach on water conservation	☑	☐	☐	☐
Public education and outreach on water consumption trends[ii]	☐	☑	☐	☐
Water meter data analysis	☑	☐	☐	☐
Consumer billing by amount of water used (volumetric)[iii]	☐	☐	☑	☐
Implementation of water utility rates sufficient to cover capital and operating costs of water system[iv]	☑	☐	☐	☐
Water conservation outcome requirements for developers	☐	☐	☑	☐
Water conservation targets[v]	☐	☑	☐	☐
Stage 1 through 4 watering restriction bylaw	☑	☐	☐	☐
Enforcement of watering restriction bylaw [vi]	☐	☐	☑	☐
Drought management plan	☐	☐	☐	☑
Actions to address water system leaks:				
Targeted leak repair [vii]	☑	☐	☐	☐
Water operator training	☑	☐	☐	☐
Replacement of aging mains [viii]	☑	☐	☐	☐
Addressing private service line leakage [ix]	☑	☐	☐	☐
Pressure management solutions [x]	☑	☐	☐	☐

i. Bylaw 3293 states that only institutional, commercial, or industrial connections must install a water meter.
ii. Incorporated into City newsletters and talked about during public outreach
iii. Some businesses and the Rosemont Trailer park are billed metered rates
iv. Bylaw 3092 Schedule H
v. In 2009, the Nelson Water Smart Action Plan had a 20% water conservation target. By 2015, a 5% reduction was achieved.

vi. Some monitoring and education done through summer students; no bylaw enforcement with fines
vii. On a case by case basis
viii. There is an aggressive capital replacement program of approximately 2% annually
ix. On a case by case basis
x. Pressure reducing valves are installed as per the Water Master Plan and best practice

Source water protection plan and climate change

The City of Nelson has a Water Master Plan last updated in 2017. This update considers the impact of climate change, such as reduced watershed yield and reduced water quality. The updated plan also suggests other options for sourcing drinking water.[31]

Water loss detection practices

The City of Nelson participated in the Columbia Basin Water Smart program, which helped identify opportunities to address water loss. The Rosemont Trailer Park is a leaky private system that the City has focused on through extensive outreach, education, and assistance measures to help address the leaks. Night flow analysis has been done for some areas, with more planned as resources and schedule allow. Both acoustic leak detection and leak noise correlation testing are done on an as-needed basis, with leak noise correlation testing focused on the Rosemont Trailer Park.

Table 6: *Implementation of water loss detection practices for the City of Nelson*

	Level of Implementation			
	Full	Moderate	Minimal	None
District water meters	☑	☐	☐	☐
Residential water meter	☐	☐	☑	☐
Night flow analysis	☐	☑	☐	☐
Water loss audits	☐	☐	☑	☐
Acoustic leak detection	☐	☐	☑	☐
Leak noise correlation testing	☐	☑	☐	☐

Community Impacts and Adaptation Outcomes

Per capita water consumption

This indicator measures water use attributable to user demand and system water loss. The available data shows that the per capita water consumption for Nelson residents is going down. In 2009, per capita water consumption was 595 litres per day. In 2015, it was 519 litres per day. In 2018, it was 482 litres per day. [32, 33] This is just below the provincial average of 494 litres per day.[34] The City of Nelson Water Master Plan update indicates that summer per capita water consumption decreased 30% between 2007 and 2016.[35]

Drinking water quality

Drinking water quality can be adversely affected by source water quality issues caused by higher air temperatures, more extreme precipitation patterns, and more rapid snowmelts that may accompany climate change.[36] From 2005 to mid-July 2019, the City of Nelson's water system has experienced 12 Water Quality Advisories (WQA) and four Boil Water Notices (BWN). Advisories for the City of Nelson water system were generally short duration, with only one incident lasting longer than 25 days. This WQA occurred in 2007 and lasted 65 days. There are no trends in the annual number or duration of advisories. The highest occurrence of water quality issues (two WQA and two BWN) occurred in May 2017.[37] Unfortunately, the cause of water advisories is not specified in the dataset provided by Interior Health Authority, making it difficult to link water quality issues to weather-related events.

Watering restrictions

Watering restriction bylaws provide a tool for utilities to reduce vulnerability to water supply challenges, and by tracking the need to implement these restrictions, water operators can better understand how climate change is affecting supply and demand. The *City of Nelson Waterworks Regulatory Bylaw No. 3293* was passed in 2015, introducing year-round water restrictions that can be upgraded to stages 1 through 3 restrictions as necessary. Under normal conditions water use is regulated to watering every second day during specific daily time windows. At stage 1, watering is limited to two days a week (Figure 13). [38] The number of days each year within each restriction stage are not tracked.[39]

City of NELSON — Mandatory Water Conservation Measures

Activity	Normal Regulations	1	2	3
Watering lawns using a sprinkler or irrigation system	4am - 9am & 7pm-10pm Even # address: Even # days of the month Odd # address: Odd # days of the month	4am - 9am & 7pm-10pm Even # address: ONLY ON Wednesday and Saturday Odd # address: ONLY ON Thursday and Sunday	4am-9am & 7pm-10pm Even # address: ONLY ON Wednesday Odd # address: ONLY ON Thursday	✗
Watering trees, shrubs, or vegetable & flower gardens using a sprinkler or irrigation system	✓	4am-9am & 7pm -10pm ANY DAY	4am-9am & 7pm -10pm ANY DAY	4am-9am & 7pm -10pm ANY DAY
Watering trees, shrubs, or vegetable & flower gardens using a hand-held container, a hose with a shut-off nozzle, or a drip-irrigation system	✓	✓	✓	4am-9am & 7pm -10pm ANY DAY
Washing sidewalks, driveways, parking lots, exterior building surfaces, and exterior windows *	✓ with a handheld shut-off nozzle	✓ with a handheld shut-off nozzle	✗	✗
Washing personal Vehicles **	✓ with a handheld shut-off nozzle	✓ with a handheld shut-off nozzle	✓ with a handheld shut-off nozzle	✗
Filling of fountains, pools, hot tubs, or garden ponds	✓	✓	✓	✗
Watering new sod or grass outside of the permitted restrictions ***	PERMIT REQUIRED	PERMIT REQUIRED	✗	✗

Figure 13: *City of Nelson water restrictions stages from normal through stage 3*

Water loss

The City of Nelson's 2016 Water Smart Action Plan estimates that its water system experiences approximately 18% water loss due to leakage.[40] A previous 2005 Water Conservation and Drought Management Study estimated 22% "unaccounted for use", which includes water loss due to leaks.[41] The City of Nelson replaces water infrastructure on an on-going basis, focusing on galvanized steel pipe and cast iron mains due to a history of breaks and water loss.[42] The Columbia Basin Water Smart Summary Report states that leakage within most systems in the Columbia Basin is 30-40%, and that this is typical of aging systems in developed nations, and particularly small rural systems.[43]

FLOODING

Projected climate changes, including more intense rainstorms and warmer, wetter winters, indicate a potential for increased flooding in snowmelt watersheds. Similarly, alterations to forest cover through wildfire, disease and logging can also increase flooding. Increases in the frequency and magnitude of floods affects communities through damage to homes and infrastructure, and negative impacts on water quality. In Nelson, several streams, including Anderson Creek, flow through the community. These channelized and culverted streams represent the greatest risk to community infrastructure given changes in the flood regime. Recognizing how flooding is changing allows communities to improve infrastructure and establish flood mitigation measures. The flooding pathway indicators include half total flow and annual peak flow timing, as well as changes in annual peak flow volume and depth of April 1st snowpack. In addition, changes in the frequency of peak flows are investigated where stream flow records are of sufficient length. Although it is recognized that flooding risk can also occur from Kootenay Lake, lake flooding is not examined in this report.

The Overall Picture

Both high elevation and lower elevation streams supplying Nelson's drinking water show increases in the frequency of flooding for larger-than-average floods. A more detailed investigation is needed to determine the cause in the altered flood regime. Although the West Kootenay is not yet witnessing trends toward more extreme precipitation that some studies have predicted for our region, a trend toward higher average spring temperatures and higher spring precipitation may drive more rapid snow melt, increasing the likelihood of flooding, particularly for lower elevation watersheds. However, this potential for increased flooding may be partially mitigated by a declining trend in spring snowpack at lower elevations. Nelson has detailed flood inundation and hazard mapping that will help inform risks due to climate change.

***Figure 14**: Flooding in Downtown Nelson in June 2006*

Climate Changes

As discussed in the Climate and Extreme Weather sections, trends toward more extreme rainfall have not been confirmed through an analysis of historic climate data for stations in and around Nelson. However, an analysis of average precipitation data shows rising annual and spring precipitation.

Freeze-thaw cycles

The frequency of freeze-thaw cycles is an important parameter for engineering design in cold regions. Freeze-thaw cycles are calculated by the number of days with temperature fluctuations between -2°C and +2°C. The historical data for Nelson indicates a downward trend in freeze-thaw cycles in winter, spring, and fall, decreasing at a rate of 17 days per century, with most of the decline occurring in the spring season. The historical trends are projected to continue downward across all seasons through the rest of the century, dropping from 30.3 days per year in the 1961-1990 reference period to 16.2 days per year by the 2050s in a low carbon scenario and 12.2 days per year in a high carbon scenario.

Environmental Impacts

April 1st snowpack

Springtime high elevation snowpack provides some indication of how much meltwater will be available to feed creeks in the early summer months. The April 1st snowpack data for Nelson is available for both low and high elevation sites. [44]

The low elevation Nelson site is a manual snow survey site dating back to the late 1930's located near Cottonwood Lake at an elevation of 930 meters. The high elevation site is an automatic snow pillow site located at an elevation of 2100 metres in Redfish Creek that started recording in 2002. The data at the low elevation site reveals a downward trend in April 1st snow water equivalent (SWE), which is determined to be statistically significant at the 95% confidence level (Figure 15). The Redfish snow pillow site reveals an increasing trend in April 1st SWE (Figure 16). A longer record of high elevation April 1st SWE is needed to confirm the significance of the increasing trend suggested in the 18-year record for Redfish given the 20- to 30-year cyclic influence of the Pacific Decadal Oscillation. Regardless of statistical significance, both trends are consistent with climate model projections for the Nelson region, which forecast increases in winter and spring precipitation and spring temperatures that would result in greater snow accumulation above 2000 meters and relatively lower accumulation at low elevations.

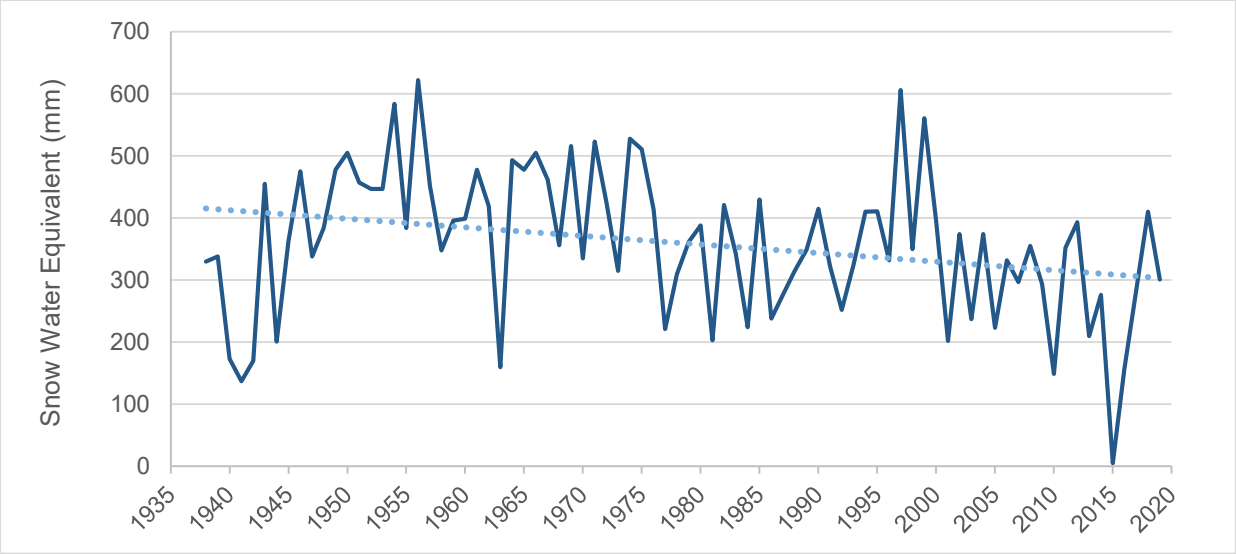

***Figure 15**: April 1st snow water equivalent (SWE) and trend line at the Nelson manual snow survey site at 930 meters elevation*

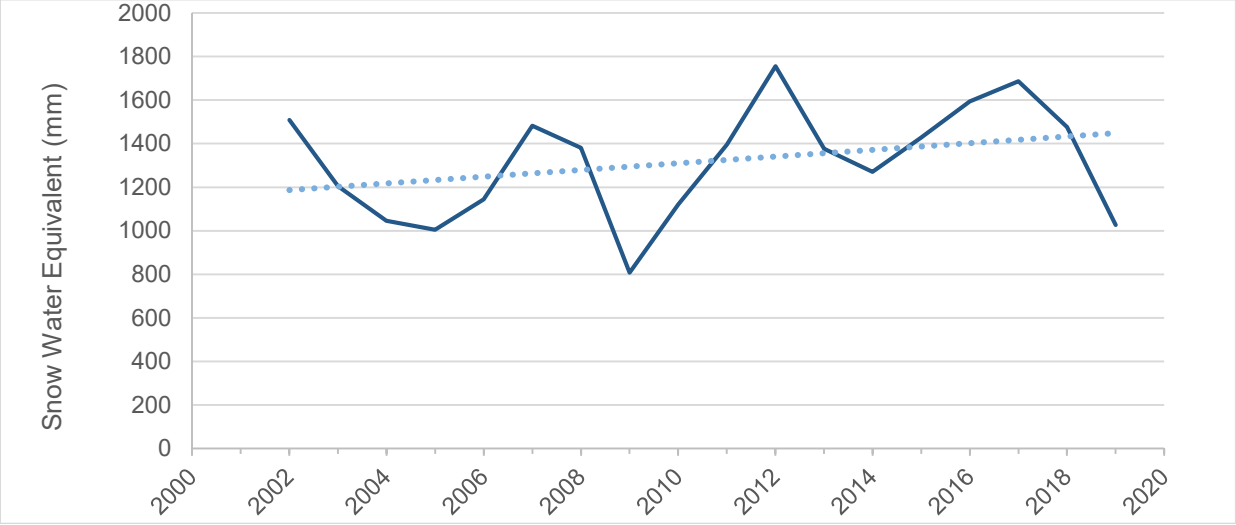

***Figure 16:** April 1st snow water equivalent (SWE) and tend line at the Redfish automatic snow pillow site at 2100 meters elevation*

No trend in stream flow timing and volume

As discussed in the Water Supply section, trends are not present for the half annual flow or peak flow timing for Five Mile Creek. Peak flow volume for Five Mile Creek also does not show a significant trend, although the shorter record length is a limitation in the detection of trends. In Anderson Creek the annual peak flow and the half-annual flow volume have shifted forwards in time by over six days and four days, respectively, on average, compared to when gauging began. No trends in peak flow volume are detected and a visual inspection of the time series of annual maximum peak flows for Anderson Creek suggests more large flows have occurred since about 1995.

Flood frequency increasing

Changes in flood frequency for Five Mile Creek and Anderson Creek is investigated. A relatively lengthy record of stream flow gauging on Anderson Creek and a moderate record on Five Mile Creek allows for an investigation of changes in the frequency of flooding on these streams. Changes in flood frequency is investigated by dividing the record of annual maximum peak flows into two subsets of data and applying a frequency analysis to both subsets. The historical return period of a flood reflects the annual probability of occurrence of a flood of a given magnitude for the period of record (i.e. annual probability is reciprocal of the return period).

The flood frequency analysis for Anderson Creek reveals an upward shift of the 1990 to 2017 subset of maximum peak flows relative to the 1947 to 1990 for return periods ranging from 5- to 20-years (i.e. maximum daily flows ranging from 1.1 to 2.2 m^3/s, Figure 17). The upward shift for a given return period flood translates to an increase in the probability of occurrence for a given magnitude. A flood with a magnitude of just under 1.5m^3/s that originally had a return period of about eight years is now occurring with a frequency of just under six years (shown by red arrow in Figure 17), a 33% increase in frequency. The upwards shift of the 1990 to 2017 frequency distribution in Anderson Creek is not statistically significant at the 95% confidence level.

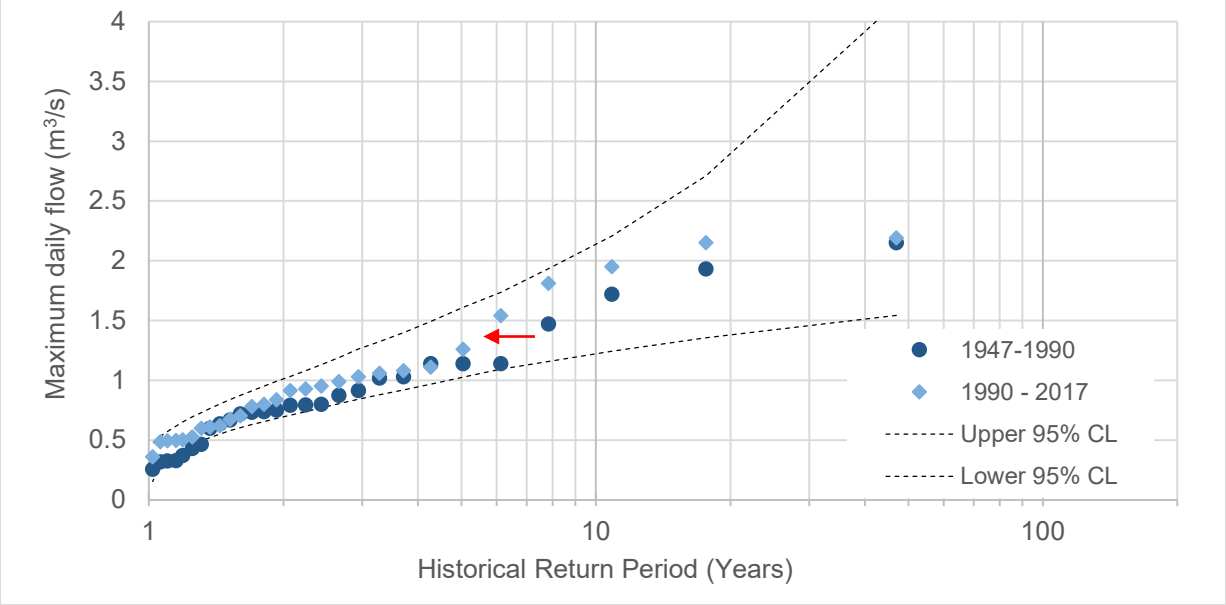

Figure 17: *Flood frequency analysis for subsets of the annual maximum daily flow record on Anderson Creek. The upwards shift falls within the 95% confidence level (CL) around the 1947–1990 subset indicating it is not statistically significant. Red arrow reveals a 33% change in return period (frequency) for a 1.5 m^3/s flood.*

Five Mile Creek frequency analysis also reveals an increase in frequency for floods ranging in magnitude from 13m^3/s to 16m^3/s (Figure 18). As with Anderson Creek, the upwards shift in the frequency distribution of floods is not considered statistically significant at the 95% confidence level.

A more detailed level of investigation and longer record length is needed to determine the cause of the upward shift of the frequency distribution of floods on Anderson and Five Mile Creeks. It is possible that it reflects the cumulative effects of decadal climate cycles and altered forest cover associated with wildfire and disease.

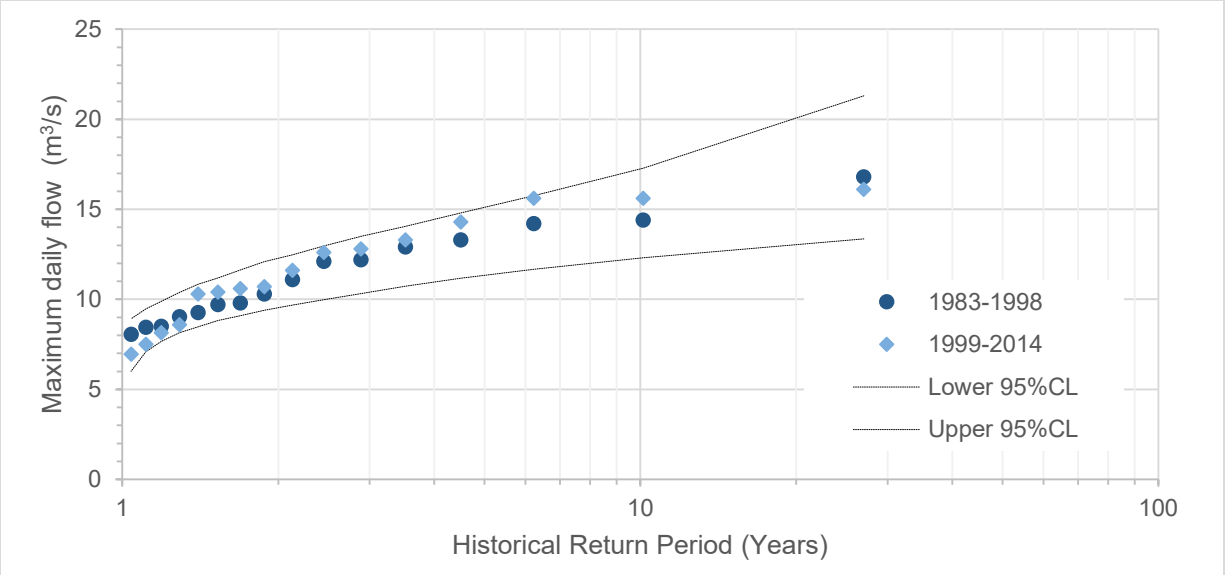

Figure 18: *Flood frequency analysis for 16-year subsets of the annual maximum daily flow record on Five Mile Creek. The upward shift of the 1999-2014 subset lies within the confidence bands around the 1983-1998 subset indicating that this increase is not statistically significant at the 95% confidence level (CL).*

Adaptation Actions and Capacity Building

As discussed in the Extreme Weather section, the City of Nelson has an Emergency Preparedness Plan in place with several established components and others in development.

Floodplain mapping

Flood inundation and hazard mapping was completed in 2019 for the entire City of Nelson. This includes stormwater modeling for storm events.[45]

Flood protection expenditures

Information on spending related to flood protection infrastructure provides some measure of a local government's efforts to improve their resilience to climate change. This data was not made available for this report.

Community Impacts and Adaptation Outcomes

Provincial emergency assistance

As with the Extreme Weather pathway, monitoring emergency assistance funding issued by the province can provide some measure of the economic impact of disaster and associated recovery

over time. There has been no provincial emergency assistance for any flooding events in Nelson within the last five years.[46]

Dwellings in the floodplain

Understanding how many dwellings are within the floodplain will permit a more accurate assessment of flood risk and help planners understand whether new development policies are needed to support community resilience to flooding. According to a 2018 report, the City of Nelson has 44 dwellings within the floodplain.[47]

Flood-related highway closures

There are no records of flood-related highway closures in the Nelson area since the launch of Drive BC monitoring program in 2006. Closures related to mudslides are reported in the Extreme Weather Pathway.[48]

No evacuation notices

There have been no recent evacuation notices for flooding within the City of Nelson.

AGRICULTURE

Climate has a significant, but complex, impact on food growing activities, with some projected climate changes expected to increase productivity and others reducing it. Climate change also has the potential to negatively affect food production in other parts of the world, which means that locally produced food and local food self-sufficiency could become important climate adaptations in coming years. The Agriculture Pathway tracks the climate-related viability of food production, the impact of climate change on agricultural activity, and the degree to which farmers and backyard growers are prepared to deal with climate change.

The Overall Picture

A trend toward higher temperatures is influencing the growing climate in the region, with Nelson experiencing more growing degree days than in the past and a small increase in the length of the growing season. Continued monitoring of drought levels will help planners understand how a trend toward higher precipitation levels is affecting agricultural viability and local food production. While the number of Nelson residents engaged in backyard gardening shows local enthusiasm for food self-sufficiency, the proportion of homegrown food consumed is low.

Climate Changes

As discussed in the Climate and Extreme Weather sections, average annual and seasonal temperatures are increasing in the Nelson area, as is annual and spring precipitation. While Nelson has not yet seen a significant trend in extreme precipitation, projections show it increasing, along with more precipitation in winter, spring and fall. Summer precipitation is projected to decrease, and both the number and frequency of extreme heat days is on the rise.

Environmental Impacts

Drought Index

The BC Drought Index is comprised of four core indicators: basin snow indices; seasonal volume runoff forecast; 30-day percent of average precipitation; and 7-day average streamflow. While this Drought Index data is too short to infer any trends, initial years will contribute to creating a baseline against which future conditions can be assessed. The City of Nelson is contained in the 'West Kootenay Basin' of the index. Since 2015, there has been an annual average of 59 'dry' and 31 'very dry' days in the West Kootenay Basin. The number of days under drought conditions varies from year to year. For example, 2018 was a particularly dry year with 98 days drier than normal conditions (70 dry and 25 very dry), while 2016 was a wetter year with only 70 dry days and no very dry days. [49]

Length of the growing season

A longer growing season[i] allows for greater diversity of crops (especially crops requiring longer days to maturity), greater flexibility in early planting avoiding late summer drought, and more time for plant growth. Some communities in the Columbia Basin are experiencing a longer growing season. Historic climate data for Nelson (1950-2018) shows growing season length increasing by 40 days per century. By the 2050s, this trend is projected to jump to 41 and 62 days per century under low and high carbon scenarios, respectively. During the 1961 to 1990 baseline period, Nelson's growing season length averaged 220 days, and is projected to increase to between 245 and 233 days by the 2050s.

Growing degree days

Growing degree days[ii] describe the amount of heat energy available for plant growth and provide better insight on how plants are affected by temperatures than straight temperature data. Growing degree days for Nelson (1950-2018) have been increasing by 418 growing degree days per century. By the 2050s, growing degree days are projected to increase by 631.1 and 819.5 for the low and high carbon scenarios, respectively, from a 1961-1990 baseline of 1963.6 growing degree days (Figure 19).

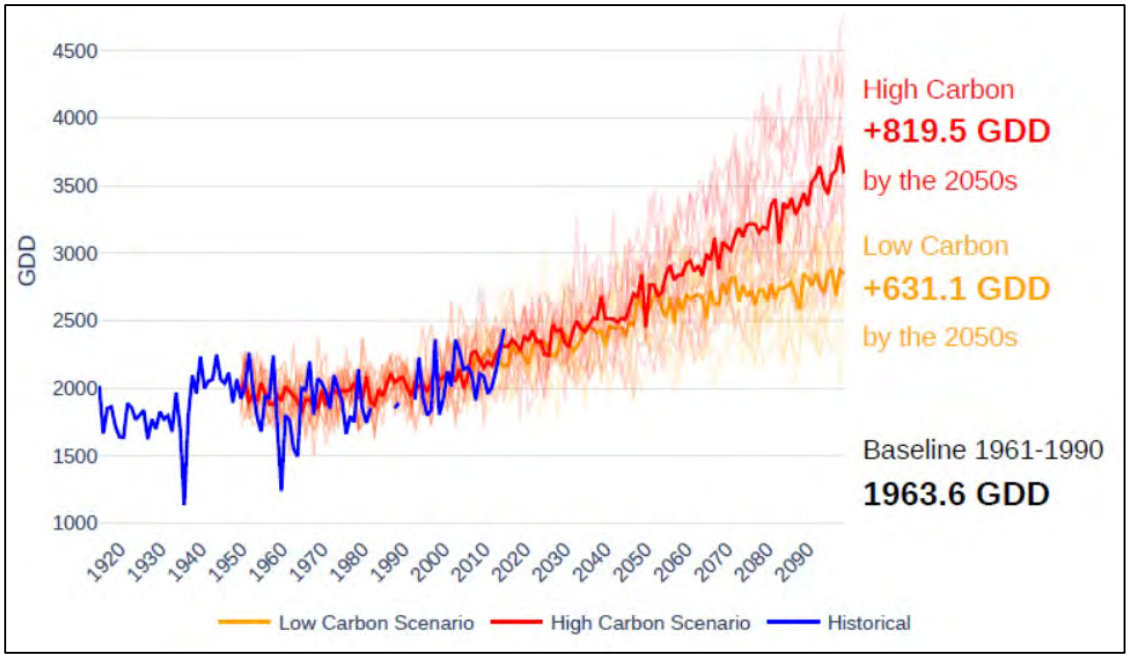

***Figure 19**: Growing degree days in the City of Nelson*

[i] For the purposes of this report, growing season is defined as the number of days annually between the first and last five consecutive days with a mean temperature of 5°C.

[ii] For the purposes of this report, growing degree days is calculated by multiplying the number of days that the mean daily temperature exceeds 5°C (average base temperature at which plant growth starts) by the number of degrees above that threshold. Studies often use different definitions of growing degree days; therefore, caution should be exercised when comparing these results to other research.

Consecutive dry days

The annual maximum number of consecutive dry days for Nelson has declined since the 1950s at a rate of -10.7 days per century. During the 1961 to 1990 period, Nelson's annual maximum number of consecutive dry days was 17.6 days. This is projected to increase by 1.7 to 2.6 days by the 2050s under low and high carbon scenarios, respectively. In a high carbon scenario, the maximum dry spell is projected to be increasing at a rate of 13 days per century by the 2050s.

Adaptation Actions and Capacity Building

Many residents grow some of their own food

Backyard gardening of edible crops is an indicator local self-sufficiency and food security. A voluntary survey of Nelson residents conducted in the summer of 2019 and completed by 132 people found that 83% of respondents grow some of their own food, mostly in home gardens (97%), in plots ranging from less than 5 square feet to over 700 square feet (see Table 7 for more detail). No residents reported growing food in community gardens. The majority of respondents (71%) reported growing between 1-10% of their total food intake. Most home gardeners reported growing vegetables. Over half reported growing fruit or herbs, with raspberries being the most common berry. Only 6% of gardeners reported having nut trees. The most popular items grown were tomatoes, lettuce, potatoes, kale, beans, and berries. Composting is very common with respondents, with 86% indicating they compost garden and yard waste and 83% indicating they use that compost in their food gardens.

Table 7: *Area under cultivation (excluding orchards and berry patches) by growers in the City of Nelson*

Area	% of respondents	# of respondents
Less than 5 square feet	9.8	10
5-15 square feet	14.7	15
15-30 square feet	14.7	10
30-50 square feet	9.8	10
50-100 square feet	19.6	20
100-200 square feet	11.8	12
200-300 square feet	12.8	13
More than 300 square feet	9.8	10

WILDFIRE

Wildfire can cause serious damage to community infrastructure, water supplies and human health. It is projected that climate change may increase the length of the wildfire season and the annual area burned by wildfire due to warmer, drier summers. The Wildfire Pathway tracks fire risks and impacts on communities as well as adaptation actions being undertaken by communities. The City of Nelson is situated in the Kootenay Lake Fire Zone (Figure 20), which falls within the boundaries of BC's Southeast Fire Centre.

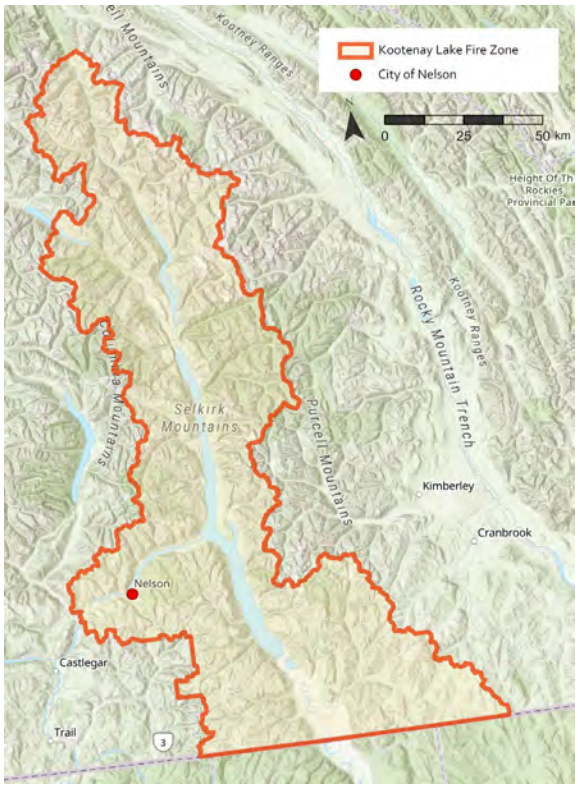

***Figure 20**: Kootenay Lake Fire Zone and the City of Nelson*

The Overall Picture

Wildfires are becoming more frequent at regional and national scales and studies generally suggest that this trend, along with a trend to more area burned, will continue. The active wildfire seasons experienced in 2017 and 2018 highlight the social and economic impacts of fire due to fire bans, evacuation notices and alerts, air quality advisories, and road closures. Since 1950, the City of Nelson has had multiple wildfire starts within two kilometres of the municipal boundary, yet only two fires have grown greater than one hectare. Although human-caused wildfires are decreasing, fire prevention education and fuel management remain important as most human-caused fires occur near communities. To reduce wildfire risk, Nelson has a Community Wildfire Protection Plan and a strong commitment to FireSmart practices, as evidenced by recent updates to its Wildland Interface Development Permit Area.

Climate Changes

High fire danger is increasing

The BC Wildfire Service establishes wildfire danger ratings using the Canadian Forest Fire Danger Rating System. The number of days in the high and extreme danger classes provides an indication of how weather and water availability are influencing fire risk. From 1991 to 2019, the Smallwood fire weather stations had an average of 20.2 days per year with a danger rating of

high or above. Smallwood is the nearest fire danger forecasting station to Nelson. The greatest number of days above a high danger rating at 68 days occurred in 2017, followed by 57 days in 2003, and 55 days in 2015 (Figure 21).These data show a significant trend of roughly 0.6 more days each year at or above a high danger rating.[50]

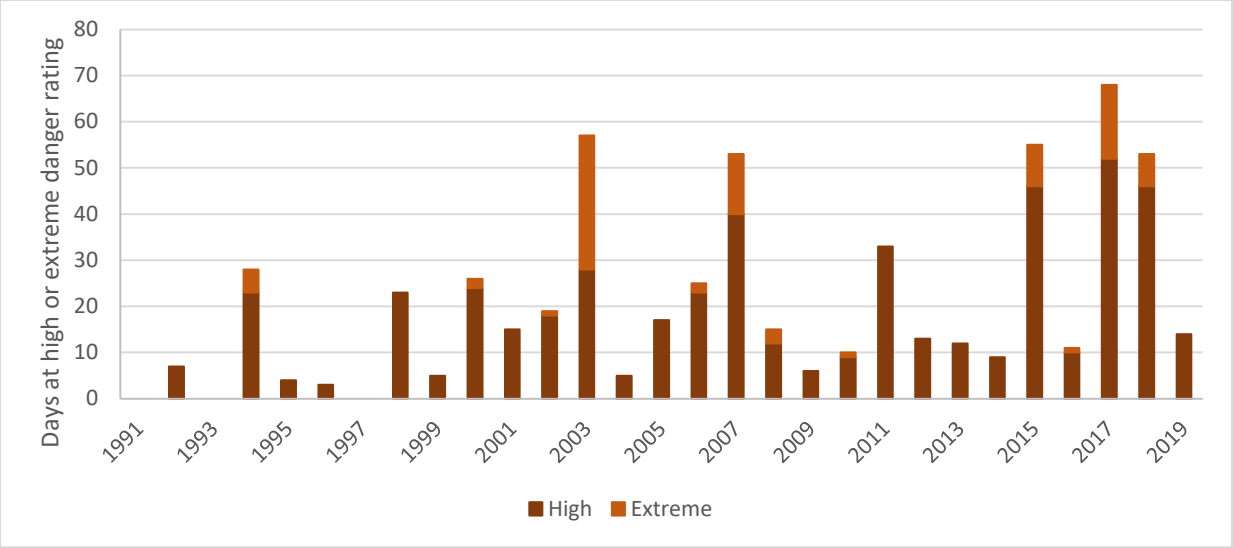

Figure 21: *Days with high or extreme fire danger rating at the Smallwood fire weather station (West of Nelson)*

Environmental Impacts

Air quality declines in active fire years

The air quality indicator measures daily concentrations of fine particulate matter ($PM_{2.5}$) in the air, which can be strongly influenced by wildfire events. High $PM_{2.5}$ concentrations can have significant impacts on human health.[51] There is no air quality monitoring station in Nelson; however, the nearest station in Castlegar can provide some insight on air quality in the region. The worst air quality on record occurred in 2018, with 30 days of $PM_{2.5}$ concentrations above the 24-hour $PM_{2.5}$ air quality objective for British Columbia of 25 ug/m^3.[52,53]

A comparison of Castlegar data from 2016 (a year with minimal wildfire activity) to 2018 (a year with exceptionally high wildfire activity) shows how air quality in our mountainous region can be influenced by smoke from wildfires (Figure 22).

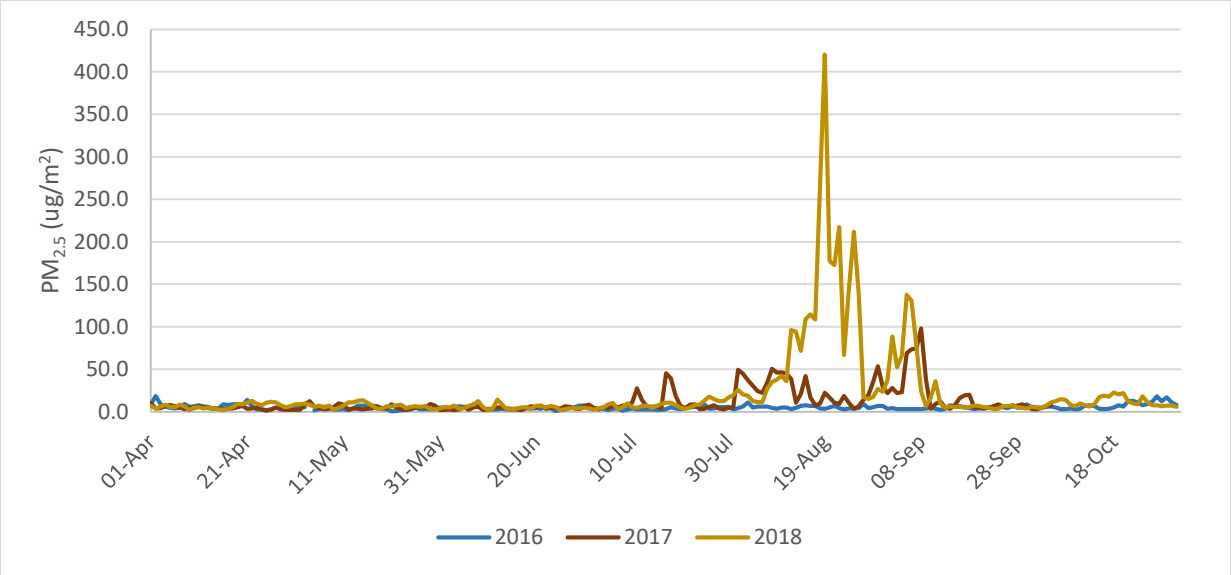

***Figure 22**: Daily average $PM_{2.5}$ readings at Castlegar Zinio Park in 2016, 2017 and 2018*

In 2017, the BC Ministry of Environment implemented a Smokey Skies Advisory service to advise communities when they are likely to be affected by wildfire smoke. This smoke modeling initiative does not serve as a substitute for a $PM_{2.5}$ monitoring station but can provide some indication of smoke prevalence. In 2017 and 2018 West Kootenay forecast region was under a Smokey Skies Advisory for 43 and 46 days respectively.[54]

Average of three wildfire starts per year

This indicator tracks the total number of human-caused and lightning-caused wildfire starts per year. Since the mid-1900s, there is no statistically significant trend in the number of wildfires started annually in the Southeast Fire Centre region. All fire zones in the Southeast Fire Centre and the Kootenay Lake Fire Zone show significant decreases in human-caused fires since 1950. There are no trends in lightning-caused fire starts over the 68-year recording period within the Kootenay Lake Fire Zone. This is typical of most of the areas analyzed in the Southeast Fire Centre.[55]

Two factors may be affecting the identification of trends in the analysis. One is the small geographic scale of the datasets, which may not represent changes in weather patterns that take place over a large geographic area. The second is an issue with data reporting standards, which changed in the late 1990s to exclude suspected fires and smoke traces. This may overinflate estimates of fire starts in earlier years.[56]

On average, there are three wildfires starts per year within two kilometres of Nelson. The ratio of fires caused by humans vs. lightning can be influenced by both climate and human activities. Within a two kilometres radius of Nelson, the ratio differs from that of the Southeast Fire Centre where, historically, about two thirds are lightning-caused. Near Nelson, records show that more fires have been caused by humans than lightning. This is a typical pattern around municipalities,

as most human-caused fires tend to occur near populations centers. However, both the Southeast Fire Centre and the Kootenay Lake Fire Zone have seen significant declines in human-caused fires over time and records from recent years show lighting as the dominant cause of wildfire.

No trend in area burned, but extremes are increasing

This indicator provides a direct measure of how much fire is occurring on a specific landscape. Since the onset of provincial wildfire suppression efforts in the mid 1900's, no statistically significant trend can be observed in the annual area burned in the Kootenay Lake Fire Zone or the Southeast Fire Centre region.

The annual area burned is highly variable and appears to follow a pattern of severe fires seasons occurring roughly every 10 to 20 years.[57] The area burned during severe fire seasons shows an apparent increase at the regional scale, but this is not detected by statistical trend analysis (Figure 23)

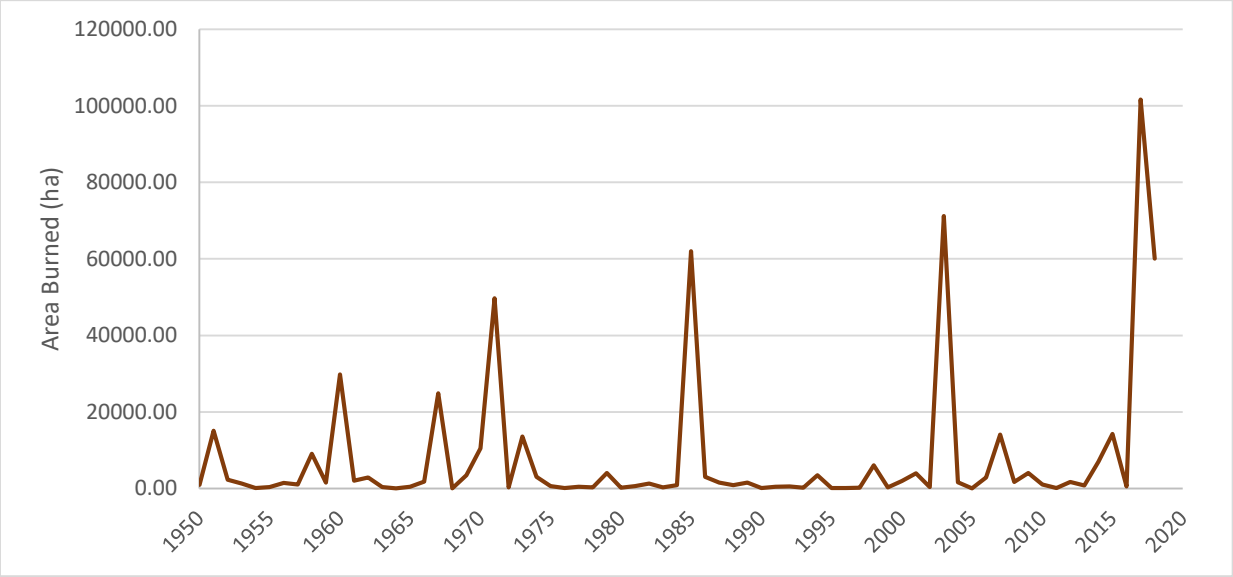

***Figure 23**: Annual area burned in the Southeast Fire Region*

Changes in the size of wildfire may reflect changes in forest management practices as well as changing climate conditions. The value of fire as a natural disturbance regime has been more recognized in recent years, and in some cases, forest managers may be allowing wildfires to grow larger now than in the past.[58] Improved data quality and fire mapping in later years may also be influencing this trend.

The Kootenay Lake Fire Zone, which includes Nelson, experienced severe wildfire seasons in 1967, 1985, 2003, 2017 and 2018. The worst fire season since 1950 in the Kootenay Lake Fire Zone was 2003 in terms of area burned, with over 19,000 hectares of forest burned.[59] Significant fires have occurred in close proximity to Nelson in recent years. Nelson's watershed had fires greater than 500 hectares in both 1985 and 2003.

A significant upward trend is present in the number of fires in the Southeast Fire Centre region that grew larger than 1 ha in size (Figure 24). This aligns with recent reports that BC's fire seasons are becoming more extreme as a result of climate change.[60]

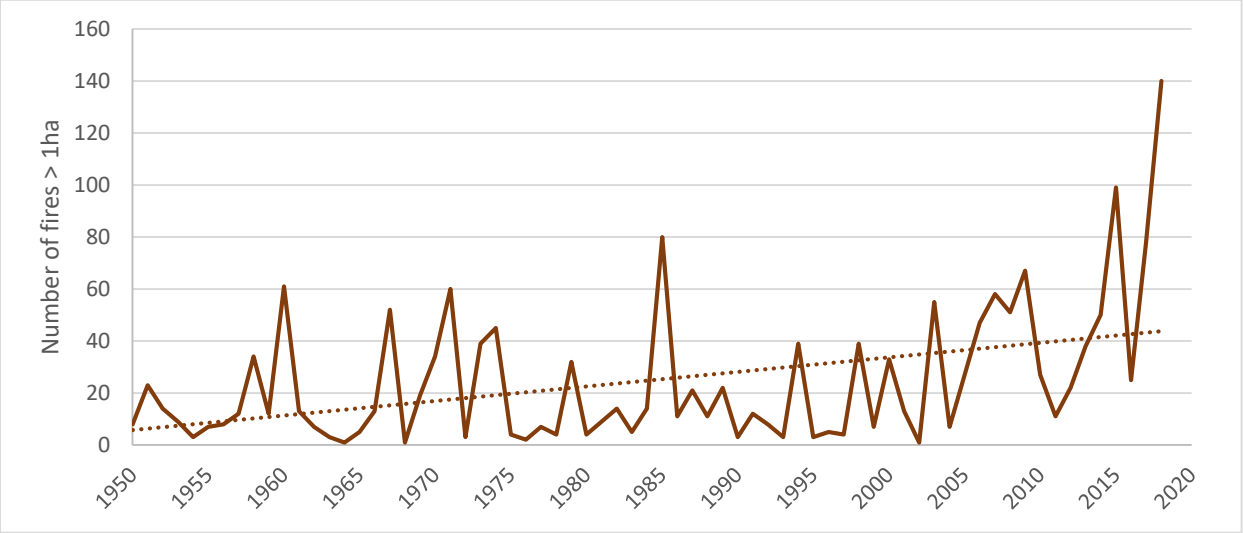

***Figure 24**: Fires >1 ha in the Southeast Fire Centre region, 1950-2018*

Adaptation Actions and Capacity Building

Interface fire fuel treatments

Interface fire risk reduction involves assessing and treating high-risk areas to reduce wildfire risk. The City of Nelson has a Community Wildfire Protection Plan that was last updated in 2015. Within this plan, 100% of the interface area around Nelson has been mapped.[61] City staff estimate that, as of 2019, 5-10% of priority interface area has been treated. A significant challenge is that most of the land immediately adjacent to the City is under private ownership.[62]

FireSmart recognition

This indicator reports on the number of neighbourhoods and households recognized through Fire Smart Canada's Community Recognition Program and Home Partners Program, providing a measure of citizen involvement in reducing the risk of wildfire to their homes. The City of Nelson has a FireSmart program that has been in place since 2010. Since 2015, there has been extensive community awareness programs and over 300 FireSmart home assessments have been completed (average between 60-80 assessments per year). The City has a *Development Permit Area #3 - Natural Environment and Hazardous Lands* (DPA) that includes properties in the City located next to forested lands in the wildland interface zone. This is an updated DPA that reflects the most recent FireSmart guidelines and replaces the previous DPA that was in place since 2008. This DPA contains requirements for FireSmart landscaping and building materials.[63, 64, 65]

Community Impacts and Adaptation Outcomes

Frequency of interface fires

This indicator measures the annual number of wildfires that come within two kilometers of address points (Figure 25). Since 1950, Nelson has experienced only two interface fires greater than 1 hectare in size.[66]

Cost of fire suppression

The average annual cost of fire suppression in the Kootenay Lake Fire Zone from 1970-2019 was $1.95 million, peaking at $22.44 million in 2003 and falling as low as $1317 in 1976. [67] Costs of fire suppression will vary from year to year and are significantly influenced by prevailing weather conditions. The dataset shows an upward trend over the period of record (Figure 26); however, given that reported values are not corrected for inflation, the true direction and magnitude of this trend cannot be assessed.

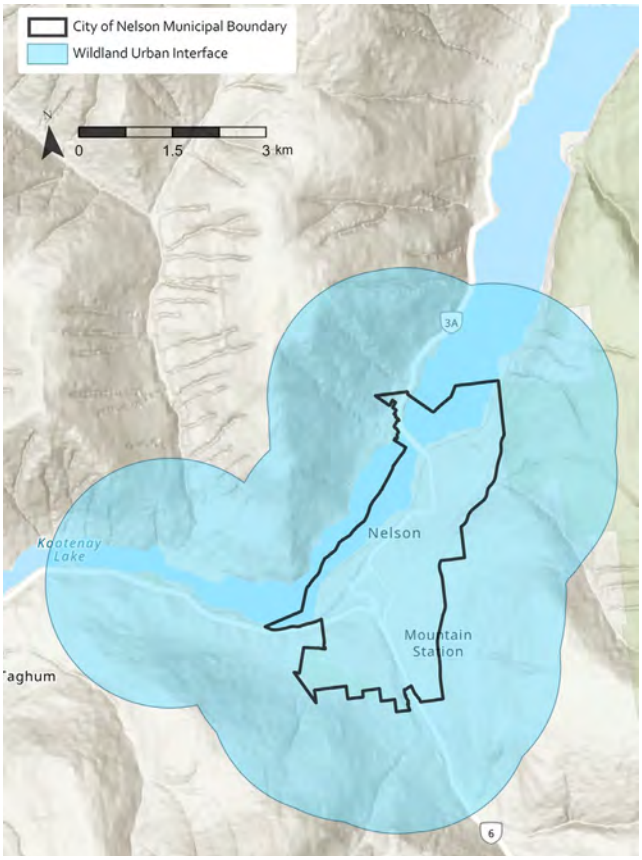

Figure 25: *2 km wildland urban interface zone around the City of Nelson.*

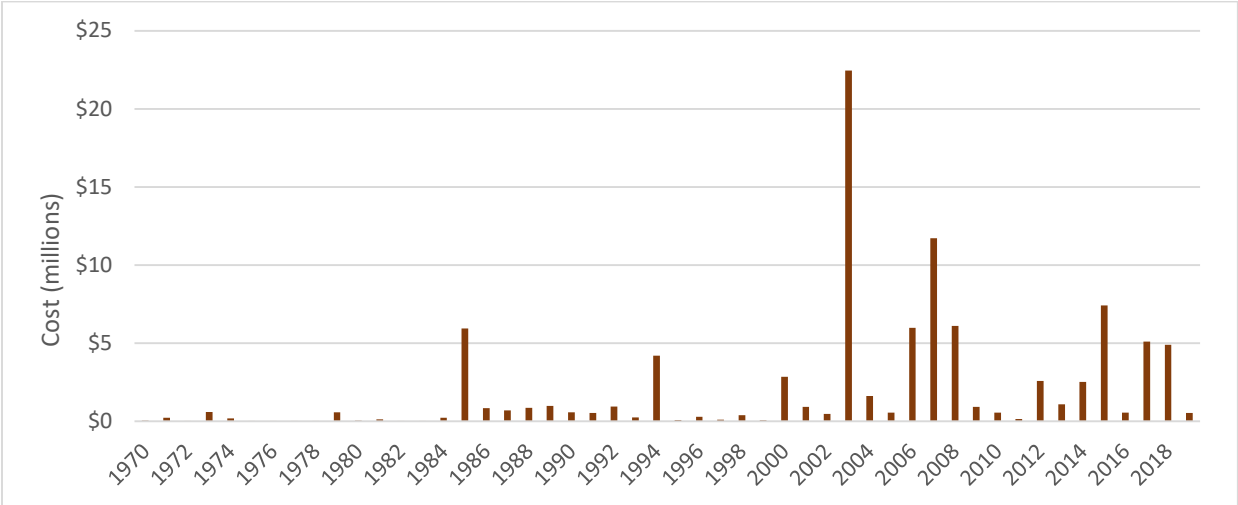

Figure 26: *Annual cost of fire suppression in the Kootenay Lake Fire Zone. (Data values from the 1970s are generally too small to show on the scale needed to show data from recent years.)*

Fire-related highway events

On July 26, 2017, a small wildfire near Tagum caused a closure of Highway 3A in both directions for two hours. This is the only wildfire-caused highway closure near Nelson recorded by Drive BC, which has records beginning in 2006. Highway 3A and Highway 6 are the only roads in in the Nelson area monitored by Drive BC.[68]

Provincial emergency assistance

As with the Extreme Weather and Flooding pathways, there has been no provincial emergency assistance for any wildfire events in Nelson in the last five years.[69]

Annual days under campfire ban

This indicator tracks the number of days annually for which the BC Wildfire Service has issued a campfire ban for the Southeast Fire Centre. It provides a measure of the social cost of the increasing wildfire risk that is projected to accompany climate change. Since 2000, there have been eight years with campfire bans. The longest fire ban occurred in 2017, lasting 77 days.[70] Long term tracking of this indicator is necessary to establish a trend.

Within the City of Nelson, backyard fires are not allowed at anytime of year, with some exceptions.[71]

No evacuation notices

There have been no recent wildfire evacuation notices for the City of Nelson.

NEXT STEPS

Action Areas

The findings of this report will inform Nelson's upcoming Climate Change Action Plan, which will likely surface additional adaptation priorities and opportunities. Assessment results from this report indicate that the City of Nelson has initiated important steps to improve its adaptive capacity. Some areas for further consideration are evident in the data:

- **Wildfire risk reduction**. Nelson's Community Wildfire Protection Plan identifies recommendations to reduce interface fire risk and establishes priority fuel treatment areas. A very small portion of priority interface land has been treated. By engaging other agencies and private land owners, the City of Nelson may be able to advance creative solutions to this issue, an approach that is supported by the province's new community wildfire resilience framework. The City of Nelson's commitment to FireSmart will help residents advance their own contributions to wildfire risk reduction in the wildland urban interface.
- **Personal and household emergency preparedness**. Continued encouragement of personal and household emergency preparedness among residents would help foster resilience to the types of extreme weather that are expected to increase with climate change. Local governments have an important role to play in personal emergency preparedness as they are often the 'front line' for residents when disaster strikes.
- **Local food production.** Supporting local food self-sufficiency is an important contributor to the resilience of a community, and the enthusiasm for farming and backyard food growing in Nelson is evident. At the same time, growing agricultural water demand and climate impacts on water supply and demand during the growing season could result in water use conflicts and shortages in the future.
- **Water conservation.** Source water monitoring and protection, water conservation targets, residential water metering, and leak detection and repair represent opportunities to increase the efficient use and resilience of Nelson water supplies.
- **Community trees.** The combination of historical and projected climate changes will increasingly cause stress to community trees and forests as the local bioclimatic regime changes. Trees under stress are more susceptible to damage by high winds, freezing rain, heavy snowfalls, drought, floods, disease, and insects. Fallen trees and branches are already the leading cause of power outages. Tree care and procedures for identifying and addressing "danger trees" may warrant new approaches, including education and engagement of residents and property owners.
- **Vulnerable populations**. The elderly, chronically ill and the very young are more vulnerable to poor air quality events and extreme heat events. Publicly accessible buildings or refuges are a relatively new idea in most jurisdictions and rural communities

may have few locations if any that would be suitable to act as a heat refuge or clean air shelter. While this is not a lead responsibility for local governments, they can play a supportive role in establishing these facilities.

Future Assessments

It is recommended that the next full SoCARB assessment be conducted in five years (2025). In the interim, the City of Nelson may wish to track certain priority indicators on a more frequent basis to inform City planning and decision making on policy, operations and capital expenditures. A number of SoCARB indicators are tracked as part of the State of the Basin initiative, which means substantial data may be available through the RDI.

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Appendix B: Nelson's Risk Assessment Workshop Summary

CLIMATE CHANGE TRENDS, IMPACTS AND STRATEGIC ACTIONS

Climate Risk Assessment Workshop Summary

City of Nelson

May 2020

SECTION 1: Workshop Background

Climate Change Action Plan

The City of Nelson has a long history of leadership when it comes to reducing emissions and building resilience to climate change. Key steps have been guided by our commitment to transition to 100% renewable energy by 2050, Path to 2040 Sustainability Strategy, our Low Carbon Path to 2040, our Corporate Greenhouse Gas Reduction Plan and ongoing hazard and vulnerability identification and reduction led by the Fire & Rescue Services and Public Works.

Of course, we have not been alone in showing this leadership – Nelson is also home to very active, climate change-aware and focused non-profit organizations, small businesses and community members.

Previous leadership aside, rapidly shifting climatic conditions and increasing scientific confidence that global temperatures will continue to rise for decades to come, have led us to a renewed focus on further reducing Nelson's footprint and preparing for the increasing impacts we will see as our climate continues to change. And we are focused on doing this work as a community.

To start, The City of Nelson is developing a comprehensive Climate Change Action Plan that will focus on improving our corporation and community's capacity to both mitigate greenhouse gas emissions and to adapt to changing climatic conditions. This is the impetus for the 'Climate Change Trends, Impacts and Strategic Actions' workshops that you have been invited to attend, and the results of which (part 1 of 2) this document summarizes.

Acting as our new climate change roadmap, this Action Plan will:

a. Serve to consolidate and coordinate previous policies and actions and to address newly identified gaps and risks, either through amplification of great work we're already doing, or via new solutions; and
b. Focus concurrently on reducing emissions and transitioning to 100% renewable energy (mitigation) and responding to the climate change that is already happening (adaptation). This is called a 'low carbon resilience' approach, whereby climate change adaptation and mitigation research and action are de-siloed and embedded at all levels of governance, planning and practice. This type of approach not only has the potential to drive more effective results using less resources, but it also opens up the door for pursuing multiple co-benefit opportunities in the realms of health, safety, livability and economy, for example.[1]

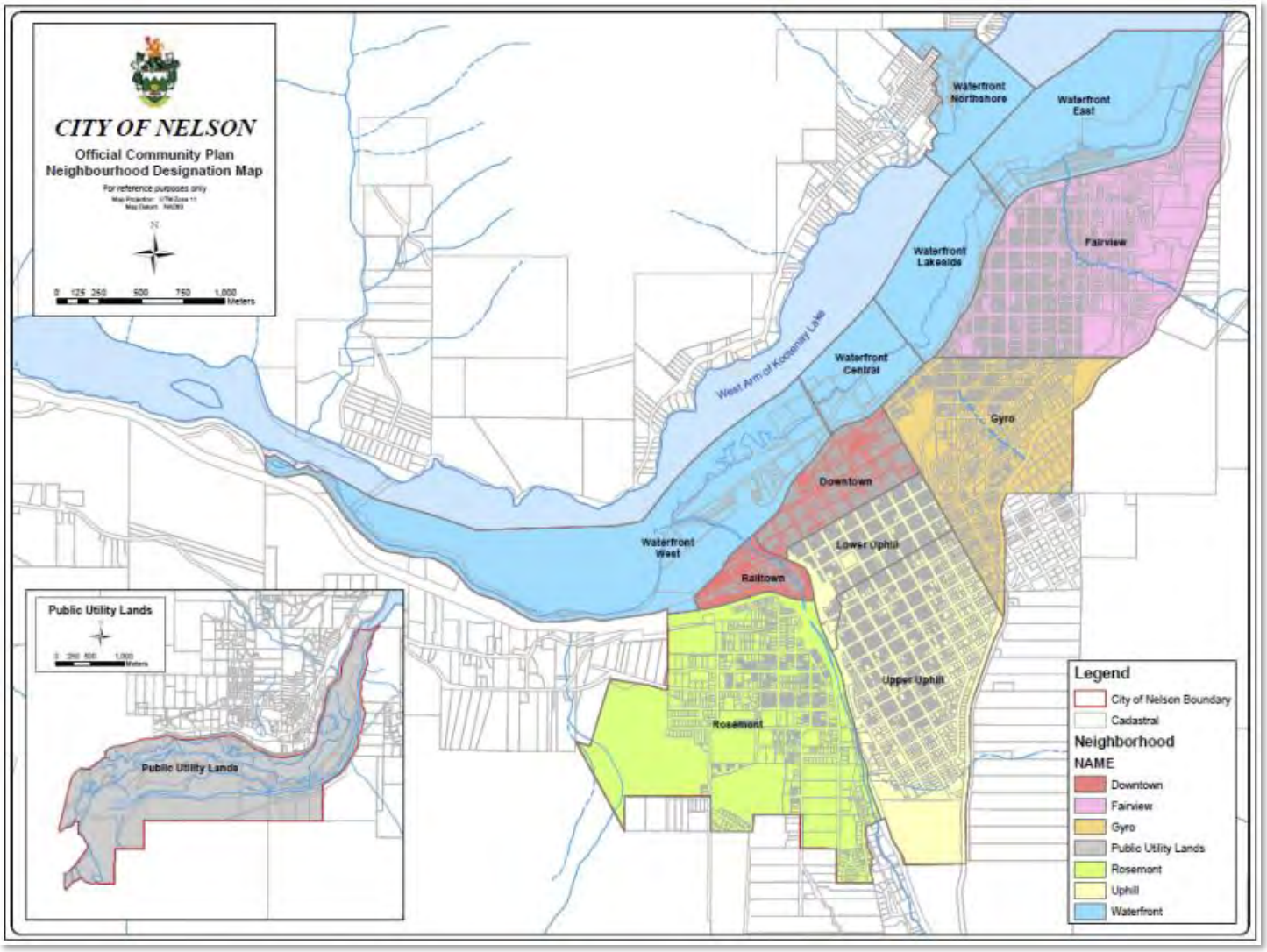
Scope

The geographic scope for the Climate Change Action Plan and the associated 'Climate Change Trends, Impacts and Strategic Actions Workshops' is the municipal boundaries of The City of Nelson. That said, this geographic limit does not mean that climate change has borders, nor that we can't work collaboratively with regional partners to address issues.

As it is a 'community' plan, the City of Nelson and the organizations, business and residents that reside here and use our services are a consideration and collaborator, and the local economy, environment, social connections, services and infrastructure that make Nelson what it is, is our context.

Finally, the temporal boundary in use for plan development is current time to 2050.

[1] To learn more about low-carbon resilience from our partners at Simon Fraser University, go here: https://act-adapt.org/special-projects/low-carbon-resilience/



Climate Change Trends, Impacts and Strategic Actions Workshop Series

A diverse range of local subject matter experts have been invited to the 'Climate Change Trends, Impacts and Strategic Actions' Workshop Series to supplement the work being done by the City's ongoing Working Group on Climate Action and the City's Climate Change Coordinator. The purpose of the workshops is to:

- Develop a shared understanding of the up-to-date climate science and climate change projections specific to Nelson and the surrounding area, and help identify key vulnerabilities in assets, services, populations, and ecosystems;
- Develop a shared understanding of the community GHG inventory and projections in Nelson, and help identify key opportunities for emissions reduction;
- Engage in informed, action-oriented conversations about opportunities to build low-carbon resilience in Nelson; and
- Work together to co-create and prioritize practical strategies that build community resilience, reduce emissions and transition to renewable energy by 2050, to be included in Nelson's upcoming Climate Change Action Plan and/or to be carried out by relevant partners and networks in the community.

The Workshop Series is comprised of two parts; Part 1 (completed on March 11, 2020) was focused on identifying and prioritizing climate risks and opportunities (summarized below) and Part 2, which will be focused on identifying emissions reduction priorities and actions that will build low carbon resilience in Nelson.

SECTION 2: Workshop 1 Content & Results

For a list of people who attended Workshop 1, go to Appendix A.

Background Content: Summary of Climate Change Projections for Nelson[2]

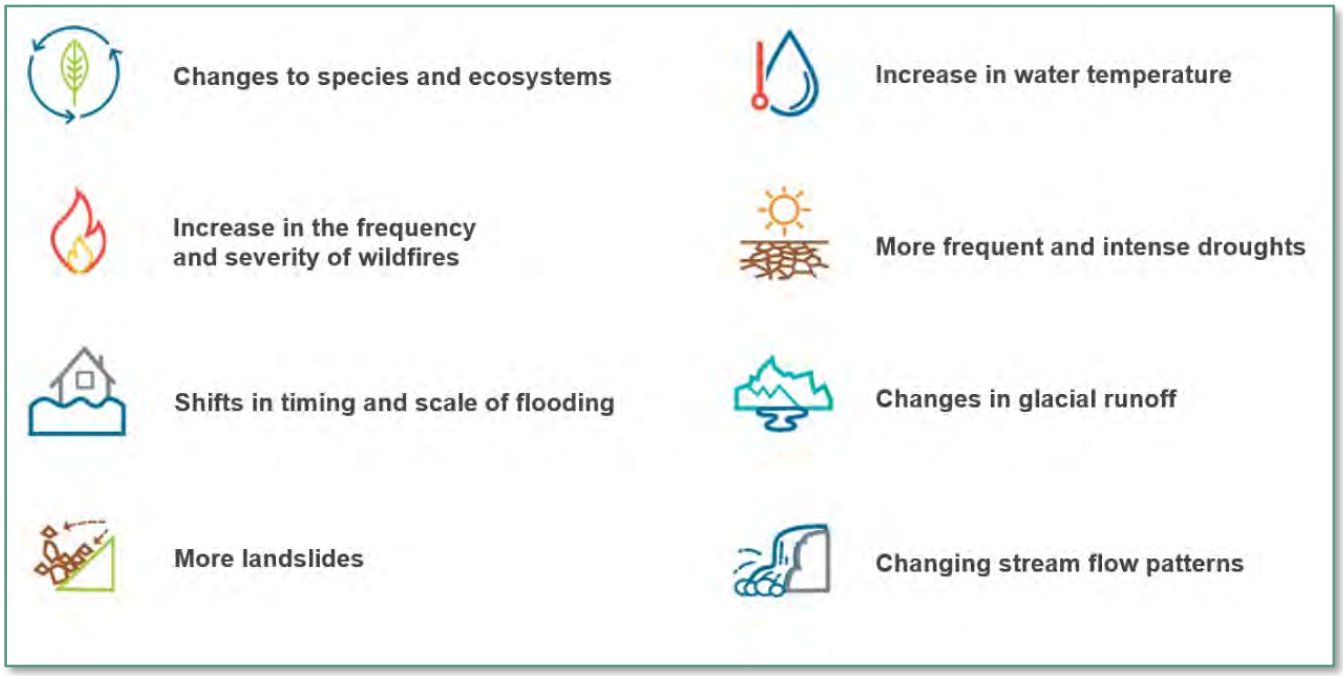
The Canadian Columbia Basin, where the City of Nelson is located, is already experiencing a) hotter, drier summers, b) warmer, wetter winters, and c) more extreme weather, and climate projections suggest these trends will continue into the future.

Some key climatic shifts to focus on include:

- Average annual temperatures in the Basin have increased by 1.6ºC over the last century, and the rate of warming has increased to 3.1°C per century over the last 5 decades;
- Annual average precipitation has increased by about 20% since the early 1900s, though the rates vary by location and season. Looking ahead to the 2050s, current global climate models are projecting average annual temperatures to be 2.7° C to 3.6° C warmer compared to the recent past (1951 to 1980);
- Winter and summer precipitation are expected to change by as much as +19% and -24% respectively; and
- Without substantial global reductions in greenhouse gas emissions, Basin residents can expect, depending on their location, up to 42 more days per year with maximum daytime temperatures over 25° C. In addition, the maximum precipitation falling on one day in any given year is projected to increase between 6% and 35%.

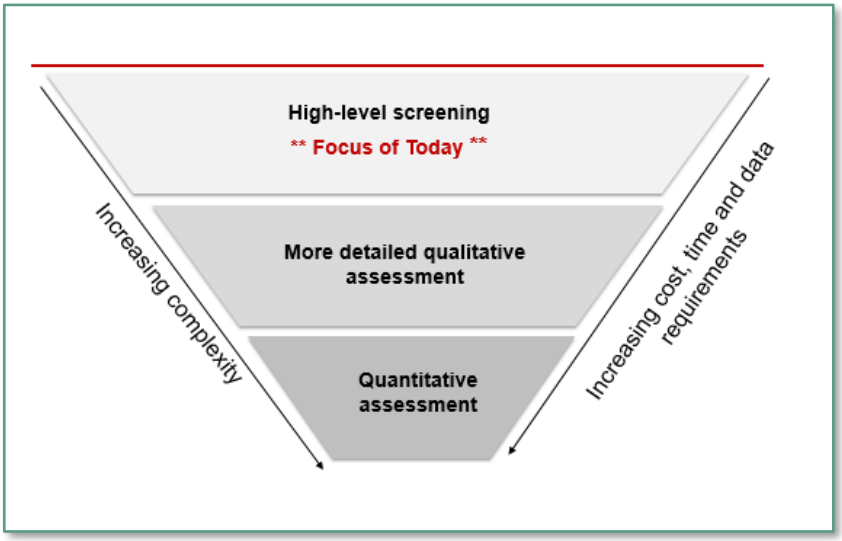
While the above listed changes may not seem significant at first glance, they are. To illustrate, imagine a hypothetical year with temperatures 10° C warmer than usual for a period of 35 days, and temperatures that are exactly average for the rest of the year: that year would still be less than 1° C warmer than normal.

Looking ahead, we can expect to see the following considerable impacts in Nelson as a result of the climate change currently occurring and expecting to occur in the future:



[2] All climate information described in this section is informed by The Columbia Basin Trust and Columbia Basin Climate Source. Go to https://ourtrust.org/wp-content/uploads/downloads/2017-03_Trust_ClimateActionBooklet_Interactive_FINAL.pdf and basinclimatesource.ca to learn more and/or download Nelson's Community Climate Change Profile here: https://basinclimatesource.ca/profiles/climateprofile_nelson.pdf

Background Content: Climate Risk Assessments



Climate Risk Assessments exist to help communities identify local risks arising as a result of climate change, as well as opportunities to address climate change in a specific context.

The risk assessment conducted for Nelson was a 'high-level' screening exercise, allowing us to work together to identify priority risks and begin strategic climate change action planning. More detailed assessment and analysis of specific risks may be a logical next step in the process.

When it comes to assessing climate change risk in Nelson, three key events and processes have been delivered to date and have acted as foundational for this workshop:

- 2013 Climate Resiliency Scanning and Planning Workshop:
  - Convener/Author: *Columbia Basin Trust; and*
  - Scope: *Nelson and RDCK.*
- 2018 Community Climate Action Meeting:
  - Convener/Author: *Columbia Basin Trust; and*
  - Scope: *Nelson and Area.*
- 2018 Transition to 100% Renewable Energy by 2050 motion passed by Nelson City Council; and
- 2019 Hazard Risk and Vulnerability Analysis, City of Nelson:
  - Convener/Author: *City of Nelson, Emergency Management; and*
  - Scope: *Nelson Municipal Limits.*

Of course, building long-term resilience to climate change involves an ongoing process of context setting, assessment, action, review, learning, reassessing and so on. *Each iteration of the process should be viewed as one more stride along the journey towards a climate resilient future.*

Workshop Results: Nelson's Climate Risk Assessment, 2020

CLIMATE RISK ASSESSMENT TERMS GUIDE

The following terms were used to guide participants throughout the workshop:

Impact: An occurrence of a weather-related event *or* a gradual change in a particular set of circumstances resulting from projected climate or environmental changes. Impacts can lead to a range of adverse or beneficial consequences for communities.

Discrete events: Impacts caused by discrete hazards such as heat waves, floods, or wildfires.

Ongoing stresses: Impacts caused by gradual climate changes over time.

Consequence: The outcome of an impact event for a particular community. A consequence can be certain or uncertain and have positive or negative effects.

Likelihood: The likelihood of the listed consequences of an impact i.e. if Impact X occurs, how likely is it that the listed consequences for Impact X will also occur? (**not to be confused with the likelihood of the actual impact occurring*).

The purpose of the climate risk assessment process is both to develop a shared understanding of local climate data and projections, and to collaboratively use that data to identify, analyze and evaluate possible impacts that may occur as a result of the changing climate in Nelson. Further, the risk assessment process will be used to identify priority risks and opportunities that should be focused on for climate change action planning in Nelson.

Using up to date climate information and projections (summarized above) and also building on previous engagement and planning work done in the community, a complete list of impacts and associated consequences were identified by Workshop 1 attendees in small groups, and discussed in plenary.

The climate risk assessment followed a three-step process, as outlined below.

Step 1 - Risk identification: the goal of this step is to identify how projected future climate or environmental changes could impact Nelson, both positively and negatively. Having completed a climate adaptation workshop in 2013, and a Hazard Risk and Vulnerability Analysis in 2019, a preliminary list of potential risks was used as a starting point and was verified by workshop participants.

Step 2 - Risk analysis: the second step involves rating, first, the potential consequences of each impact statement on the Nelson, and then rating the likelihood of consequences at that level of severity being realized. Workshop participants utilized live voting software for the analysis, allowing for discussion and verification of each impact statement, and the resulting scores. The risk analysis assumes business as usual to the 2050's, and considers Nelsons existing and proposed planning, management protocols, infrastructure and vulnerabilities. The consequence and likelihood scales used for the climate risk assessment are provided in Appendix B. The result of the risk analysis is a matrix showing priority climate risks for the city.

Step 3 - Risk evaluation: the third step involves collectively reviewing the relative position of impacts in the matrix and manually adjusting their location if they are judged—when viewed collectively—to have been either over- or under-estimated in comparison to one another. We did not have time to complete this task at the workshop; the risk evaluation was completed via follow up interviews and surveys with workshop attendees and other stakeholders who were unable to attend the workshop. The workshop results are presented below.

Table 1: Impacts with Negative Consequences

IMPACT	TYPE	POTENTIAL CONSEQUENCES	CONSEQUENCE	LIKELIHOOD	RISK LEVEL
Interface wildfire	Discrete event	• Community evacuation • Damage to buildings and infrastructure • Reduced tourism and recreation • Reduced air quality and health impacts from smoke • Injury and loss of human life, including first responders • Injury and loss of wildlife • Crop failures leading to local food supply issues • Increased population due to rural evacuations • Loss of evacuation routes / transportation disruption • Breakdown in supply chain – loss of imports for food and other supplies • Impacts on water supply and quality	**EXTREME**	**LIKELY**	**EXTREME**
Water supply shortage	Discrete Event	• Decreased and/or depleted source water supply • Reduced water for fire suppression and other emergencies • Reduced availability of water for gardens, urban agriculture, landscaping etc. • Reduced ability to accommodate population growth – leading to less economic opportunity, less diversity, less vibrancy etc.	**EXTREME**	**POSSIBLE**	**HIGH**
Ecosystem shift (altering local vegetation and wildlife composition)	Ongoing stress	• Increased ecosystem vulnerability • Geographical redistribution of plant and animal species – decline of certain species • Decreased recreation opportunities and tourism • Negative economic impacts	**HIGH**	**LIKELY**	**HIGH**
Mental health stress	Ongoing stress	• Increased demand on healthcare system • Increased personal expense, i.e. psychology/counselling appointments, wellness needs etc. • Increased support needs for vulnerable/low-income populations • Increased extreme acts and disruptions • Increased divide/conflict between opposing sectors/communities/community members	**HIGH**	**LIKELY**	**HIGH**

IMPACT	TYPE	POTENTIAL CONSEQUENCES	CONSEQUENCE	LIKELIHOOD	RISK LEVEL
Summer heat wave	Discrete event	• Drying forests, vegetation and soils • Infrastructure failure (asphalt, A/C units, power grid overloaded, network transmission failure) • Increased electricity demand for cooling • Overwhelmed healthcare system • Business closures and/or change in hours to avoid hottest time of day • Reduced local food supply due to local food failures • Increased wildlife-human interaction • Heat-related illness and loss of human life • Heat-related illness and loss of wildlife • Decreased air quality	**HIGH**	**LIKELY**	**HIGH**
Prolonged drought	Ongoing stress	• Nutrient, turbidity and algae level increase – leading to greater demand on water treatment infrastructure • Reduced water for fire suppression and other emergencies • Stunted vegetation and tree growth, leading to increased pest and disease susceptibility • Vegetation and tree death • Insufficient water to watersheds, reservoirs won't be able to supply water for energy generation • Reduced revenue generation for Nelson Hydro	**HIGH**	**LIKELY**	**HIGH**
Increase in **pests, invasive species and animal and plant disease**	Ongoing stress	• Increased damage to local food supply • Increased damage to trees and vegetation • Increased tree death and falling trees • Increased pest management costs • Increased infrastructure damage (i.e. knotweed) • Increased threats to native wildlife • Increased human-wildlife conflicts	**HIGH**	**LIKELY**	**HIGH**
Accelerated **infrastructure degradation**	Ongoing stress	• Increased speed and occurrence of (commercial, residential and institutional) building damage and maintenance needs due to change climate stressors • Increased maintenance costs for citizens, businesses, civil society and government • Increased heating and cooling demand • Increased degradation and failure of heritage structures	**HIGH**	**LIKELY**	**HIGH**
Windstorm	Discrete event	• Power outage • Damage to vehicles and property • Loss of trees • Loss of communications • Loss of pollinators • Transportation and employment disruption	**MODERATE**	**LIKELY**	**HIGH**
Reduced winter tourism and recreation	Ongoing stress	• Less water storage • Reduced winter tourism and recreation • Negative economic impacts • Increased ground-ice cover, reducing mobility and causing injury	**MODERATE**	**LIKELY**	**HIGH**
Decreased water quality from flood events and erosion	Discrete Event	• Increased water treatment demand and cost • Increased damage to water treatment infrastructure from debris • Boil water advisories/drinking water access issues	**MODERATE**	**LIKELY**	**HIGH**
Creek flooding	Discrete event	• Flooding of properties and infrastructure • Human displacement • Business closures and economic implications • Impacts on sewage treatment and water quality	**MODERATE**	**POSSIBLE**	**MEDIUM**

IMPACT	TYPE	POTENTIAL CONSEQUENCES	CONSEQUENCE	LIKELIHOOD	RISK LEVEL
		• Health impacts from decreased water quality • Increased insurance costs • Increased debris flows • Increased erosion • Impacts on lake sedimentation • Road network and transportation disruption			
Lake flooding	Discrete event	• Flooding of properties and infrastructure • Human displacement • Positive impact on fisheries and shore spawners • Impacts on sewage treatment and water quality • Health impacts from decreased water quality • Road network and transportation disruption • Bridge flooding • Flooding of Public Works complex – busses, fuel pumps, Nelson Hydro	**MODERATE**	**POSSIBLE**	**MEDIUM**
Shifting freeze/thaw cycles	Ongoing stress	• Increased occurrences and extent of pavement and asphalt damage • Increased demand for road/sidewalk maintenance • Increased freeze-thaw weathering on buildings and infrastructure • Increase in rocks slides and rock fall • Increased injuries from falls/accidents • Decreased active transportation • Increased shrub and small tree damage from soil fluctuation/root lift • Increased tree damage (i.e. bark splitting/cracking)	**LOW**	**ALMOST CERTAIN**	**MEDIUM**
Stormwater flooding	Discrete event	• Flooding of properties and infrastructure • Road network and transportation disruption • Human displacement • Business closures and economic implications • Impacts on sewage treatment and water quality • Health impacts from decreased water quality • Increased insurance costs • Increased debris flows • Increased erosion • Impacts on lake sedimentation • Road network disruption	**LOW**	**POSSIBLE**	**MEDIUM**

Nelson's climate risk assessment matrix is show in Figure 1.

Figure 1: Nelson Climate Change Risk Matrix (Draft)

CONSEQUENCE	Extreme			• Water supply shortage	• Interface wildfire	
	High				• Ecosystem shift • Pests, invasive species and disease • Summer heat wave • Mental health stress • Prolonged drought • Infrastructure degradation	

	Moderate			• Lake flooding • Creek flooding	• Windstorm • Decreased water quality • Reduced winter tourism and recreation	
	Low			• Stormwater flooding		• Shifting freeze-thaw cycles
	None					
		Rare	Unlikely	Possible	Likely	Almost certain
		LIKELIHOOD				

Table 3: Impacts with Positive Consequences

IMPACT	TYPE	POTENTIAL CONSEQUENCES	CONSEQUENCE	LIKELIHOOD	BENEFIT LEVEL
Population growth due to climate change-related migration	Ongoing Impact	• Increased cultural diversity • Economic growth/benefits • Increased development • Increased revenue for The City	**HIGH**	**LIKELY**	**HIGH**
Increased summer tourism and recreation season	Ongoing impact	• Increased tourism • Increased employment opportunities • Economic benefits • Improved quality of life for residents	**LOW**	**LIKELY**	**MEDIUM**
Increased active transportation season and activities	Ongoing impact	• Decreased congestion and emissions • Health benefits • Increased demand for/use of AT infrastructure	**LOW**	**LIKELY**	**MEDIUM**
Decreased snow removal/sanding costs	Ongoing Impact	• Economic benefit for The City • Decreased emissions from snow removal • Decreased pollution from sanding	**LOW**	**LIKELY**	**MEDIUM**
Increased food growing season (*if accompanied with irrigation)	Ongoing impact	• Increased food security • Increased community resiliency • Economic benefits	**LOW**	**POSSIBLE**	**MEDIUM**
Increased construction season	Ongoing impact	• Increased employment opportunities • Economic benefits • Increased opportunities for improved building techniques, energy efficiency etc.	**LOW**	**UNLIKELY**	**LOW**

Nelson's matrix of potential climate change benefits shown in Figure 2.

Figure 2: Nelson Climate Change Opportunity or Benefit Matrix (Draft)

CONSEQUENCE	Major					

	High				• Population growth	
	Moderate					
	Low		• Increased construction season	• Increased food growing	• Increased summer tourism and recreation • Increased active transportation • Decreased snow removal	
	None					
		Rare	Unlikely	Possible	Likely	Almost certain
	LIKELIHOOD					

Appendix A: Workshop Attendees

Fifty subject matter experts and community leaders from a broad spectrum of sectors, organizations and businesses and representing a multitude of professions and expertise were invited to the 'Climate Change Trends, Impacts and Strategic Actions' Workshops. Those able to attend the climate risk assessment workshop (Workshop #1) are listed below:

Abra Brynne	Central Kootenay Food Policy Council
Alan Danks	Nelson & District Credit Union
Carmen Procter	Nelson Hydro
Craig Stanley	City of Nelson
Greg Utzig	West Kootenay Resilience
J Stewart	Nelson Cares
Jeff Zukiwsky	All One Sky
Kady Hunter	Interior Health
Kate Letizia	City of Nelson
Kevin Cormack	City of Nelson
Kristen Aasen	City of Nelson
Laurie Carr	Central Kootenay Invasive Species Society
Len MacCharles	City of Nelson
Lisa Cannady	Community Futures
Mel Reasoner	All One Sky
Menush Akbari	Harmony Engineering
Mike Daloise	City of Nelson
Pam Mierau	City of Nelson
Rona Park	Nelson Community Services
Ryall Giuliano	Ankors
Sangita Sudan	RDCK
Tom Dool	RDCK
Travis Barrington	RDCK

Appendix B: Consequence and Likelihood Scales for Nelson

Consequence Scale – Risks

SCORE	DESCRIPTION	DEFINITION
1	**None**	• No physical health & safety impacts; minimal fear and anxiety • Minimal impact on quality of life for residents • Very little impact on local economy • Insignificant environmental disruption or damage, recovery within days • Slight damage to property and infrastructure, very short-term interruption of lifelines, or negligible cost to municipality
2	**Low**	
3	**Moderate**	• Injuries/illness affecting 5% of community; modest temporary fear and anxiety • Moderate impact/disruption to quality of life • Temporary impact on the economy; modest costs and disruption to individuals, businesses and the city • Isolated but reversible damage to wildlife, habitat or and ecosystems (may take years), or short-term disruption to environmental amenities • Damage to property and infrastructure (incl. critical facilities and lifelines), short-term interruption of lifelines to part of community, localized evacuations, or modest costs to municipality
4	**High**	
5	**Extreme**	• Injuries/illness affecting 25% of community or many fatalities; widespread long-term psychological impacts (PTSD) • Major impact/disruption to quality of life • Long-term impact on the economy; major economic costs or disruption to individuals, businesses and the city; permanent loss of key sector • Widespread and irreversible damage to wildlife, habitat and ecosystems, or long-term damage, disruption to environmental amenities • Widespread damage to property & infrastructure (incl. critical facilities and lifelines), extensive and long-term interruption of services, widespread evacuations, or major cost to municipality

Note: *"lifelines" includes gas, electricity, water, and communications.*

Consequence Scale – Potential Benefits

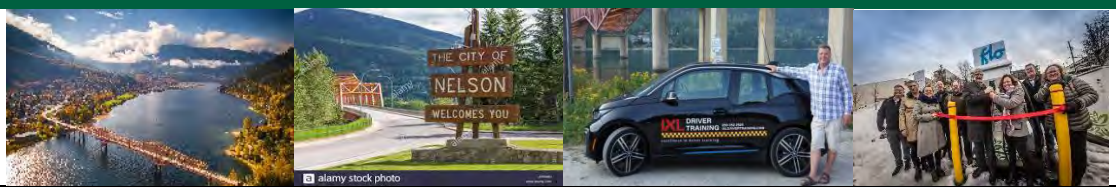
SCORE	DESCRIPTOR	DEFINITION
1	**None**	• Minimal increase in income / jobs for a few businesses • Minimal lifestyle improvement for some residents • No savings to municipality, businesses or residents
2	**Low**	
3	**Moderate**	• Increase in income / jobs for a *sector* • Lifestyle improvement for a *select group* of residents • Cost savings to municipality, businesses or residents • *Short-term* boost to reputation and image of municipality
4	**High**	
5	**Major**	• Increase in income / jobs for *key sectors* of local economy • Lifestyle improvement for a *majority* of residents • Cost savings to municipality, businesses or residents • *Long-term* boost to reputation of municipality

Likelihood Scale – Risks & Potential Benefits

SCORE	DESCRIPTION	DISCRETE EVENTS	ONGOING STRESSES
1	**Rare**	Expected to happen less than once every 100 years (annual chance < 1% in 2050)	Almost certain not to occur between now and 2050
2	**Unlikely**	Expected to happen about once every 51-100 year (1% ≤ annual chance < 2% in 2050)	Not anticipated to occur between now and 2050
3	**Possible**	Expected to happen about once every 11-50 years (2% ≤ annual chance < 10% in 2050)	As likely as not to occur between now and 2050
4	**Likely**	Expected to happen about once every 3-10 years (10% ≤ annual chance < 50% in 2050)	Expected to occur between now and 2050; it would be surprising if it did not occur
5	**Almost Certain**	Expected to happen once every two years or more frequently (annual chance ≥ 50% in 2050)	Almost certain to occur between now and 2050

Discrete events: *impacts caused by discrete hazards such as heat waves, floods, or wildfires.*
Ongoing stresses: *impacts caused by gradual climate changes over time.*

Appendix C: Nelson's Community Greenhouse Gas Inventory



City of Nelson

Community Energy and Emissions Inventory Report

June 2020

City of NELSON BRITISH COLUMBIA

Community Energy Association

Table of Contents

Summary

The City of Nelson has reduced per-capita emissions by 6.4% in 2018 compared to 2007, however total emissions have risen by 10.8% in the same time frame. Total emissions are on a trajectory to be 11.8% higher in 2030 vs. 2007 levels. Further actions will be required to align with provincial targets and international greenhouse gas (GHG) emission targets.

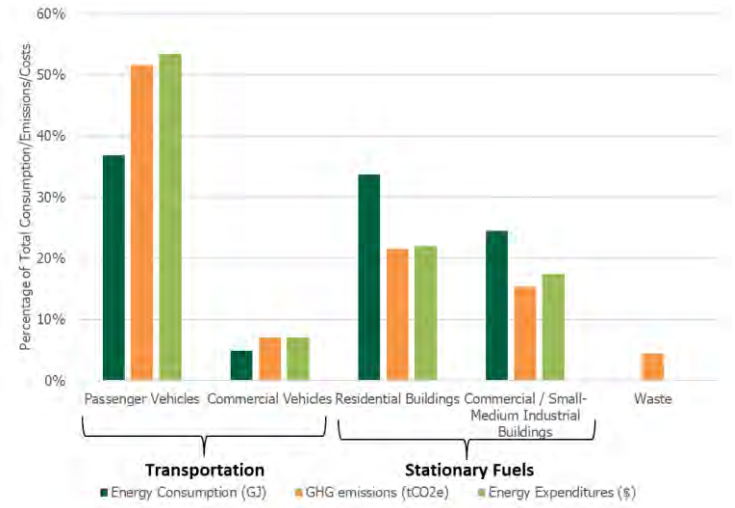
This report describes Nelson's community inventory data from 2007 to 2018, and Business As Usual (BAU) projections through to 2050. The goal being to help the City understand its current energy and emissions situation, in light of their recent commitment to 100% Renewable Energy by 2050, their current development of a comprehensive Climate Change Action Plan, and their recent interest to align their community GHG reduction targets with global standards, i.e. the Intergovernmental Panel on Climate Change's (IPCC's) recent 1.5°C report[1].

Inventory data was collected for 2007-2018, with BAU projections to 2050. The last full inventory year for which required data is available was 2018, and the results are split by sector in Figure E.1.

In 2018:

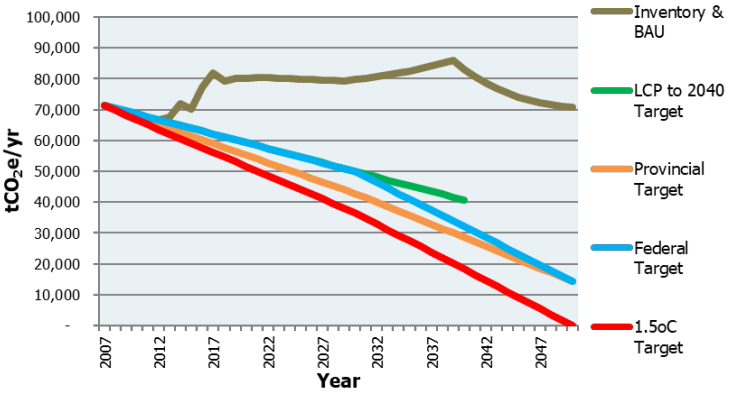
- Total energy consumption is estimated at 1,705,262 GJ
- Total GHG emissions are estimated at 79,102 tonnes of CO_2e
- Total energy expenditures are estimated at $41,829,783

FIGURE E.1 CONSUMPTION, EMISSIONS, COSTS BY SECTOR



Inventory GHG data and BAU projections are shown in Figure E.2, and compared to the City of Nelson's current *Low Carbon Path to 2040* targets (43% below 2007 levels by 2040) approved in 2011. The IPCC's 1.5°C target (45% reduction from 2010 levels by 2030, 100% reduction by 2050), commonly described as the upper-limit for global warming, is also shown, as well as the provincial and federal targets – for the sake of comparison. Note that reductions in the BAU projection incorporate planned and approved federal and provincial actions, particularly the provincial Zero-Emission Vehicles Act which mandates 100% of new light duty vehicle sales to be zero-emissions by 2040.

FIGURE E.2 EMISSIONS AND TARGETS

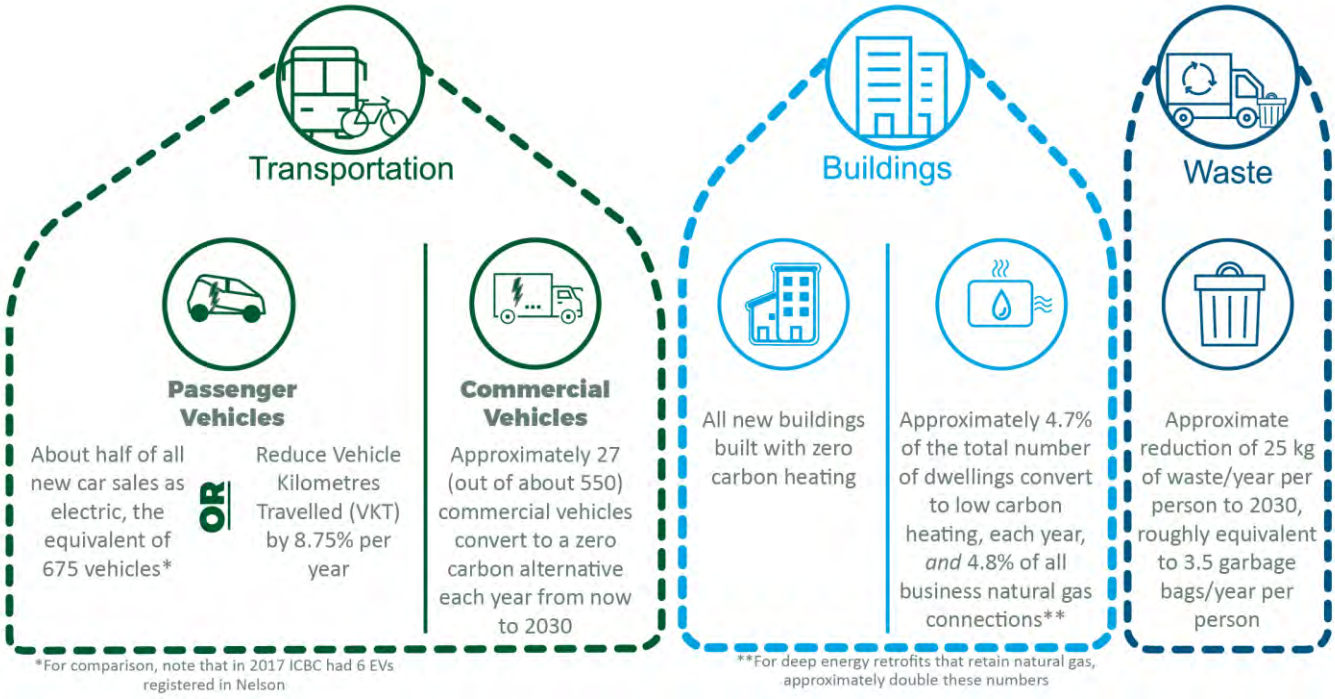


From 2007 to 2018, Nelson's total emissions rose by 10.8%. This clearly indicates that much work remains if the City wishes to meet their original GHG targets, let alone align with Provincial, Federal/ IPCC targets.

[1] IPCC's Special Report: Global Warming of 1.5°C, 2019 (https://www.ipcc.ch/sr15/)

Below are examples of the physical changes required annually to meet federal/IPCC targets in Nelson, in an attempt to illustrate the level of investment and effort that will be required. For every year, from now to 2030, Nelson would have to complete the following (as an example):

FIGURE E. 3 ANNUAL CHANGES TO MEET IPCC 2030 TARGETS IN NELSON



The next stage is to use the updated GHG Inventory to develop new targets in line with provincial, federal and international standards, and specific actions to meet them.

Introduction

This report describes greenhouse gas (GHG) community inventory data from 2007 to 2018 for the City of Nelson, and Business As Usual (BAU)[2] projections through to 2050. The goal being to help the City understand its current energy and emissions situation, in light of recent commitment to 100% Renewable Energy by 2050, their current development of a comprehensive Climate Change Action Plan, and their recent interest to align their community GHG reduction targets with provincial, federal and global standards, i.e. the United Nations Intergovernmental Panel on Climate Change's (IPCC's) recent 1.5°C report, also known as the Paris Agreement[3]. The inventory described in this report is informed by Community Energy & Emissions Inventory (CEEI) data reported by The Province of BC, alongside several supplementary data sources (described below). The CEEI itself was compiled according to the 2005 IPCC Guidelines for National GHG Inventories. Using supplementary data sources alongside the CEEI data provided by the Province, allows for a much more accurate snapshot of community emissions.

The emissions inventory is based on, and will be presented through the following sectors and subsectors, as categorized through the CEEI:

- Transportation
    - Passenger Vehicles
    - Commercial Vehicles
- Stationary Fuels
    - Residential Buildings
    - Commercial/Small-Medium Industrial Buildings
- Waste

The specific methodology and assumptions are described in Appendix 1 – Methodology & Assumptions. Raw inventory data is in Appendix 2 – Energy & Emissions Inventories, Raw Data. Results from Nelson's Heating Survey are detailed in Appendix 3 – Citizen Survey on Climate Change Results.

Current Energy Consumption & Emissions

The last complete inventory year dataset available from the Province of BC is from 2018, and was used alongside provincial utility and waste data and local transportation data (from retail gas stations) to describe Nelson's current energy consumption and emissions. See Appendix 1 – Methodology & Assumptions for a full description.

In 2018, for the whole community of Nelson:

- Total energy consumption is estimated at 1,705,262 GJ
- Total GHG emissions are estimated at 79,102 tonnes of CO_2e

[2] See 'Business as Usual (BAU)' definition on page 9

[3] In the 2015 Paris climate agreement, the countries participating in the United Nations Framework Convention on Climate Change (UNFCCC) agreed to hold the rise in global average temperature "well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius." Since then, 1.5°C has become a global, long term emissions goal and the basis Canada and British Columbia's GHG targets.

- Total energy expenditures are estimated at $41,829,783

GHG emissions (in tonnes of CO_2e) split by source are shown in , with associated energy consumption by fuel in Figure 2, and energy costs by fuel in Figure 3. The vast majority of emissions in Nelson are due to the use of mobility fuels (gasoline & diesel), and natural gas. Wood and waste contributes a small proportion, while electricity, propane, and heating oil are almost negligible.

Mobility fuels and electricity are the two largest costs, but natural gas is also significant. Note that although electricity has very low GHG emissions, the reduction of energy consumption should still be tackled in order to manage community energy expenditures, as it is quite an expensive fuel compared to natural gas (about 3 times as more expensive). On the other hand, since Nelson has its own electrical utility, some of the costs are recycled back into the community.

FIGURE 1– GHG EMISSIONS BY FUEL TYPE AND WASTE IN 2018

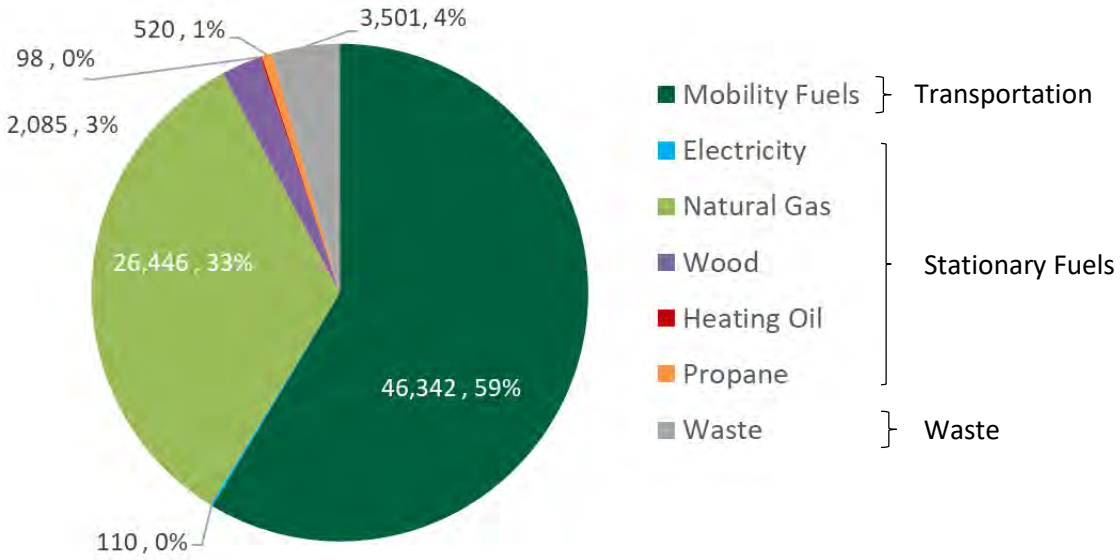


FIGURE 2 ENERGY CONSUMPTION BY FUEL TYPE IN 2018

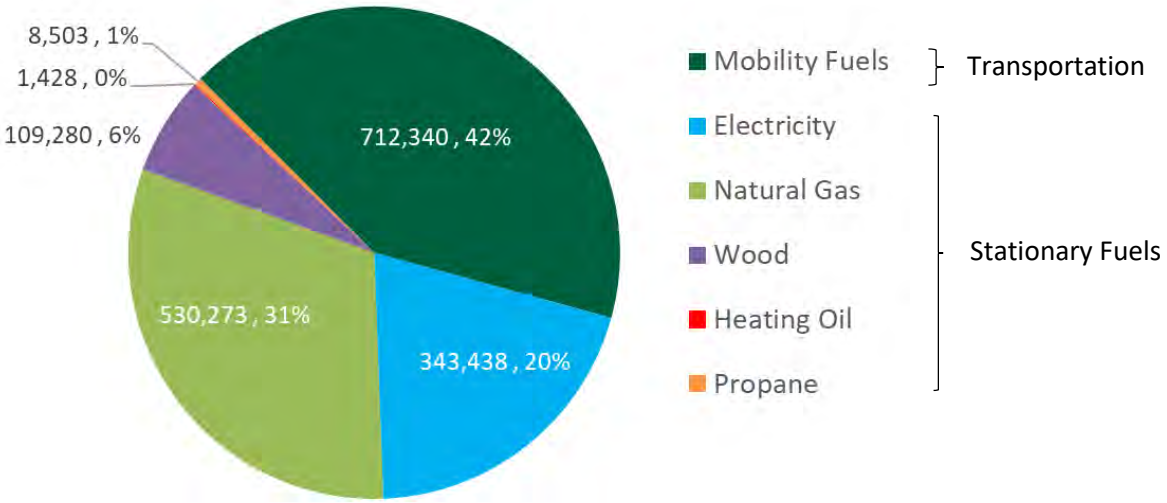


FIGURE 3 ENERGY EXPENDITURES BY FUEL TYPE IN 2018

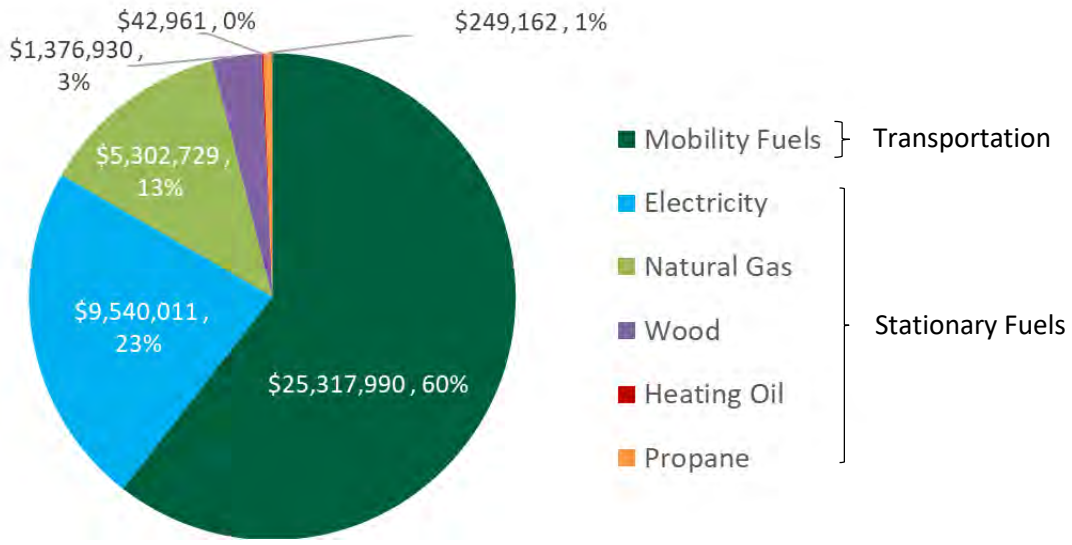


Figure 4 and Figure 5 show the proportion of energy consumption, emissions, and estimated energy expenditures all together. Figure 4 shows the split between fuels and waste; Figure 5 by sector. Note that the mobility fuels category includes passenger and commercial vehicles.

FIGURE 4 – PROPORTION OF ENERGY, EMISSIONS, AND COST BY SECTOR IN 2018, %

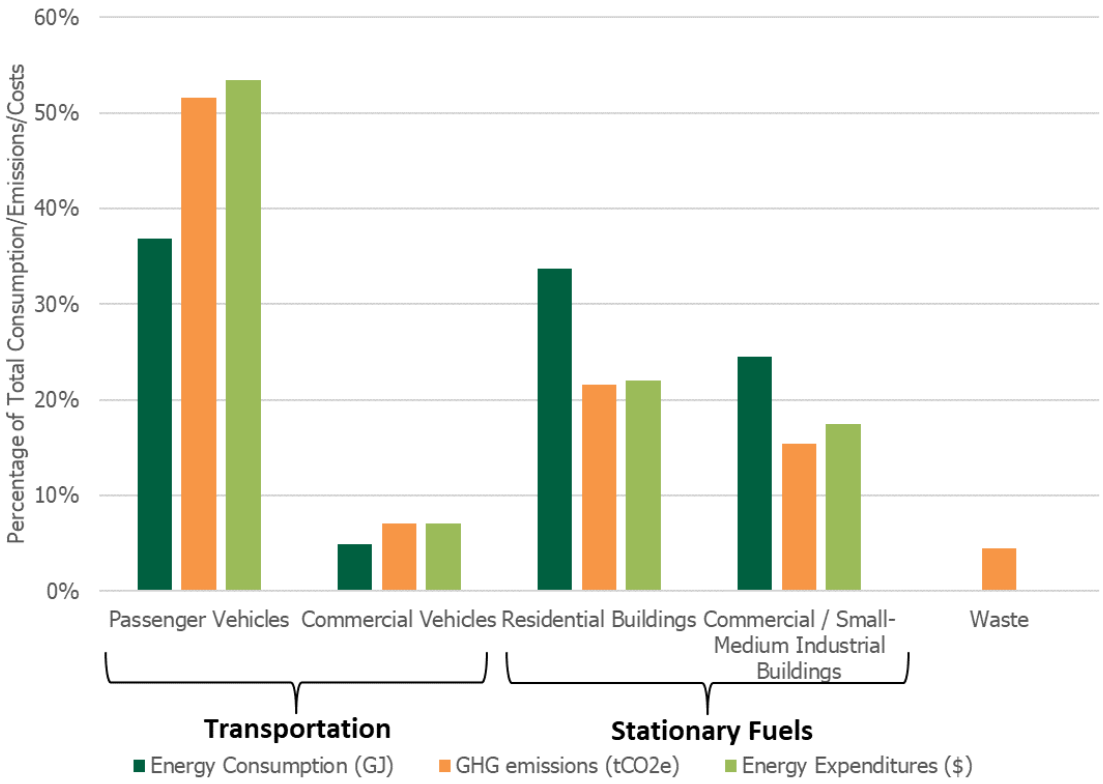
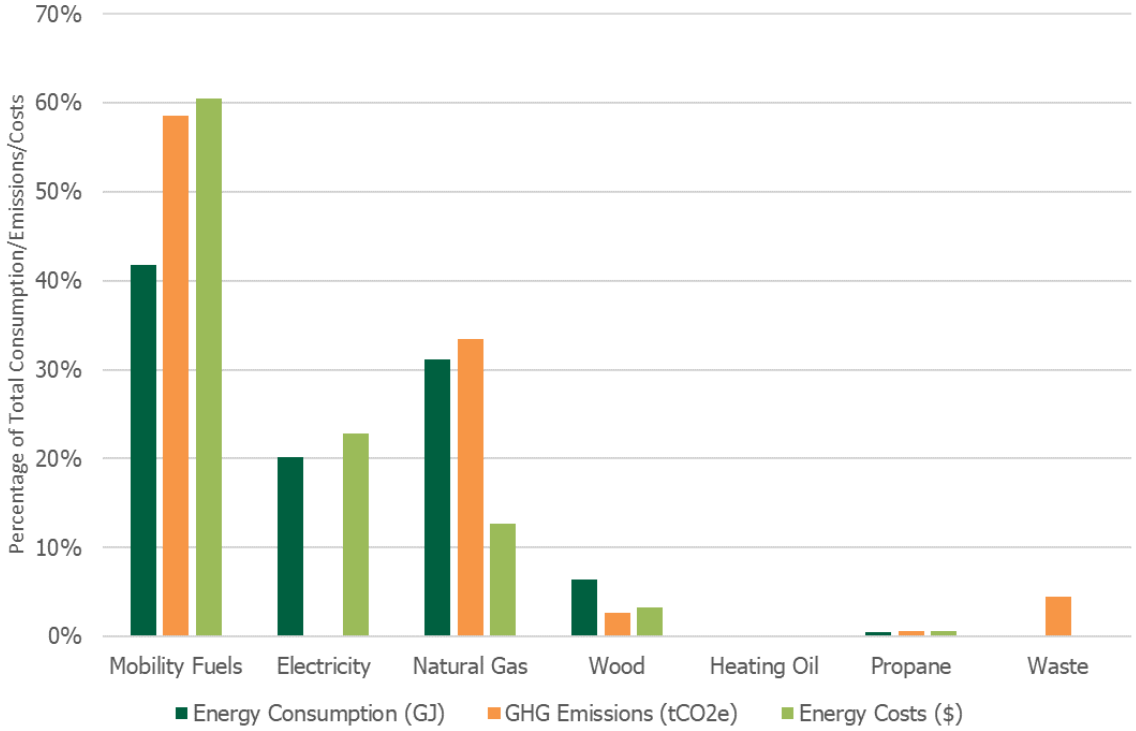


FIGURE 5 – PROPORTION OF ENERGY, EMISSIONS, AND COST BY FUEL TYPE AND WASTE IN 2018, %



Mobility fuels contribute the largest proportion of community cost and emissions at 61% and 59%, respectively, while natural gas also contributes a large proportion of emissions and energy consumption at 33% and 31%, respectively. Rapidly curbing these two fuel sources should be a priority for the City moving forward.

Dissecting mobility by user, passenger vehicles contribute the largest proportion of all three categories, representing 53% of total cost, 52% of total emissions, and 37% of total energy consumption. Note that energy consumption from diesel vehicles is likely understated, as described in Appendix 1 – Methodology & Assumptions.

Residential buildings contribute a fair proportion of energy consumption at 34%, while also contributing 22% of emissions and cost.

Landfill methane emissions from waste contribute only a small portion, at 4%.

Change in 2007 Baseline Year

One of the outcomes of the work undertaken to develop Nelson's 2018 inventory, is that emissions for the 2007 baseline year have been calculated differently, compared to the original 2007 inventory from the *Low Carbon Path to 2040 (LCP)* document, and the Province's Community Energy & Emissions Inventory (CEEI) refresh in 2016. Details on this are shown in Table 1.

TABLE 1 – DIFFERENCES IN 2007 BASELINE YEAR BETWEEN 2011 LCP, 2016 CEEI REFRESH, AND THIS ANALYSIS

Category	2011 LCP, 2007 baseline yr		Refined CEEI, 2007 baseline yr		CEA's analysis, 2007 baseline yr	
	Total	%	Total	%	Total	%
Residential buildings	15,200	23%	15,500	24%	15,500	22%
Commercial buildings	11,600	17%	11,400	18%	11,400	16%
Vehicles	39,100	59%	31,600	49%	39,000	55%
Solid waste	600	1%	5,300	8%	5,300	7%
Overall	**59,100**	**100%**	**63,800**	**100%**	**71,200**	**100%**

The reasons for the variations are as follows:

- Buildings data – is still obtained from the Province of BC's Climate Action Secretariat as before, and broadly speaking, the Province uses the same methodologies as the CEEI. However, utility data can vary after it is released – which has been the case for Nelson - and GHG emission factors have also changed slightly. Despite this, emissions for buildings are very similar between the three inventories.
- Vehicles – are a significant area of difference. The 2011 Low Carbon Path (LCP) used the Province of BC's original CEEI (2007), which used a methodology as follows:
    - ICBC vehicle registrations in the community
    - Efficiencies estimated for the vehicle types in l/km
    - Vehicle kilometres travelled (VKTs) estimated for these vehicle types based on odometer readings from the AirCare testing program in Metro Vancouver
    - Econometric modelling adjustments made for estimates outside of the Metro Vancouver area.

  The Province only created these estimates up to 2010, and CEA was not able to replicate their original methodology to update Nelson's inventories, as ICBC and other data sources used by the Province up to 2010 are no longer available. The CEEI refresh in 2016 showed a significant decrease in vehicle emissions for the 2007 baseline, relative to the original CEEI data. The *Technical Method and Guidance Document for the CEEI Reports* identified that the transportation methodology in CEEI reports has changed over time, with the current method using third-party regional VKT estimates. CEA's methodology, using Kent Group data, is outlined in Appendix 1 – Methodology & Assumptions. One of the key differences in the methodologies is that the Kent Group data does not include fuel sold from card lock stations, which will include larger commercial vehicles.

- Solid waste – is an area of significant difference. Nelson's waste was relocated from the Central Landfill to Ootischenia in 2015. Due to the "waste-in-place" method that the Province uses to calculate emissions, which is based on the historical tonnage of the landfill, it led to an artificial decrease in waste emissions. CEA's recommendations on waste are therefore based on reducing tonnage.

Trends and Forecast

Targets & Business As Usual Forecast

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

Nelson's 2011 'Low Carbon Path (LCP) to 2040' Community Energy and Emissions Action Plan listed actions that needed to be completed to allow Nelson to achieve the following targets over a 2007 baseline year, by 2040:

- 57% reduction in per capita GHG emissions (from 7 to 3 tonnes per year)
- 43% reduction in community-wide GHG emissions
- 26% reduction in community-wide energy use

A summary of LCP targets compared to provincial, federal and IPCC targets, as well as their baseline years, are shown in Table 2. Note, only net reduction community emissions targets are shown as per capita and energy use targets are no longer standard GHG target formats.

What does 'Business As Usual' mean?

Business As Usual, or BAU, is a way of describing what is estimated to happen to Nelson's emissions if the City takes no further action to decrease emissions beyond what they are already doing and plan to do. A number of factors are taken into account to develop BAU emissions scenarios, population growth being one of the most important considerations. As the number of people increase in a community, more buildings are needed/used and more vehicles are driven on roads.

Other considerations that were taken into account to develop Nelson's BAU emissions scenario for this report include the following:

- Changing climate patterns— as warmer winters and hotter summers occur, they are and will continue to change the way that energy is consumed in buildings
- Likely future impacts of policies already adopted by other orders of government, such as:
  - Renewable and low carbon fuel standards
  - Vehicle tailpipe emissions standards
  - Zero-Emission Vehicle (ZEV) mandate as part of the CleanBC Plan, requiring 10% of new vehicle purchases by 2025 as ZEVs, 30% by 2030, and 100% by 2040
  - The greening of the BC Building Code ready buildings by 2032 (progressive steps towards net zero energy). The City of Nelson has already adopted Step 1 of the Step Code, which is a good first step.

TABLE 2 – LOCAL, PROVINCIAL, FEDERAL AND INTERNATIONAL TARGET REDUCTIONS

	LCP to 2040	Provincial	Federal	IPCC
Baseline year	2007	2007	2005	2010
Community GHG Emissions	30% by 2030 43% by 2040	40% by 2030 60% by 2040 80% by 2050	30% by 2030 80% by 2050	45% by 2030 100% by 2050 (Net zero)

Figure 6 and Table 3, show graphical and numerical representations of Nelson's BAU projections compared to the current net reduction Community GHG Emissions targets from the LCP (listed above), with emissions targets that would be congruent with meeting the Provincial target, the Federal target and the 1.5°C global standard.

FIGURE 6 – INVENTORY AND BAU PROJECTIONS, IN RELATION TO THE CURRENT LCP GHG EMISSION REDUCTION TARGETS VS PROVINCIAL, FEDERAL AND 1.5°C TARGETS

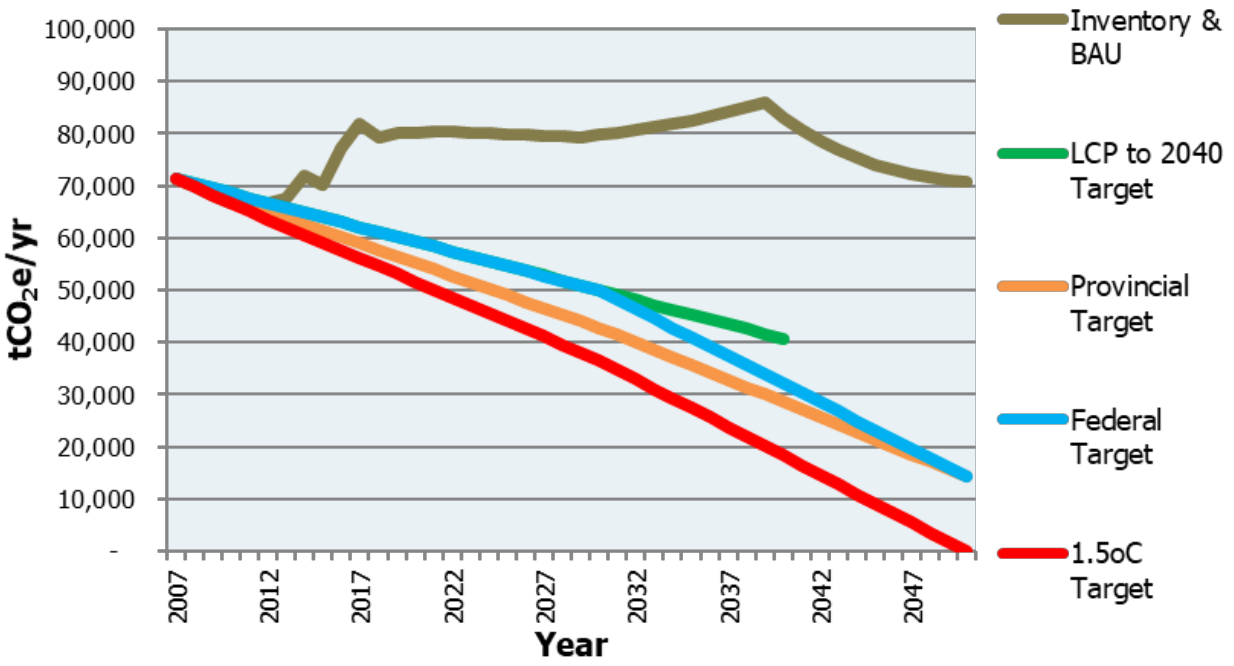


TABLE 3 – EMISSIONS AND TARGETS BY NUMBERS & PERCENTAGES

	2007	2010	2018	2030	2040	2050
Inventory & BAU estimate (tCO_2e)	71,409	66,567 (-6.8%)	79,102 (10.8%)	79,804 (11.8%)	83,088 (16.4%)	70,672 (-1.0%)
LCP net reduction trajectory (tCO_2e)	71,409	68,617 (-3.9%)	61,173 (-14.3%)	50,008 (-30.0%)	40,703 (-43.0%)	n/a
Province of BC target (tCO_2e)	--	--	--	42,845 (-40.0%)	28,563 (-60.0%)	14,282 (-80.0%)
Federal Target (tCO_2e)	--	--	--	49,986 (-30.0%)		14,282 (-80.0%)
1.5°C target (tCO_2e)	--	--	--	36,612 (-45.0%)	18,306 (-72.5%)	0 (-100.0%)

Note: LCP and Province targets are based on 2007 baseline, while the 1.5°C target is based on a 2010 baseline. Federal is based on 2005 baseline, however no inventory data is available for 2005, therefore a 2007 baseline is being shown *for illustration purposes only*.

Figure 6 and Table 3 show that the City was initially on track towards its targets until 2013, however increased emissions from passenger transportation starting in 2014 and a spike in natural gas and wood heating in 2017/2018 have resulted in a 10.8% increase in emissions overall.

Note that reductions in the BAU projection incorporate federal and provincial actions, particularly the provincial zero-emission vehicle mandate which comes into effect in 2040.

Overall, these results indicate that significant action is necessary to bring Nelson back on track towards its current targets, and any future targets they may develop to more closely align with provincial, federal and international standards. In particular, focusing on shifting away from natural gas heating, and shifting towards electric vehicles on a large-scale.

Emission changes for each fuel and solid waste are shown in Table 4, with only electricity and solid waste demonstrating reductions. Note that the solid waste "reductions" were due to waste being sent to the Ootischenia landfill starting in 2015 compared to the Central landfill in 2014 and before. This altered the "waste-in-place" calculation that the Province uses. The reductions were therefore artificial, and should not be used at face value as a metric for progress. From a tonnage perspective, waste tonnage actually increased by 28% from 2007-2018. Therefore, decreasing waste tonnage, particularly organic waste, should be considered moving forward.

TABLE 4 – EMISSION REDUCTIONS 2007-2018 BY FUEL & WASTE

Category	Absolute decrease*	Percentage decrease*	Reason
Mobility fuels	(7,249)	(19%)	Significant rise in passenger vehicle fuel consumption
Electricity	154	58%	Slight increase in consumption, but strong decrease in GHG intensity
Natural gas	(2,250)	(9%)	Significant rise in consumption in 2017
Wood	(142)	(7%)	Significant rise in consumption in 2017
Heating Oil	(7)	(7%)	Significant rise in consumption in 2017
Propane	(38)	(7%)	Significant rise in consumption in 2017
Solid waste	1,838	34%	Tonnage sent to landfill increased by 28%, but waste started to be sent to Ootischenia starting in 2015 vs. Central landfill in 2014 and before. This altered the "waste-in-place" calculation that the Province uses
Solid waste tonnage	(1,322 tonnes)	(27%)	
Overall	(12,074)	(17%)	Combination of the above

*Brackets indicate a negative (or increase vs. decrease)

Again, even with the 6.4% decrease in per capita emissions, the *actual* emissions indicate that considerable work must be done to curb natural gas and mobility fuel consumption in order to reduce associated emissions, particularly if the City wishes to align with a 1.5°C by 2030 target.

BAU by Fuels and Sectors

Figure 7 and Figure 8 are similar to Figure 6, but they show exactly where emission reductions have fluctuated historically, where they will change in a BAU scenario, and where reductions will need to be made to meet the 1.5°C targets. Note that in Figure 7, electricity and heating oil are nearly invisible. This is due to the minimal GHG emissions associated with each source.

FIGURE 7 – INVENTORY AND BAU PROJECTIONS SPLIT BY FUELS & WASTE, WITH LCP, PROVINCIAL, AND 1.5°C TARGETS

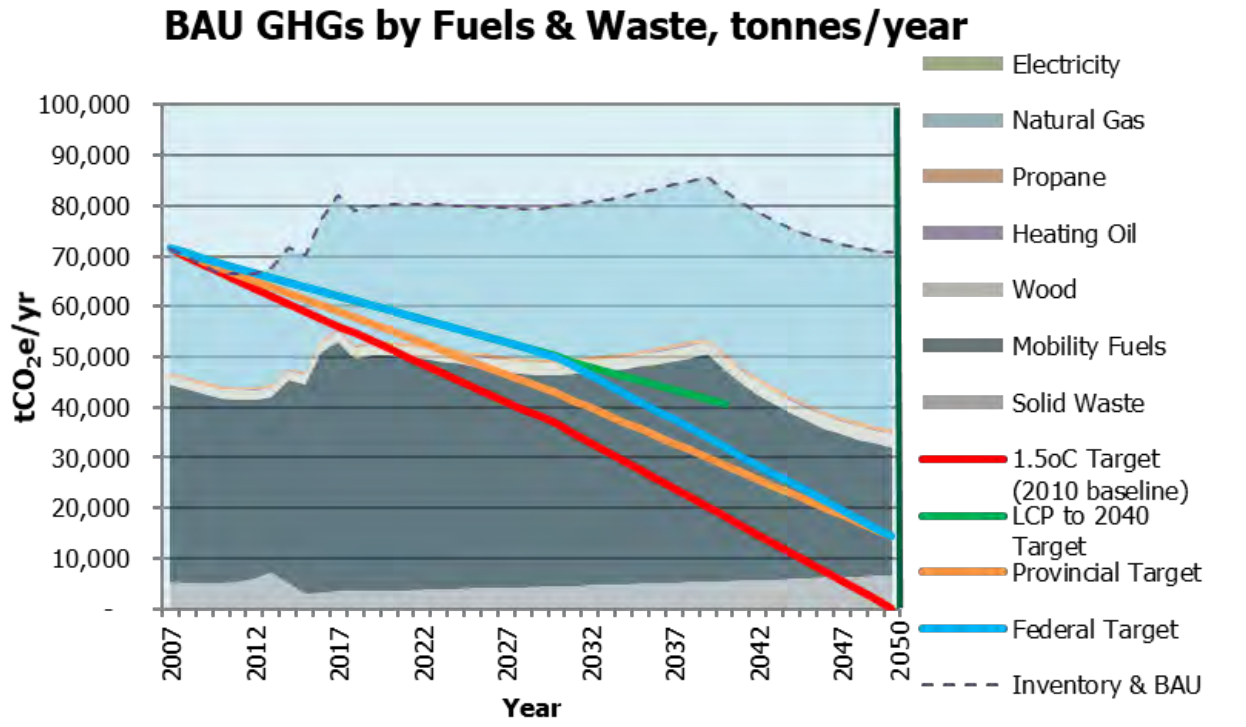
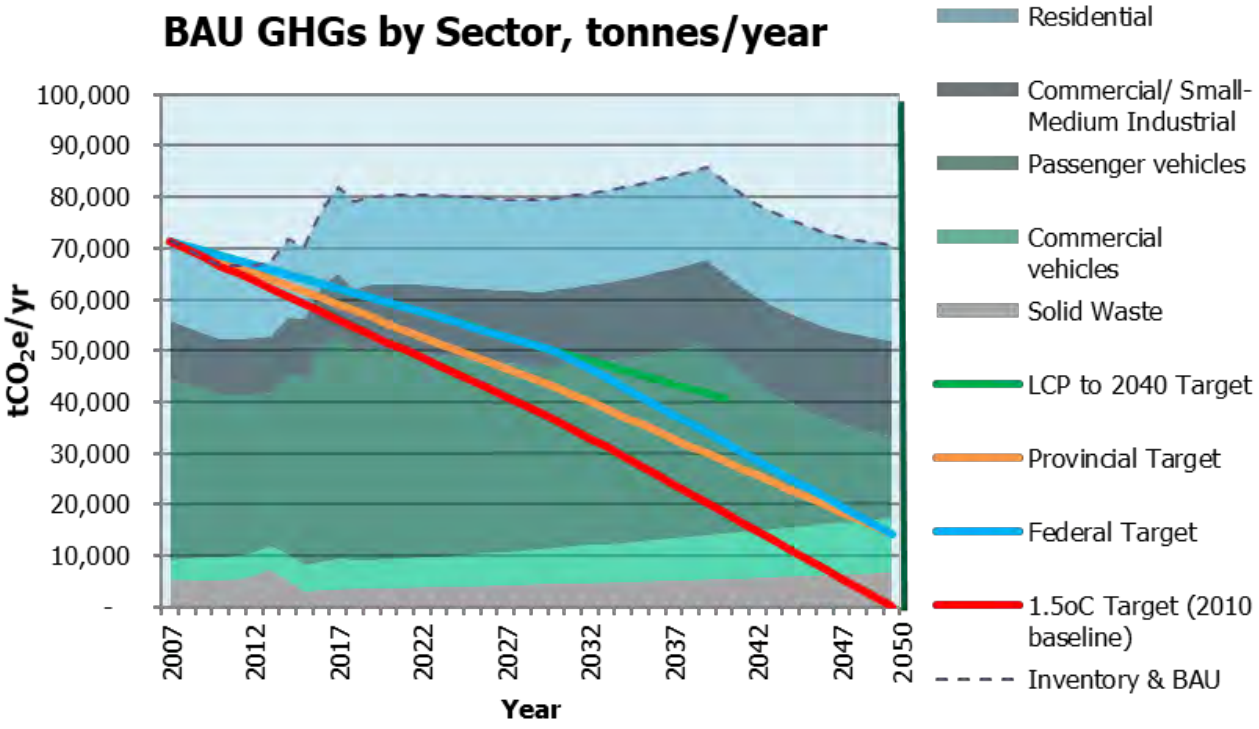


FIGURE 8 – INVENTORY AND BAU PROJECTIONS SPLIT BY SECTOR, WITH LCP, PROVINCIAL, FEDERAL, AND 1.5°C TARGETS



From 2007 to 2018, emissions have primarily fluctuated due to a) increased use of mobility fuels, especially gasoline - likely due to fluctuations in economic activity, and b) heating energy consumption increases in 2017, with natural gas producing the largest increase in emissions (see Appendix 2 – Energy & Emissions Inventories, Raw Data).

Projecting forwards, in a BAU scenario it is believed that emissions from passenger vehicles will decrease because of Federal tailpipe emission standards[4] (200 g CO_2e/km in 2015 to 119 g CO_2e/km, in 2025), BC Renewable & Low Carbon Fuel Standard requirements[5] (10% reduction in carbon intensity by 2020, 20% by 2030), and vehicle electrification. Natural gas emissions are also expected to increase slowly, especially in the residential sector, due primarily to population growth.

T to meet Nelson's current 2030 targets, natural gas will need to be tackled for the residential and commercial/small-medium industrial sectors, along with passenger and commercial vehicles. For 2050 targets, all emissions sources will need to be addressed, even solid waste.

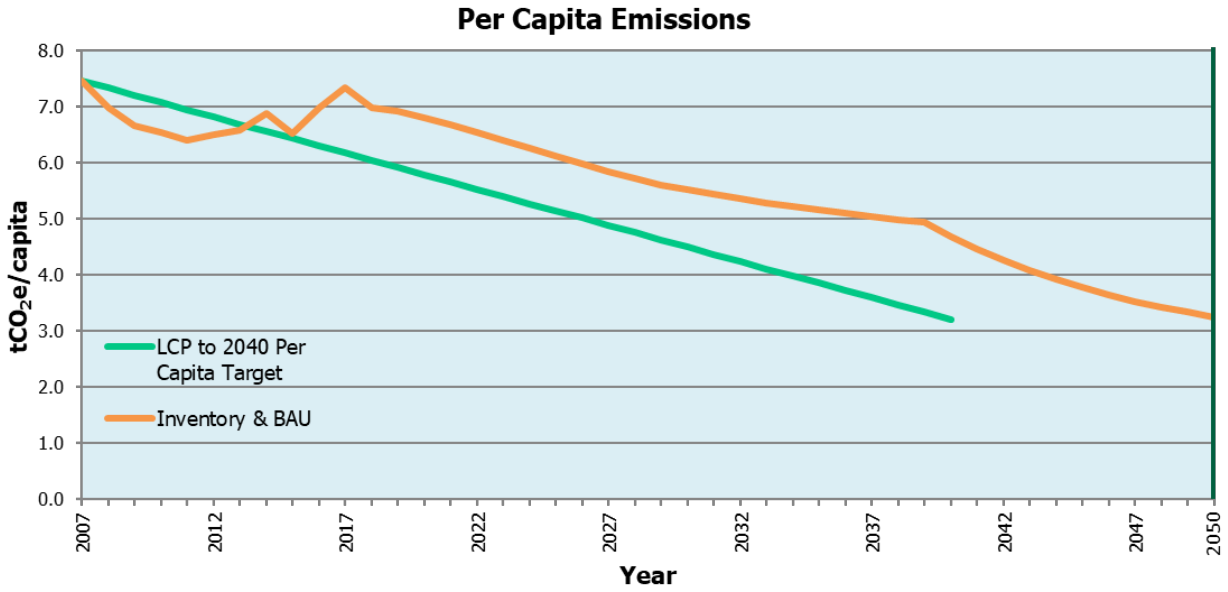
Per-Capita BAU Forecast

Given Nelson's population growth (2007: 9,559; 2018: 11,313; 2050 projection: 21,707) in comparison to similarly sized communities, and Nelson's per capita emissions target from the LCP, 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 9.

[4] SOR/2010-201. Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations. Available from: http://laws-lois.justice.gc.ca

[5] BC Low Carbon Fuel Standard. Available from: https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/renewable-low-carbon-fuels

FIGURE 9 – PER CAPITA INVENTORY AND BAU PROJECTIONS, IN RELATION TO THE CURRENT LCP GHG EMISSION REDUCTION TARGET, AND 1.5°C TARGETS



Per capita emissions:

- Nelson's GHG per capita emissions decreased by 6.4% from 2007 to 2018
- The LCP 2040 per capita target would be a 57% decrease from 2007 levels
- The 1.5°C 2030 per capita target would be a 66% decrease from 2007 levels, or a 61% decrease from 2010 levels

From a per capita perspective, Nelson had been on pace to meet its LCP per capita target until approximately 2014, when passenger vehicle consumption increased by 0.5 tCO_2e/capita; and again in 2016 producing another 0.5 tCO_2e/capita increase; followed by an increase in natural gas heating in 2017, amounting to a 0.19 tCO_2e/capita increase. The latter increase is partially supported by an increase in heating degree days in the Nelson area by 17% in 2017.[6] However, even with this context, the LCP per capita target continues to be challenging to meet. With respect to re-evaluating targets moving forward, per-capita emissions may be useful in some contexts, but population growth can skew results such that per-capita emissions are decreasing, while total emissions actually increase, as observed with Nelson.

Total Energy Consumption BAU Forecast

With respect to total energy consumption, the LCP also contained a target of 26% reduction below 2007 levels by 2040. Figure 10 below, shows Nelson's performance with respect to energy consumption from

[6] Historical Climate Data, Government of Canada. (2020). https://climat.meteo.gc.ca/historical_data/search_historic_data_e.html

2007 to 2018, as well as projections to 2050. Table 5 shows energy consumption for specific years of interest, and the percentage reduction (or increase) relative to 2007.

FIGURE 10 – ENERGY CONSUMPTION INVENTORY & BAU, IN RELATION TO THE CURRENT LCP ENERGY REDUCTION TARGET

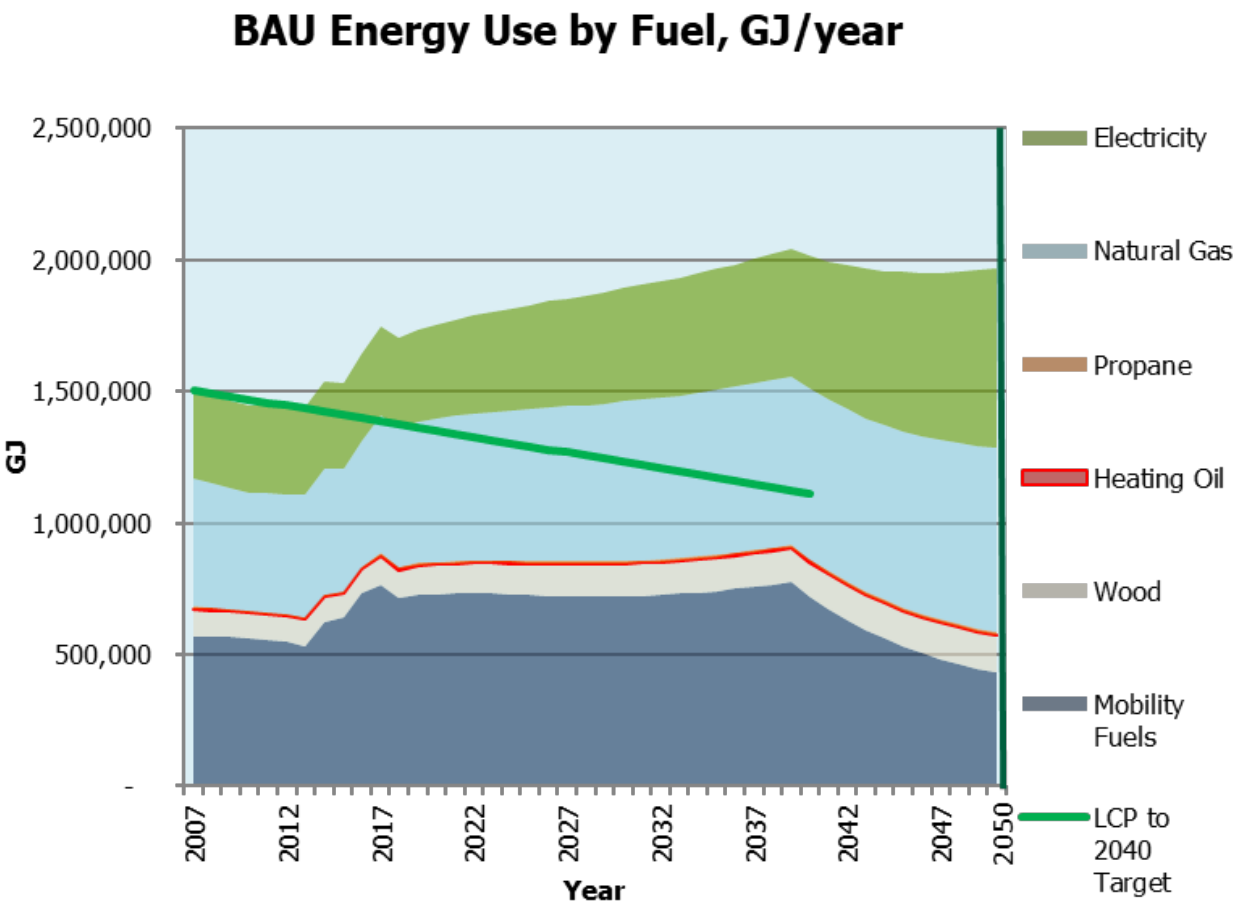


TABLE 5 – ENERGY CONSUMPTION AND LCP TARGET

	2007	2010	2018	2030	2040	2050
Inventory & BAU estimate (GJ)	1,504,604	1,443,554 (-4.1%)	1,705,262 (13.3%)	1,853,211 (23.2%)	1,969,537 (30.9%)	1,912,175 (27.2%)
LCP net reduction trajectory (GJ)	1,504,604	1,469,041 (-2.4%)	1,374,205 (-8.7%)	1,231,952 (-18.1%)	1,113,407 (-26.0%)	n/a

Compared to the 2007 baseline, energy consumption rose 13.3% in 2018. Two spikes in consumption occurred in 2014 and 2016 from increased mobility fuel consumption, and another spike in 2017 was due primarily to significantly higher heating consumption for natural gas. It would be notable to identify natural gas consumption from the Provincial inventory for 2018 and 2019 to determine if the increase was an anomaly, or if it will become an ongoing trend. Given that Nelson's LCP target is a 26% reduction in energy consumption by 2040, Nelson would have to reduce overall energy usage by 35% to 2040, relative to 2018.

Moving Forward - Meeting the 2030 1.5°C Target, the Scale of the Challenge

Below are *examples* of the physical changes that would be required annually (until 2030) to meet IPCC targets in Nelson, in an attempt to illustrate the level of effort and investment that will need to be considered:

- Transportation, passenger vehicles:
    - Approximately 675 internal combustion engine vehicles convert to electric every year from now to 2030, which is about half of all new car sales. (For comparison, note that in 2017 ICBC had 6 EVs registered in Nelson.)
      OR
    - Decrease the Vehicle Kilometres Travelled by passenger vehicles 8.75% per year from now to 2030— approximately 11 million VKTs per year.
- Transportation, commercial vehicles:
    - Approximately 27 commercial vehicles converting to a zero carbon alternative each year from now to 2030, out of the estimated 550 vehicles that would be on the road in 2020
- Buildings:
    - All new buildings built with zero carbon heating
    - Approximately 246 residential buildings using natural gas converted to zero carbon heating every year from now to 2030. This is about 4.7% of the total number of dwellings estimated in Nelson, each year. For deep energy retrofits that retain natural gas, approximately double these numbers
    - Approximately 25 businesses using natural gas converted to zero carbon heating every year from now to 2030. This is about 4.8% of the total number of business natural gas connections estimated in Nelson, each year. For deep energy retrofits that retain natural gas, approximately double these numbers.
- Waste:
    - Approximate reduction of 25 kg of waste/year per person, based on tonnage of 6,859 t in 2010, 6,231 t in 2017, and estimated tonnage of 6,623 t in 2020

Next Steps

The next stage is to develop updated targets based on the findings described in this report, and then actions for meeting these targets, in line with the scale suggested in the previous section.

Actions should be informed by this data, research and public engagement, and then modelled against new targets to ensure that they are sufficient in terms of obtaining the emissions reductions required.

Performance should then be monitored via updated Inventories in 3-5 year intervals.

Appendix 1 – Methodology & Assumptions

This appendix contains details on the methodology and assumptions for creating the GHG inventory and projections for Nelson.

Inventory Methodology

Nelson's GHG inventory was created using data for buildings, transportation, and waste obtained from the Province of BC's Community Energy & Emissions Inventory (CEEI) data,[7] and utilities and landfill waste data at the utility level.[8]Data on gasoline and diesel sales from Nelson gas stations obtained from Kent Group. Data from the City of Nelson's electrical utility was also obtained for 2018. Based on the data compiled, full inventory years were able to be complied for 2007, 2010, and 2012-2018.

The City of Nelson also conducted a 'Citizen Survey on Climate Change' in 2019 that captured heating fuel information, which was used to determine the fraction of home owners that used wood, heating oil, and propane and was also incorporated into the inventory. Determining heating oil, wood, and propane consumption for each year was based on annual natural gas consumption to estimate average building heating load. Energy conversion efficiencies were then applied (85% for heating oil and propane furnaces, 50% for wood stoves) in conjunction with the survey results to determine energy consumption for each fuel source. Propane data for the Nelson sewage treatment plant for 2019 was also included, and back cast using population growth for previous years.

Emissions factors for inventory years are shown in the following table, and are sourced from the Province of BC's 2017 GHG Inventory. Note that 2018 emission factors are based on 2017 data.

TABLE 6 – EMISSIONS FACTORS USED FOR INVENTORY YEARS

GHG/GJ, by Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Gasoline	0.068	0.067	0.066	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
Diesel	0.070	0.069	0.068	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067
Mobility fuels	0.069	0.067	0.066	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.066	0.066
Electricity	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	0.050	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	0.019	0.019
Heating oil	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068
Propane	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061

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

To determine fuel consumption by the three fuels, an average heating load for a typical house was required. This was determined by using natural gas consumption for each year, divided by the number of connections (houses), and incorporating the efficiency of a natural gas furnace (estimated at 85%). For example, in 2017, natural gas consumption per house was estimated at 82.8 GJ/year. Incorporating

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

natural gas efficiency, this equates to 70.4 GJ/year heating load. The proportion of houses that used each fuel in the survey, was multiplied by the number of houses in the City, to determine the equivalent number of houses in the City using each fuel. Heating oil and propane were estimated to provide 100% of heating in the homes where they were used, while wood was considered secondary heating, and estimated to provide 50% of heating.

With respect to solid waste, tonnage estimates from Provincial sources were compared to tonnage data from the City and from the Regional District of Central Kootenay (RDCK). The most recent inventory year from the Province from 2017 indicated a tonnage of 6,231 tonnes, taken as the population-based proportion of regional district waste attributed to Nelson. From RDCK-attained 2019 data for the Grohman Transfer Station, which is weighed and thus considered accurate, tonnage was estimated at 6,289 tonnes, with approximately 3,270 tonnes from residential and non-account businesses. Note that these numbers also include waste generated from the Hwy 6/3A junction to Six Mile, and are therefore likely a slight overestimate. Nevertheless, tonnage numbers are very close to the Provincial estimate, therefore we consider the Provincial tonnage and emissions estimates reasonable.

Emissions from Land Use, Land Use Change, and Forestry are not included in the community profile as per the Province's methodology for their 2017 inventory.

Inventory Assumptions

Assumptions made with respect to the inventory are as follows:

- The Province of BC made a series of standard assumptions in the creation of the CEEI data for 2007,2010, and 2012 which are outlined on the CEEI webpage: https://www2.gov.bc.ca/gov/content/environment/climate-change/data/ceei.
- The Province of BC made other assumptions for the post-CEEI data for additional 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. Note that the 2017 Provincial Inventory incorporated updated assumptions including backcasting, which incorporated new or improved methodologies to current and prior years as applicable. This is why updated CEEI data may be different from the original CEEI data.
- In creating the inventories, CEA made other assumptions in addition to these:
    - 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 Nelson was 2010. CEA regularly uses Kent Group data for inventories where data is available. Note that while new ICBC data was available at the 3-digit postal code level up to the 2018 year, data quality issues (particularly discrepancies relative to the CEEI data provided) led to the decision to use Kent Group data.
    - Provincially-sourced electricity data is predominantly from Nelson Hydro. For 2017 and 2018, Nelson Utility data was available directly from the City, while the remaining years used provincial data.

  - Though FortisBC gas data was included with the new Provincial inventory up to 2017, only residential numbers were incorporated, as commercial/industrial data for 2012 and beyond included large industrial. FortisBC commercial/industrial gas data post-2012 is prorated with population growth. Natural gas data was obtained for the 2018 year as well, however the data appeared to use different community boundaries, as about 45% more connections were included vs. the Provincial data, resulting in a 28% increase in consumption. We decided to not use the data due to the discrepancy in the number of connections and the subsequent rise in emissionsand instead projected based on population growth to populate the 2018 year for natural gas.

- As mentioned in the previous bullet points, fuel data was derived through Kent Group fuel sales data for Nelson, Castlegar, and Trail for 2007-2018, then prorated based on population proportions between the three cities. The prorating methodology was chosen over examining gas stations within City of Nelson boundaries only because data was only available for five gas stations in the City, as opposed to 13 between the three cities. Commuters were also more likely to travel across municipal boundaries throughout the Central Kootenays, rather than remaining confined to Nelson city boundaries.
- CEA now uses Kent Group data for inventories as a best practice where data is available and representative of the community, since CEEI transportation data is outdated (last data point is 2010). The Kent Group data was corroborated against the CEEI transportation estimate, and in doing so an assumption was made that all vehicle sizes up to and including medium duty trucks from CEEI data would be within the service boundary for Kent Group gas stations. Heavy duty trucks were excluded, as they are assumed to be fuelled by commercial card lock fuel stations, which are outside the service boundary for Kent Group. Using the aforementioned methodology and assumptions for quantifying consumption, the Kent Group data yielded a difference of 31% for gasoline, and -14% for diesel vs. our estimated consumption numbers in 2018 using 2010 CEEI and scaled by population growth. Though the gasoline component from the Kent Group methodology is considerably higher than the CEEI/population growth methodology, the CEEI data is 8 years out of data. The underestimate for diesel from the Kent Group data also makes sense since card lock stations are not included, and would likely account for a fair proportion of diesel consumption.
- In addition to some methodological challenges to using fuel sales data, a major drawback is the lack of information on fuel sales through card lock stations, which are not included with the data.[9] 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 5,260 tonnes in 2010. If that is approximately accurate, then that would constitute a small but not inconsiderable omission, as Nelson's 2010 GHG

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

emissions are estimated at 66,600 tonnes of CO_2e excluding most commercial vehicles. 5,260 tonnes would be about 8% of this.

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 and that will have quantifiable impacts are incorporated.

Assumptions related to projections are as follows:

- The Province's incremental steps to net zero energy ready buildings by 2032, via the BC Energy Step Code
- Federal and provincial tailpipe emissions standards: new light duty vehicle emissions decline from 200 g CO_2e/km in 2015 to 119 g CO_2e/km in 2025 (Federal policy), and then decline again to 105 g CO_2e/km in 2030 (Provincial strengthening of this policy). This is for new vehicles, and is included in the projections taking account of vehicle turnover rates
- Renewable & low carbon transportation fuel standards: 20% by 2030, as in CleanBC Plan
- An average annual decrease of 1.2% in natural gas consumption per residential connection is included, to align with FortisBC planning
- The Province's CleanBC Plan Zero Emission Vehicle Mandate of 100% of new vehicles by 2040. From the impacts of this, in our BAU scenario we assume that the proportion of electric vehicles on Nelson roads will be:
    - 1% in 2025
    - 2% in 2030
    - 13% in 2040
    - 66% in 2050 (even with 100% of all new vehicles sold having zero emissions, there is still a lag with vehicle turnover rates)
- How the impacts of a changing climate will affect building energy consumption:
    - Climate change data for the region was obtained from ClimateData.ca. CEA obtained this from the "downloads" section of the website, selected the BCCAQv2 (annual) dataset, Heating Degree Days (HDD's) or Cooling Degree Days (CDD's) variables, and the location on the map to be analysed
    - 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. As RCP 6.0 scenario not available on ClimateData.ca, RCP 4.5 (median values) were used as a proxy even though this is a more conservative scenario
    - Decreases in residential and commercial natural gas consumption are assumed to be proportional to decreases in 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

- Based on ClimateData.ca RCP 4.5 median values, the 30 year average of HDD's around 2018 are 4,342, and in 2050 they will be 3,753
- Decreases in residential and commercial electricity consumption are 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 CDD's. These proportions were obtained from the Navigant 2016 Conservation Potential Review for BC Hydro
- Based on ClimateData.ca RCP 4.5 median values, the 30 year average of CDD's around 2018 are 54, and in 2050 they will be 132

Appendix 2 – Energy & Emissions Inventories, Raw Data

This appendix contains the raw energy & emissions inventory data for each complete inventory year: 2007, 2010, and 2012-2018

2007

Sector	Subsector Desc	Measurement Desc	Energy (GJ)	CO2E (t)
On-Road Transportation	Mostly Light Duty Cars	Gasoline	515,209	35,243
On-Road Transportation	Mostly Heavy Duty Trucks	Diesel Fuel	55,332	3,849
Solid Waste	Community Solid Waste	Solid Waste		5,339
Buildings	Residential	Electricity	159,305	124
Buildings	Residential	Natural Gas	260,062	12,970
Buildings	Residential	Propane	6,658	407
Buildings	Residential	Heating Oil	1,332	91
Buildings	Residential	Wood	101,861	1,943
Buildings	Commercial/Small-Medium Industrial	Electricity	178,525	139
Buildings	Commercial/Small-Medium Industrial	Natural Gas	225,093	11,226
Buildings	Commercial/Small-Medium Industrial	Propane	1,229	75

2010

Sector	Subsector Desc	Measurement Desc	Energy (GJ)	CO2E (t)
On-Road Transportation	Mostly Light Duty Cars	Gasoline	491,958	31,880
On-Road Transportation	Mostly Heavy Duty Trucks	Diesel Fuel	70,844	4,745
Solid Waste	Community Solid Waste	Solid Waste		5,037
Buildings	Residential	Electricity	163,114	124
Buildings	Residential	Natural Gas	238,345	11,887
Buildings	Residential	Propane	6,308	386
Buildings	Residential	Heating Oil	1,262	86
Buildings	Residential	Wood	96,520	1,842
Buildings	Commercial/Small-Medium Industrial	Electricity	165,844	126
Buildings	Commercial/Small-Medium Industrial	Natural Gas	208,151	10,381
Buildings	Commercial/Small-Medium Industrial	Propane	1,208	74

2012

Sector	Subsector Desc	Measurement Desc	Energy (GJ)	CO2E (t)
On-Road Transportation	Mostly Light Duty Cars	Gasoline	477,068	30,915
On-Road Transportation	Mostly Heavy Duty Trucks	Diesel Fuel	69,264	4,639
Solid Waste	Community Solid Waste	Solid Waste		5,934
Buildings	Residential	Electricity	166,680	68
Buildings	Residential	Natural Gas	234,776	11,709
Buildings	Residential	Propane	6,539	400
Buildings	Residential	Heating Oil	1,308	89
Buildings	Residential	Wood	100,039	1,909
Buildings	Commercial/Small-Medium Industrial	Electricity	176,400	72
Buildings	Commercial/Small-Medium Industrial	Natural Gas	216,804	10,813
Buildings	Commercial/Small-Medium Industrial	Propane	1,217	74

2013

Sector	Subsector Desc	Measurement Desc	Energy (GJ)	CO2E (t)
On-Road Transportation	Mostly Light Duty Cars	Gasoline	463,131	30,012
On-Road Transportation	Mostly Heavy Duty Trucks	Diesel Fuel	70,181	4,701
Solid Waste	Community Solid Waste	Solid Waste		7,229
Buildings	Residential	Electricity	161,175	59
Buildings	Residential	Natural Gas	243,749	12,157
Buildings	Residential	Propane	6,635	406
Buildings	Residential	Heating Oil	1,327	91
Buildings	Residential	Wood	101,516	1,937
Buildings	Commercial/Small-Medium Industrial	Electricity	175,299	64
Buildings	Commercial/Small-Medium Industrial	Natural Gas	217,311	10,838
Buildings	Commercial/Small-Medium Industrial	Propane	1,220	75

2014

Sector	Subsector Description	Fuel	Energy (GJ)	CO2E (t)
On-Road Transportation	Mostly Light Duty Cars	Gasoline	543,005	35,188
On-Road Transportation	Mostly Heavy Duty Trucks	Diesel Fuel	76,669	5,135
Solid Waste	Community Solid Waste	Solid Waste		5,143
Buildings	Residential	Electricity	155,669	50
Buildings	Residential	Natural Gas	255,647	12,750
Buildings	Residential	Propane	6,607	404
Buildings	Residential	Heating Oil	1,321	90
Buildings	Residential	Wood	101,086	1,929
Buildings	Commercial/Small-Medium Industrial	Electricity	174,198	56
Buildings	Commercial/Small-Medium Industrial	Natural Gas	220,612	11,003
Buildings	Commercial/Small-Medium Industrial	Propane	1,260	77

2015

Sector	Subsector Desc	Measurement Desc	Energy (GJ)	CO2E (t)
On-Road Transportation	Mostly Light Duty Cars	Gasoline	563,735	36,531
On-Road Transportation	Mostly Heavy Duty Trucks	Diesel Fuel	74,945	5,020
Solid Waste	Community Solid Waste	Solid Waste		3,057
Buildings	Residential	Electricity	152,001	49
Buildings	Residential	Natural Gas	237,064	11,823
Buildings	Residential	Propane	6,038	369
Buildings	Residential	Heating Oil	1,208	83
Buildings	Residential	Wood	92,380	1,763
Buildings	Commercial/Small-Medium Industrial	Electricity	176,924	57
Buildings	Commercial/Small-Medium Industrial	Natural Gas	227,868	11,365
Buildings	Commercial/Small-Medium Industrial	Propane	1,292	79

2016

Sector	Subsector Desc	Measurement Desc	Energy (GJ)	CO2E (t)
On-Road Transportation	Mostly Light Duty Cars	Gasoline	649,787	42,107
On-Road Transportation	Mostly Heavy Duty Trucks	Diesel Fuel	80,994	5,425
Solid Waste	Community Solid Waste	Solid Waste		3,368
Buildings	Residential	Electricity	153,664	49
Buildings	Residential	Natural Gas	243,802	12,159
Buildings	Residential	Propane	6,109	374
Buildings	Residential	Heating Oil	1,222	84
Buildings	Residential	Wood	93,467	1,783
Buildings	Commercial/Small-Medium Industrial	Electricity	178,976	57
Buildings	Commercial/Small-Medium Industrial	Natural Gas	233,622	11,651
Buildings	Commercial/Small-Medium Industrial	Propane	1,306	80

2017

Sector	Subsector Desc	Measurement Desc	Energy (GJ)	CO2E (t)
On-Road Transportation	Mostly Light Duty Cars	Gasoline	677,306	43,891
On-Road Transportation	Mostly Heavy Duty Trucks	Diesel Fuel	87,503	5,861
Solid Waste	Community Solid Waste	Solid Waste		3,430
Buildings	Residential	Electricity	160,937	51
Buildings	Residential	Natural Gas	283,338	14,131
Buildings	Residential	Propane	7,253	444
Buildings	Residential	Heating Oil	1,451	99
Buildings	Residential	Wood	110,966	2,117
Buildings	Commercial/Small-Medium Industrial	Electricity	176,560	56
Buildings	Commercial/Small-Medium Industrial	Natural Gas	236,246	11,782
Buildings	Commercial/Small-Medium Industrial	Propane	1,333	82

2018

Sector	Subsector Desc	Measurement Desc	Energy (GJ)	CO2E (t)
On-Road Transportation	Mostly Light Duty Cars	Gasoline	629,206	40,774
On-Road Transportation	Mostly Heavy Duty Trucks	Diesel Fuel	83,134	5,568
Solid Waste	Community Solid Waste	Solid Waste		3,501
Buildings	Residential	Electricity	168,205	54
Buildings	Residential	Natural Gas	289,167	14,422
Buildings	Residential	Propane	7,142	437
Buildings	Residential	Heating Oil	1,428	98
Buildings	Residential	Wood	109,280	2,085
Buildings	Commercial/Small-Medium Industrial	Electricity	175,232	56
Buildings	Commercial/Small-Medium Industrial	Natural Gas	241,106	12,025
Buildings	Commercial/Small-Medium Industrial	Propane	1,361	83

Appendix 3 – Citizen Survey on Climate Change Results

The following indicates the results from the Citizen Survey on Climate Change conducted by the City of Nelson in 2020, and was used to populate wood, heating oil, and propane residential data:

Q8. What type of fuel do you use to heat/cool your home? Check all that apply.									
Answer Choices	Natural Gas	Electricity (Hydro)	Wood	Heating Oil	Alternative energy sources (solar, wind etc.)	Propane	Don't know	Other (please specify)	Total
Q6: Fully detached house	299	286	171	1	8	9	0	13	465
Q6: Semi-detached house/duplex	19	28	4	0	0	0	1	2	36
Q6: Townhouse/row house	10	4	1	0	0	1	1	0	14
Q6: Condo/apartment/secondary suite	24	49	0	0	1	0	1	1	63
Q6: Prefer not to answer	2	4	4	1	0	0	1	0	8
Total	354	371	180	2	9	10	4	16	586
Percentage								Answered	586
								Skipped	0

Appendix D: Co-Benefits of Focus

Co-benefits are the universal pay-offs or improvements that can arise from action taken to mitigate or adapt to climate change - above and beyond the numerous benefits expected to result from a more stable climate. Climate initiatives with co-benefits result in 'win-win' scenarios for the environment and the community, and can often save money and time when planned and implemented integratively.

The co-benefits to climate action that have been focused on throughout the process of Nelson Next's development have been informed by community engagement and best practice research, and they are as follows[1]:

Sustainable Behaviour: lifestyle changes that improve health benefits through more active mobility and changes in diet, reduced material consumption and waste, low carbon energy use
Improved Resource Efficiency: meeting needs with better use of water food and energy sources, circular economy sees more resume and recycling of local goods, reduce waste and consumption
Enhanced Resilience: improved food security, healthy natural ecosystems, emergency preparedness, energy self-sufficiency and backup power, protecting local buildings, roads, and other infrastructure from climate impact
Public Health: improved access to clean air, indoor air quality, healthy local food, safe and healthy homes, nature, safe walking and cycling routes, safer streets, human health and well-being
Economic Growth: increasing tax base, secure new jobs, value of goods and services, ingenuity, sustainable business opportunities, more locally owned businesses, builds shared wealth
Community Cohesion: increased neighborhood vibrancy, collective response to disruptions, increased access to transit and mobility, traditionally excluded groups are engaged to strengthen social bonds, vulnerable populations have increased security, protecting quality of life for future generations
Cost Savings: lower cost of home energy bills, car maintenance, and necessary goods, reduced energy poverty, reduced energy consumption associated with green building and retrofitting strategies
Biodiversity: Protection and preservation of local ecosystems and species at risk, clean, natural water sources, connectivity of green spaces, habitat protection, nature education, increased capacity of local soil, forests and wetlands to sequester carbon

[1] List informed by: Simon Fraser University, ACT Team. 2019. *Low Carbon Resilience Interventions: Case Studies.* Accessed 2020. https://act-adapt.org/wp-content/uploads/2020/04/ACT-LCR-Interventions.pdf & Carbon Discolsure Project. 2020. T*he Co-Benefits of Climate Action: Accelerating City-Level Ambition.* Accessed 2020. https://6fefcbb86e61af1b2fc4-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/005/329/original/CDP_Co-benefits_analysis.pdf?1597235231#:~:text=What%20is%20a%20co%2Dbenefit,through%20expansion%20of%20green%20spac e