

Whatcom County Draft Climate Action Plan

July 2021

Preface

The Climate Impact Advisory Committee was created in 2017 by the Whatcom County Council under Ordinance 2017-080, Whatcom Code Chapter 2.126. The Whatcom County Council established the goal of 100% renewable energy use within County operations and the larger Whatcom County community.

The Whatcom County Climate Impact Advisory Committee (CIAC) has been tasked with revising the County’s Climate Action Plan (CAP) at a minimum of every five years. The CIAC is entirely composed of volunteers from our community who have spent many months researching, writing, and editing this Climate Action Plan. As requested by the County Council this plan provides recommendations for both reducing and/or mitigating greenhouse gas emissions and adapting to the inevitable changes occurring from climate disruption.

The recommendations in this Whatcom Climate Action Plan were informed by key background reports from Cascadia Consulting Group that included Whatcom Climate Trends and Projected Impacts, Whatcom County Greenhouse Gas Inventory 2017, and Vulnerability Assessments. In addition, the recommendations or strategies in this Climate Action Plan are aligned with the Washington 2021 State Energy Strategy.

The CIAC has also drawn heavily on the knowledge of stakeholders in Whatcom County. In 2019 volunteers from the CIAC and the local League of Women Voters interviewed over 120 community leaders and stakeholders in the County to ask them what they would like to see in a revised climate action plan. This Climate Action Plan incorporates many of the ideas from this early community outreach effort.

Additionally, numerous subject area experts in the community helped develop the recommendations and/or review draft content. The CIAC is grateful for the support it has received in compiling this report as well as the support from Whatcom County staff and the County Council during the development and publication of this Climate Action Plan.

Climate Impact Advisory Committee (CIAC) Members

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William Bethel	Katherine Kissinger, <i>Secretary</i>	Treva Coe
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Key Supporting Documents:

- [Whatcom County Climate Action Plan: Summary of Observed Trends and Projected Climate Change Impacts](#), prepared by Cascadia Consulting Group, January 2020 (website)

- [Whatcom County Greenhouse Gas Inventory 2017](#), prepared by Cascadia Consulting Group, July 2020.
- Vulnerability Assessments Toolkit, prepared by Cascadia Consulting Group, 2020
- [Washington 2021 State Energy Strategy](#), Transitioning to an Equitable Clean Energy Future, December 2020, prepared by the Washington Department of Commerce.
- [Community Research Project Report](#), 2019

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List of Acronyms

Acronym	Full Name
AAC	Agriculture Advisory Committee
BSEL	Bioproducts Science and Engineering Laboratory
<i>bp</i>	British Petroleum
CAP	Climate Action Plan
CCSU or CCS	Carbon Capture Storage and Utilization or Carbon Capture and Storage
CEF	Clean Energy Fund
CETA	Clean Energy Transformation Act
cfs	Cubic feet per second – a measure of water flow
CH ₄	Methane
CIAC	Climate Impact Advisory Committee
CNG	Cascade Natural Gas Corporation
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide equivalent
CoSMoS	Coastal Storm Modeling System
COVID-19	Coronavirus Disease of 2019
C-PACER	Commercial Property Assessed Clean Energy + Resiliency
CRP	Conservation Reserve Program
DER	Distributed Energy Resources
DG	Distributed Generation
DLC	DesignLights Consortium
DNR	Washington Department of Natural Resources
DR	Demand Response
EIA	Energy Information Administration
E/VMT	Emissions per Vehicle Mile Traveled
EPA	Environmental Protection Agency
EV	Electric vehicle
°F	Degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FTE	Full Time Equivalent
GHG	Greenhouse Gas
GMA	Growth Management Act

ICE	Internal combustion engine
IPCC	Intergovernmental Panel on Climate Change
KWh	Kilowatt hour
LENS model	Lynden-Everson-Nooksack-Sumas model (surface/groundwater)
MJ	Megajoule
MT	Metric Tons
MW	Megawatt
NERC	North American Electric Reliability Corporation
NGO or NGOs	Non-Governmental Organization(s)
NOX	Nitrogen Oxides
NSEA	Nooksack Salmon Enhancement Association
NZC	Net Zero Carbon
PACE	Property Assessed Clean Energy
pH	potential of Hydrogen
PDR	Purchase and Development Rights
PNNL	Pacific Northwest National Laboratory
PSE	Puget Sound Energy
PUD1	Whatcom Public Utility District No 1
PV	Photovoltaics (solar)
SMP	Shoreline Management Program
SOV	Single Occupancy Vehicle
TDM	Transportation Demand Management
TNC	Transportation Network Companies
TOD	Transit Oriented Development
UGA	Urban Growth Area
UTC	Utilities and Transportation Commission
VMT	Vehicle Miles Traveled
WCOG	Whatcom Council of Governments
WRIA	Water Resource Inventory Area (Watershed Management Board)
WTA	Whatcom Transit Authority
WUI	Wildland/Urban Interfaces

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Executive Summary

We write this executive summary soon after our County experienced a record-breaking 3-day heat wave that exceeded 100°F in many areas of the Pacific Northwest including Whatcom County. The effects of this heat wave are still being assessed, but it is estimated that a billion small sea creatures – including mussels, clams, and snails – died along the coastlines of the Salish Sea and 25 to 30% of the raspberry crop in Whatcom County was likely destroyed. In addition, the snowpack in the North Cascades, which was measured at 130% of normal in March, contained no available water by July 6th.

The recent heat wave in the Pacific Northwest is just the latest in a long list of similar extreme weather events becoming more commonplace around the world. Although we are often told that we cannot equate weather events with climate change, 27 international climate scientists in the World Weather Attribution group have found that this heat wave could not have occurred if the planet had not already warmed by about 2°F. A sobering finding from their models was that this event, previously expected to occur about once in 1000 years, can be expected every 5 to 10 years within the next 20 years with continued warming. The rate of global warming is alarming and our climate models to date have frequently underpredicted the impacts because of this rapid pace of change.

This update of the 2007 Climate Action Plan was two years in the making and much of the writing was completed by a dedicated group of community volunteers who drew heavily on the knowledge of County staff and stakeholders in the County. These volunteers also spent untold time researching the science and the best approaches for reducing greenhouse gas (GHG) emissions and adapting to the inevitable warming and associated climate impacts that are currently occurring and will continue with or without action at every level of government.

The Pathway to Climate Resilience

Our committee is in consensus that the most important recommendation to the Whatcom County Council and Executive is the necessity to establish an Office of Climate Action. This office would house staff dedicated to coordinating efforts across multiple County departments, providing critical information to County departments and the public, and promoting community engagement in projects that boost climate resilience. Without such an Office the County will miss multiple opportunities to implement the specific recommendations for climate mitigation and adaptation detailed in the following sections of this Report. Without an Office of Climate Action, the County will also miss the growing opportunities for funding from private, State and federal agencies, as well as opportunities to participate in the emerging clean fuel economy. The Office should be headed by a Senior Climate Advisor with wide knowledge of climate policy and science, in addition to experience in public service. The office should also include a data analyst/information specialist dedicated to providing and publicizing information relating to local climate and its effects, as well as monitoring the progress of our efforts toward mitigation and adaptation.

This Climate Action Plan closely follows the science and technology recommendations that are widely accepted by policy experts across the globe. Experts agree that the key to reducing greenhouse gas (GHG) emissions is the electrification of systems that currently use fossil fuels with clean electricity

(defined as electricity that is generated without emissions). This is the only way we can reduce emissions rapidly in the next three decades. It is also clear that if we do not start immediately, this mountain of emissions will be too steep to climb. New technologies are rapidly evolving, and all levels of government need to continue to support research, development, and deployment, but we cannot wait for a silver bullet to save us. We must act now with the tools we have.

Electrification of buildings and transportation, combined with accelerated conversion to renewable sources of energy, could alone reduce emissions by 70 to 80% across the US and create a much healthier environment for our families, both indoors and out. Minor contributors to emissions such as gas stovetops and fireplaces are not the issue. Instead, we need to encourage a transition away from space and water heating with gas, a major source of CO₂ emissions in buildings. Electric vehicle technology is accelerating so fast that many major car manufacturers will curtail production of gasoline-powered vehicles by 2035. Providing the required amount of electricity will take major investments in infrastructure, as well as collaboration and planning among governments, utilities and communities.

In addition to electrification of transportation, we need to greatly reduce the amount of single occupancy vehicle travel. Residents, businesses, municipalities and the County should all work together to significantly expand interconnected multimodal transportation, especially non-motorized trails that are separated from busy and congested thoroughfares, to provide the public safe options for commuting.

Industrial point-source emissions are the County's largest source of emissions, contributing 51%--a fact we did not know until the greenhouse gas assessment for 2017 was completed in June 2020. Since the largest emissions source for the state is transportation, the state, Whatcom County, and the refineries should work together on win-win solutions to reduce transportation-related GHG emissions while securing long-term economic benefits for the County. Our petroleum refining industry and its highly-skilled workforce have the opportunity to become part of the statewide solution for reducing emissions through the production of low-carbon fuels and development of other renewable energy sources.

The County's effort to restrict the growth in industrial emissions (i.e., Cherry Point Amendment) is a good example of using the County's authority over land use to address climate change. Smart land use practices can reduce GHG emissions and also help us better adapt to the inevitable changes that are already occurring. We view land use as the bridge or fulcrum that can balance emissions from the built environment with storage or sequestration of carbon in our natural environment. Changes in zoning codes and regulations are also an effective way to reduce the amount of single-occupancy vehicle transportation by requiring emphasis on density, giving commuters alternative transportation options in existing and new neighborhoods, and preservation of green spaces.

Smart land use can also increase climate resilience to drought, flooding and wildfires. For example, wetlands not only store large quantities of carbon, but are also a critical component of our overall hydrologic system for water storage, filtration of contaminants, habitat for many different plant and animal species, and as a collection point for flood waters. Likewise, preservation of estuaries protects against storm surge in coastal areas and is a critical link in the food chain for saltwater and freshwater species. Stronger codes and regulations in wildland-urban interface, in addition to the overall reduction

in development potential in those areas, can reduce the frequency of wildfires and the resulting economic damage as well as enhancing the forestry economy.

The vast natural ecosystems in our forests, foothills, lowlands and flood plains can be used to increase carbon storage and build climate resilience. Climate adaptation efforts are essential so that our natural ecosystems can continue to thrive under a changing climate. When healthy, natural environmental systems can sequester large amounts of carbon and provide carbon storage. Adaptation will be difficult for some ecosystems and will likely require significant help from us to restore the damage that is already occurring and to prevent future damage.

Climate impacts are nowhere more visible than on our water supply. Whatcom County faces the challenge of too much water in the winter and early spring, combined with too little water in the later summer and early fall. Continued increases in the frequency of flooding and drought are very visible signs of our changing climate. Over the last 150 years or more, development has reduced the flood capacity of our river systems. In addition, natural water storage systems (snowpack, glaciers, and even our shallow groundwater aquifer) that would normally feed our river systems in late summer have been directly impacted by climate change or development or both.

Resolving uncertainty in our current and future water supply under climate change is the first step in understanding and dealing with this contentious issue. Restoring and protecting our streamflow levels and temperature to ensure year-round salmon migration and survival is the greatest climate challenge currently facing Whatcom County. Fortunately, there are many tools we can employ to adapt to climate change such as incentivizing efficiency in water consumption systems, rebuilding the connectivity of our fragmented hydrologic system, and enhancing estuarine, marine shoreline and coastal wetland habitats for fish and shellfish.

Agriculture can also play an important role in water use efficiency, increasing soil carbon storage, and also building food security and enhancing the local agriculture economy. Regenerative farming practices have been shown to enhance carbon storage, increase soil moisture, and reduce the amount of fertilizer needed. These practices can be economically incentivized by establishing a carbon market in Whatcom County to reward farmers for increasing their soil carbon. The County also needs to change codes for renewable energy siting so farmers can benefit from the additional income generated from these installations.

The large amount of forested land in Whatcom County is a huge sink for atmospheric carbon and needs to be wisely managed. A baseline for carbon sequestration by forests was recently established using information from 2000 to 2010. Our forests were found to sequester, on average, 4 million MT CO₂e per year, roughly equal to half of the emissions in the County. This important carbon sink should be monitored every 5 years as an indicator of forest health and land use changes. Revising decades old forest management practices will also be necessary to maintain our forest economy and reduce destruction from wildfires and disease.

Our natural ecosystem services provide clean water, clean air, soil productivity, water storage, flood control and many other services that are necessary for life on Earth. Climate change is occurring faster than our ecosystems can adapt therefore we must do everything we can to preserve these systems. This

includes promoting community education on the importance of preserving ecosystems such as wetlands and wildlife corridors. Some land use codes may need revision based on current and future climate conditions and the County can provide technical, logistical and financial support for community organizations that are restoring and enhancing ecosystems. A long-term monitoring program of ecosystem health is essential.

The longer we delay climate action, the more difficult and expensive it will be to preserve the natural systems that support life as we know it on Earth. The need to combat climate change and prevent irreversible damage to our County and planet is urgent and we must rise to the challenge facing us, for our own sake and for that of future generations.

Key Priorities in the Whatcom County Climate Action Plan

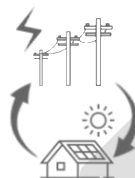
County Implementation



In order to accomplish climate resilience in Whatcom County through the many strategies and actions recommended by this plan, the County needs to establish and staff an Office of Climate Action.

- Establish an Office of Climate Action within the Office of the Executive.
- Appoint an interim director from within current County staff while pursuing funding to hire a permanent Senior Climate Advisor to head the office.
- Hire a data analyst/information specialist to begin compiling relevant climate data and making them available to staff and the community.

Electricity and Buildings



Electrification of buildings is one of the most important strategies for quickly reducing emissions, especially if electricity generation comes from clean, emissions free sources. Climate resilience occurs when buildings can operate at times without utility power & can provide power back to the grid. In essence, buildings become grid assets to help manage the electricity load on the grid.

- Commit to net zero carbon emissions for government buildings & create resilience hubs for emergencies & community benefits.
- Accelerate deployment of distributed energy resources & broadband while ensuring equity & energy resilience.
- Develop an equity-based financing plan to expand energy efficiency upgrades and electrification of space and water heaters.
- Promote leadership at the state and county levels through support of climate legislation and demonstration projects that promote climate resilience.

Industry



Because industry is the largest GHG emitter in Whatcom County, rapid reductions in industry emissions are essential. The state, County and refineries need to work together to successfully transition to the production of clean fuels and ensure a strong long-term manufacturing base and the jobs that come with it.

- Facilitate a solutions-focused collaboration with *bp's* Cherry Point plant manager and energy experts in academia, state, and federal governments to discuss ways to reduce refinery emissions 50% by 2030.
- Promote the research, development, & collaboration needed to build a hydrogen electrolysis facility to create green hydrogen in Whatcom County.
- Establish a regional center for research, development and demonstration to accelerate the development of low carbon fuels and building materials modeled after Washington's Maritime Blue Strategy.

Transportation



Transportation is already on a rapid pathway to decarbonization with the growing transition to EVs. The County can make this transition equitable with new programs, & updates in regulations and codes that accelerate EV charging infrastructure and provide multimodal transportation options for County residents.

- Accelerate adoption of EVs through pooled EV purchases, charging stations at all government buildings and parks, and building codes that promote EV charging at businesses and homes.
- Implement the regional trails plan for commuting and recreation and provide safe active transportation routes for schools.
- Explore and encourage electrification of buses throughout the county.

Waste



Waste is an expanding problem for disposal & consumer expense, but information on the magnitude of this problem is unavailable. Nevertheless, much can still be done through codes to reduce the amount of waste we generate and encourage recycling.

- Collect the necessary data through expanded audits to evaluate the success of existing programs & the benefit of new programs.
- Encourage the eliminate single use plastic bags, containers & utensils.
- Expand the Food Recovery Program to add a food kitchen to reduce food waste.

Land Use



Land use zoning and codes are perhaps the most important tools that the County can use to mitigate emissions in industry, buildings, transportation, and waste. These tools also help us adapt to climate change and ultimately create climate resilience.

- Create a climate-resilient regulatory framework for new County development.
- Use regulations to enhance active & public transportation systems & infrastructure.
- Require a climate-focused risk assessment for all County infrastructure.
- Protect ecological zones that create climate resilience such as riparian areas, floodplains, shorelines, wetlands & migrations corridors.

Water Resources and Fisheries



No climate impact is as predominant as its effect on Whatcom's water resources and fisheries. Water availability also impacts agriculture, forestry and our important plant and animal ecosystems. It is currently the most important and contentious issue in the County. Fortunately, there are approaches we can employ now to help these important ecosystems adapt to climate change.

- Resolve uncertainty in current & future water supply under climate change.
- Restore and protect watersheds that enhance streamflow and reduce water temperature to ensure year-round salmon migration & survival.
- Incentivize efficiency upgrades to water consumption systems and new augmentation approaches.
- Rebuild connectivity of our fragmented hydrologic system to increase natural water storage on the landscape & reduce flood damage.
- Enhance estuarine, marine shoreline and coastal wetland habitats for fish and shellfish.

Agriculture



Farmers have long been recognized as stewards of our land and can play an important role in efforts to adapt to our changing climate. Low till or no till management practices increase soil carbon and moisture content. Irrigation efficiency and improved management of drainage can also enhance soil water storage. Development of heat- and drought- resistant crops will be essential under a changing climate.

- Adopt climate smart farm management practices that maximize soil carbon storage and increase water and nutrient availability.
- Ensure a minimum of 100,000 acres of farmland is available for agriculture including rezoning the Rural Study Areas to Agricultural zoning.
- Reduce agriculture emissions & increase renewable energy, while providing farmers with new income opportunities.
- Promote use of climate research including drought- and heat-resistant crops.

Forestry



Our forests are an important part of our economy providing recreation, wood products, and cultural identity. We must adapt our decades old forest management practices to the drier and warmer conditions today and in the future or suffer the economic and health impacts of more wildfires and disease. This starts with measuring the health of our forests & adapting our forest practices to maximize health.

- Protect, enhance, & monitor carbon storage and sequestration in forest ecosystems through implementation of a carbon credit program and other mechanisms.
- Increase forest health, survival & climate resilience using forest management practices that reduce wildfire risk, increase soil moisture, streamflows, & preserve wildlife habitat.
- Promote climate resilient planning & programs to maintain our forest economy for recreation and wood products.
- Reduce development pressure on rural forestry and other forested lands through re-zones and voluntary conservation easements

Ecosystems



Although many ecosystems are already covered above, this chapter emphasizes the crosscutting issues necessary to adapt to climate change that are common across natural environment systems. The common themes are community education, revising land use codes, financial support for restoration, and implementing a long-term monitoring system for ecosystem health.

- Develop and implement zoning regulations that protect wildlife climate migration corridors
- Revise land use & development codes based on current & projected climate impacts to reduce damage & enhance resilience.
- Provide technical, logistical, and financial support for community efforts to restore & enhance ecosystems.
- Implement long-term monitoring to assess the impact of climate on ecosystem health.

Crosscutting Issues

Although the climate mitigation and adaptation strategies and actions are organized by topic areas in this report, several crosscutting themes reoccur in multiple areas. These crosscutting issues will need to be actively coordinated across County departments and among senior County staff and the County Council.

- 1. Leadership.** County climate action efforts are largely invisible to Whatcom residents. There is no single person who is dedicated to coordinate climate action across departments, seek state and federal funding for programs, and is accountable to the public. During state legislation sessions, the County needs to voice its position on various bills that support climate action recommendations. The Senior Climate Advisor in the Office of Climate action should, under the guidance of the Executive and Council, provide this leadership.
- 2. Equity and Inclusion.** Equity, especially in energy upgrades, and inclusion of a representative cross-section of the community in the planning and priorities associated with climate actions is essential as the County moves forward. The goal of the County should be to protect the most vulnerable communities first. Climate risk may include exposure to excessive heat or cold temperatures and poor air quality. Climate risk of flooding, drought, and wildfires is highly dependent on location. These issues disproportionately impact low-income households, people of color, and people on fixed incomes.
- 3. Honor Tribal Treaties and Sovereignty.** The County needs to remain committed to our government-to-government relationship with our sovereign tribal nations when implementing climate recommendations in this plan. For example, Cherry Point is acknowledged as the ancestral homelands of the Lummi Nation, which has historic burial grounds located in the heart of this industrial zone. Cherry Point also holds traditional reef net fishing areas as well as harvesting for salmon and crab. The County needs to continue honoring Tribal treaty rights when preserving critical habitats and fully recognize land, water, and resource rights, and protect cultural sites.
- 4. Evaluation of Climate Impacts in All Aspects of Planning.** Climate impact and risk (present and future) need to be evaluated in all aspects of planning to understand the potential impact on carbon emissions:
 - a. In the Comprehensive Plan;
 - b. In the planning process for new County infrastructure (such as roads, bridges, and buildings);
 - c. Regulations for urban growth areas and new industrial, commercial and residential developments (density, building codes, and multimodal transportation plans);
 - d. Zoning for rural and commercial forest lands;
 - e. Shoreline Management Plan
- 5. Increased Resources for Planning, Data Analysis and Outreach.** The data analyst/information specialist in the Office of Climate Action should provide necessary information services. A common theme throughout the different sectors was a general lack of readily accessible data for both planning and evaluating the success or outcomes of various programs. Information on the carbon footprint of County facilities was not available nor the carbon footprint of employee commuting. Energy savings for building efficiency upgrades were also not available. Although the County

produced an excellent solid waste management plan, we do not know if this planning is impacting the trend in per capita waste.

In the natural environment multiple organizations collect information such as streamflow levels, temperature, and water quality, yet the County lacks a centralized database that could serve as a repository for this information to evaluate trends. Snohomish County has such a system at tableau.com, where information can be accessed by the public and analyzed and graphed to indicate trends and get a better understanding of changes occurring over time. Whatcom County needs to sponsor such a system.

Community outreach is also very important, especially if this outreach reaches a diversity of viewpoints. A diversity of viewpoints can lead to better planning and outcomes, while at the same time generating community buy-in. Community workshops should be considered for designing new programs that embrace the guiding principles that are discussed in Section 1 of this report.

- 6. Need for Financial Incentives and Mechanisms.** To quickly reduce emission, the County will need to provide financial incentives and mechanisms. The initial cost of energy efficiency upgrades can be steep for homeowners and businesses. Ecosystem restoration and floodplain management projects can also be very expensive. There are many sources of stimulus and infrastructure funds available at the state and federal levels that could help fund new programs, yet individual staff may be unaware of these opportunities or do not have the time to apply for grants.

Another concept that crosscuts the Natural Environment section of this report is the need for a Carbon Market to incentivize management practices that increase carbon storage in soils and plants. A carbon market sells offsets or carbon credits to businesses that are large carbon emitters and financially rewards landowners who store carbon. A similar idea is being promoted locally to form the [Kushan Carbon Trust](#). The trust does not own the land, but instead buys an easement to ensure long-term storage of the carbon. The landowner generates income from the carbon credits and is responsible for protecting the carbon asset.

- 7. Need for Universal Broadband Access.** Universal broadband access was recommended in several sectors. Reliable internet access can be used to remotely control energy use in homes and reduces transportation emissions by enabling work from remote locations. Social equity is not achieved if broadband is only available to wealthier households or those outside rural areas.
- 8. Benefit of Research, Development and Demonstration Projects.** Although this Climate Action Plan relies on existing technologies, many of these available technologies are not widely deployed and may be unfamiliar to the public. Local demonstration projects are a very effective way to test new technologies and show residents and builders their advantages. The County should design and execute demonstration projects through collaborations with local research universities, national laboratories, state and federal agencies and the private businesses. Data and information collected from demonstration projects can also be used to support changes in existing regulations or even state laws and legislation. This may especially be important for modernizing our state water laws.

Organization of the Climate Action Plan

This Climate Action Plan covers both the Built and Natural Environments in Whatcom County. Although the plan is long, it provides a detailed roadmap of the actions that need to be accomplished in order to avoid the most devastating impacts of climate change and do our part to meet state emission targets.

This plan is organized as follows with the primary authors listed in parentheses:

Section 1 – “Climate Change in Whatcom County” discusses climate impacts, terminology, our 2017 greenhouse gas assessment, and the guiding principles for our strategies and actions. (Ellyn Murphy)

Section 2 - "The Built Environment" Electricity & Buildings (Cynthia Mitchell, David Hostetler, Ellyn Murphy), Industry (Sue Gunn), Transportation (Phil Thompson), and Waste (Ellyn Murphy). These are the main sources of emissions, and we present the solutions and strategies to reduce emissions.

Section 3 - "Natural Environment" Land Use (Kaylee Galloway), Water Resources and Fisheries (Chris Elder, Ellyn Murphy, Stevan Harrell), Agriculture (Stevan Harrell), Forestry (Ellyn Murphy) and Ecosystems (Katherine Kissinger). This section discusses the impacts of climate change on these areas and how these areas can be part of the solution.

Section 4 - "Implementation" suggests how best to coordinate and implement the strategies and actions suggested in Sections 2 & 3 and the Appendix (Stevan Harrell). Good management oversight of climate actions includes community engagement, a stepwise process for defining individual projects, coordinating project execution, assessing outcomes, and adapting next steps based on current circumstances.

Section 5 - Appendix - Details of the strategies, actions, and benefits of the proposed recommendations.

The CIAC would also like to thank the numerous stakeholders in the community that participated in strategy development and reviewed sections and chapters of this report. Without their expertise and willingness to help, we could not have completed such a comprehensive plan and are grateful for their support. These participants are listed in the appendices for the various sectors covered in this report.

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**SECTION 1 - CLIMATE CHANGE IN
WHATCOM COUNTY**

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Much has changed since Whatcom County released the 2007 Climate Action Plan and the window of opportunity for avoiding the worst impacts of climate change has narrowed.

The climate crisis is like a slow-moving pandemic impacting the world's ecosystems, those systems upon which all life on earth depends to survive and thrive. There is no climate vaccine, but we have the tools to control the climate pandemic if we choose to use them.

Whatcom County's challenge is straightforward but by no means easy. To avoid irreversible damage to these natural systems, it is estimated that the global community needs to reduce greenhouse gas (GHG) emissions by about 7.6% every year until 2030 to meet the Paris target of no more than 2.7°F warming.¹ Today we live in a world where the global average temperature already has risen almost 2°F above pre-industrial levels. On our current track, temperatures are expected to rise by almost 6°F, bringing even wider-ranging and more destructive climate impacts.

Governments at all levels, many global corporations, and millions of private citizens are acting to reduce their GHG emissions. Many of the giants of US industry, such as Apple,² Amazon,³ and Microsoft,⁴ which were built on science, have committed to net zero or net negative carbon by 2030. These are aggressive plans to decarbonize in a relatively short period of time. But this is what the scientific evidence and modeling tells us is needed.

All greenhouse gas emissions contribute to worldwide impacts from climate change, but only we can act locally to do our part in solving the problem.

In fact, utilities and fossil fuel companies are adapting – acknowledging that fossil assets such as coal-fired power plants are becoming cost inefficient to operate. Government policy shifts in favor of cleaner energy are hastening the stranding of some in-ground fossil fuel reserves. British Petroleum (*bp*) and Shell wrote off billions in such assets, citing Covid-19 and climate change.⁵ *bp* itself set a net zero carbon target for 2050⁶ and recently, went even farther and committed to reducing oil production by more than 40% by 2030 and emissions from refining by nearly 30%. In the next decade, *bp* plans to invest \$50

¹ Cut Global Emissions by 7.6% Every Year for Next Decade to Meet 1.5°C Paris Target – UN Report, Nov 26, 2019. <https://unfccc.int/news/cut-global-emissions-by-76-percent-every-year-for-next-decade-to-meet-15degc-paris-target-un-report#:~:text=Cut%20Global%20Emissions%20by%207.6,Paris%20Target%20%2D%20UN%20Report%20%7C%20UNFCCC>

² Apple commits to be 100% carbon neutral for its supply chain and products by 2030, July 21, 2020. <https://nr.apple.com/dE9n5d3o7T>

³ We are all in on The Climate Pledge: net zero carbon by 2040, June 23, 2020. <https://blog.aboutamazon.com/sustainability/we-are-all-in-on-the-climate-pledge-net-zero-carbon-by-2040>

⁴ Jay Greene, "Microsoft pledges to remove more carbon than it produces by 2030," Jan 16, 2020, *The Washington Post*. <https://www.washingtonpost.com/technology/2020/01/16/microsoft-climate-change-pledge/>

⁵ Nicholas Kuznets, "BP and Shell Write Off Billions in Assets, Citing Covid-19 and Climate Change." *Inside Climate News*, July 2, 2020. <https://insideclimatenews.org/news/01072020/bp-shell-coronavirus-climate-change>

⁶ Jillian Ambrose, "*bp* sets net zero carbon target for 2050," Feb 12, 2020, *The Guardian*. <https://www.theguardian.com/business/2020/feb/12/bp-sets-net-zero-carbon-target-for-2050>

billion in renewable energy.⁷ How will this impact Whatcom County, home to two large refineries owned by *bp* and Phillips 66?

Fortunately, we already have the cost competitive technology needed to reverse our current climate trajectory.⁸ Just as we mobilized the entire US economy to win World War II, we can do the same today with significantly smaller shifts in economic activity.⁸ The renewable energy sector has become a major US employer with over 3 million workers and outnumbers fossil fuel workers by 3-to-1.^{9,10} One recent estimate suggests that as many as 15 to 20 million jobs would be created over the next decade through a serious decarbonization effort.¹¹

Seventy to 80% of US carbon emissions could be eliminated by 2035 using the following five commercially available technologies: wind and solar power plants, rooftop solar, electric vehicles, heat pumps, and batteries (Fig. 1.1).⁸

Eliminating fossil fuels in the electricity system and widespread use of EVs would address more than 70% of total emissions. It's time to get started.

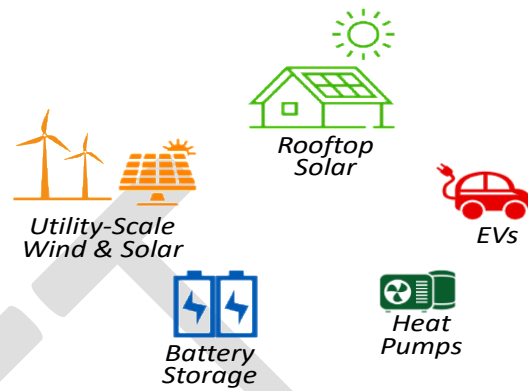


Figure 1.1: Five available technologies to reduce carbon emissions by 70 to 80%.

⁷ David Blackmon, “*bp* Commits Big Investments Toward Its ‘Net Zero Emissions by 2050’ Target,” *Forbes*. <https://www.forbes.com/sites/davidblackmon/2020/08/04/bp-commits-big-investments-towards-its-net-zero-emissions-by-2050-target/#18662c8c2003>.

⁸ David Roberts, “How to drive fossil fuels out of the US economy, quickly” *Vox*. <https://www.vox.com/energy-and-environment/21349200/climate-change-fossil-fuels-rewiring-america-electrify>

⁹ Anna McGinn “Fact Sheet – Jobs in Renewable Energy, Energy Efficiency, and Resilience” (2019) Environmental and Energy Study Institute. <https://www.eesi.org/papers/view/fact-sheet-jobs-in-renewable-energy-energy-efficiency-and-resilience-2019#3>

¹⁰ Silvio Marcacci, “Renewable Energy Job Boom Creates Economic Opportunity as Coal Industry Slumps,” Apr 22, 2019. *Forbes*, <https://www.forbes.com/sites/energyinnovation/2019/04/22/renewable-energy-job-boom-creating-economic-opportunity-as-coal-industry-slumps/#4127763e3665>

¹¹ Saul Griffith, founder, and chief scientist of Otherlab (otherlab.com); co-founder of Rewiring America <https://www.rewiringamerica.org/>

Important Climate Concepts

GHG emissions are anthropogenically-produced heat-trapping gases in the atmosphere that result in global warming. The impacts of these emissions are dependent on where you live, even where you live in Whatcom County. For example, if you live on the coast, sea level rise and storm surge are a concern; if you live near the Nooksack River, flood intensity and frequency are a concern; and if you live in a wooded area, wildfires are a concern. Whatcom County must do its part to reduce emissions while addressing the impacts already occurring at the County level.

A **GHG assessment** is a detailed inventory of the GHGs released to the atmosphere during a given year. This assessment is divided into the major categories of GHG sources. **ClearPath**, a leading online software platform, was used for this report. ClearPath adheres to international protocols for GHG assessments and is available through Whatcom County’s membership in Local Governments for Sustainability.

Greenhouse gas emissions are reported in metric tons, MT, “carbon dioxide equivalents,” written CO₂e. This reflects that there are additional GHGs, such as methane and nitrous oxide that are important. Expressing these gases as carbon dioxide equivalents allows for more valid comparisons.

Climate resilience is our ultimate aim in planning for, and responding to, climate change. Resilience is “the capacity of a system, be it a person, a forest, a city or an economy, to deal with change and continue to function.”¹² Resilience is especially important given the uncertainty about the timing and magnitude of climate change impacts. In advocating for climate resilience, we acknowledge that change will continue to occur, and when it does, our built and natural systems can recover with proper planning and policy decisions.

Actions to combat climate change and its effects fall into two broad categories in this Climate Action Plan. **Mitigation** is the avoidance, reduction (and when possible, the total elimination) of heat-trapping emissions usually associated with human activity.

Adaptation is altering human behavior and/or systems to reduce or avoid the climate change impacts likely to occur despite any mitigation. Climate resilience requires both mitigation and adaptation (Fig. 1.2). This Plan’s climate adaptation strategies focus on these more localized effects in Whatcom County.

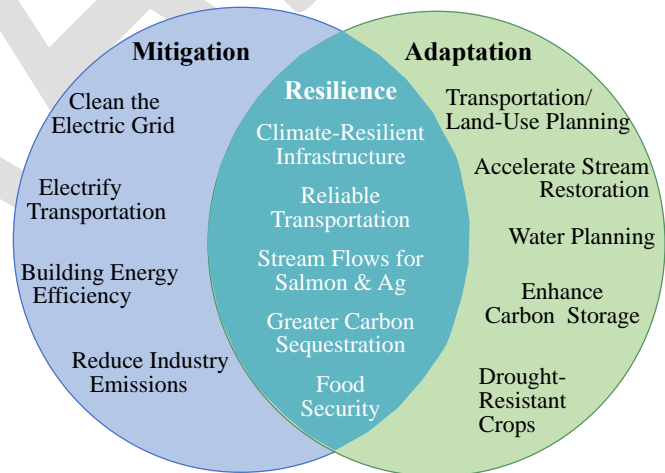


Figure 1.2: Climate resilience relies on implementing both mitigation and adaptation strategies.

¹² “Resilience is the New Sustainability,” March 25, 2019, *HydroPoint*.
<https://www.hydropoint.com/blog/resilience-is-the-new-sustainability/>

The content of this revised climate action plan has necessarily evolved since the 2007 Whatcom County Climate Action Plan.¹³ Nearly 15 years have passed with increasing impacts and damage of climate change requiring more adaptation coupled with mitigation. Economic and environmental impacts of climate change will inevitably worsen without more ambitious action at every level of government.

Climate vulnerability assessments are used to rate the susceptibility of a natural or human system to damage from climate change. Vulnerability is a function of exposure, sensitivity, and adaptive capacity. Vulnerability assessments were completed for transportation, land use and agriculture, freshwater, and ecosystems and species and are discussed in more detail under those topic areas in this report.

While the vulnerability ratings tend to be qualitative in nature, the underlying technical data demonstrates that the County government and its residents are facing severe and costly climate-related impacts. Adaptation planning and investment can avert much of the economic toll. Climate strategies and actions are designed to minimize disruption of Whatcom County's economy and environment, while increasing community resilience and improving long-term economic and public health. However, to succeed, the County will need to devote substantial resources now to avoid much higher climate-related costs down the road.

This updated Climate Action Plan reviews the current and projected climate impacts for Whatcom County and provides a roadmap of strategies and actions that are necessary to avoid or alleviate the most devastating impacts of climate change.

Observed Trends and Projected Impacts in Whatcom County

Cascadia Consulting Group's full climate science summary for Whatcom County is briefly summarized here.¹⁴

Temperature

- By the 2050s, the average year in Washington will likely be warmer than the hottest year of the 1900s.
- By the 2050s, average annual temperatures in Puget Sound are projected to increase by 4.2 °F to 5.5 °F under low- and high-emissions scenarios, respectively. By 2100, they are projected to be 5.5 °F to 9.1 °F warmer.
- Heat waves have increased in frequency every decade since the 1960s and are projected to continue to do so.¹⁵

¹³ Whatcom County Climate Protection and Energy Conservation Action Plan, September, 2007.

<https://whatcomcounty.us/DocumentCenter/View/36617/Whatcom-County-2007-Climate-Protection-and-Energy-Plan>

¹⁴ Whatcom County Greenhouse Gas Inventory 2017, prepared in 2020 by Cascadia Consulting Group:

https://www.whatcomcounty.us/DocumentCenter/View/48029/WhatcomCountyGHGInventory_DRAFT_June2020

¹⁵ Climate Change Indicators: Heat Waves. <https://www.epa.gov/climate-indicators/climate-change-indicators-heat-waves>

Precipitation

- Average annual precipitation in Puget Sound is projected to increase by 4% to 5% by the 2050s under low- and high-emissions scenarios, respectively, and another 2% by the 2080s under both emissions scenarios.
- Wetter conditions are anticipated in spring, fall, and winter, while summer will likely continue to get drier and warmer in Puget Sound. By the 2050s, summer precipitation is projected to decrease by 50% under a high-emissions scenario.
- Under a high-emissions scenario, heavy precipitation events west of the Cascades are projected to increase in intensity by 22% by the 2080s—meaning events will bring 22% more rain and a higher frequency.

Hydrology

- Mountains draining into Puget Sound are projected to have 29% less snowpack by the 2040s.
- By the 2040s, 40 miles of the Nooksack River basin will exceed the thermal tolerance of adult salmon, compared to zero miles currently.¹⁶
- The Nooksack River basin is anticipated to transition from being a mixed snow and rain-dominant system to a rain-dominant system in the future. By the 2080s, peak streamflow in the Nooksack River is projected to shift approximately 27 days earlier in the year.
- Flooding in the Nooksack River is expected to become more intense and frequent. Under a moderate emissions scenario, streamflow in the Nooksack River during a 100-year flood event is projected to increase by 27% by the 2080s.
- Under a moderate emissions scenario, summer minimum streamflow in the Nooksack River is projected to decrease by 27% by the 2080s.

Sea Level Rise and Storm Surge

- By 2100, relative sea level rise in the Bellingham area is projected to be between 1.5 and 1.9 feet with a 50% likelihood of exceeding those values.
- Puget Sound coastlines, including Whatcom County, are expected to experience increased storm surge and high tide flooding due to sea level rise.

Wildfire

- By the 2050s, Western Washington is projected to have 12 more days per year with very high fire danger.
- By 2100, the time period between wildfires in the North Cascade ecoregion will shorten by a factor of 2.2 to 2.5.
- The median area burned annually from wildfire across the Northwest is projected to increase by 0.6 million hectares (1,482,000 acres) by the 2080s.

¹⁶ Floodplain by Design and The Nature Conservancy, 2018. Climate Change in the Nooksack River: A quick reference guide for local decision-makers: <https://cig.uw.edu/our-work/decision-support/floodplains-by-design/>

Air Quality

- In the future, Whatcom County’s air quality is likely to decline during periods of increased wildfire activity in the Pacific Northwest, especially during the summer and early fall.
- Warmer temperatures and increases in ozone pollution may reduce Whatcom County’s air quality and can affect sensitive vegetation and ecosystems.

Whatcom County Greenhouse Gas Challenge

Largely because of the industries at Cherry Point, Whatcom County emits more than double the GHG per capita as the state as a whole. We have 3% of the state’s population but generate almost 8% of its greenhouse gases. Even if we leave the industrial emissions aside, our per capita emissions are still 30% higher than the state average, because well over half our electricity is generated from fossil fuels.

Whatcom County emits more than double the GHG per capita as the state as a whole. We have 3% of the state’s population but generate almost 8% of its greenhouse gases.

Communitywide Emissions

Overall, our communitywide emissions grew 35% between the 2001 inventory that was the basis of the 2007 Climate Action Plan and the 2017 GHG assessment we use here, while population grew only 27% during that interval (Table 1). Because of our high emission rates, a rapid transition to clean energy here is imperative. It is a crucial element in the state’s effort to cut statewide emissions of GHG in half by 2030 and requires Whatcom’s rapid transition to a clean energy economy.

Table 1. Total Communitywide GHG emissions and County government emissions for 2000-2001 and 2017. Emissions are reported in MT of carbon dioxide equivalent (MT CO₂e). FTE is Full Time Equivalent.

Communitywide Inventory	2001	2017	% Change
Population	170,980	216,300	+27%
Residential Households	75,740	96,271	+27%
Total Emissions	2,750,728	7,583,578	+176%
Total Emissions (without Industrial point source emissions)	2,750,728	3,721,230	+35%
County Government Inventory	2000	2017	% Change
County Staff FTE’s	759	813	+7%
County Government Total Emissions	10,318	9,950	-4%

Our communitywide distribution of GHG emissions is very different when compared to statewide emissions. The categories in Figure 1.3 were previously established by the State Department of Ecology. Transportation is the largest emitter of GHGs in Washington State, followed by burning fossil fuels (principally natural gas) for buildings and water heating. The third category of emissions results from

electricity generated by fossil fuels, biomass, and waste. The fourth category is somewhat of a catch-all, including industrial point source, waste, and agriculture.

In Whatcom County, industrial point source emissions constitute 51% of this combined category of industry, waste and agriculture that together represents over half of Whatcom’s GHG emissions. GHG emissions from electricity generation is the second highest category in Whatcom County because almost 60% of our electricity is generated using fossil fuels.

These simplified categories help explain the state’s basic energy strategy – electrify all possible end uses in the transportation, space and water heating, and industry sectors and eliminate fossil fuels from electricity generation. At the same time, electrification is not enough unless we decarbonize the grid itself. Removing fossil fuels from the electric grid is the focus of the 2019 Clean Energy Transformation Act (CETA). Here in Whatcom County, electrification of buildings and transportation, decarbonization of the grid and severely reducing industrial emissions, are thus the three legs of our climate mitigation actions that will be explained in the following sections of this Climate Action Plan.

The 2021 Washington State Energy Strategy provides an overarching roadmap to guide reduction of sector emissions where city and county governments have influence. In developing climate strategies, the CIAC is aware that there are areas where the County has direct control and areas where the County has indirect influence. The strategies and recommendations in this report will follow, where possible, the state energy strategies and policies.

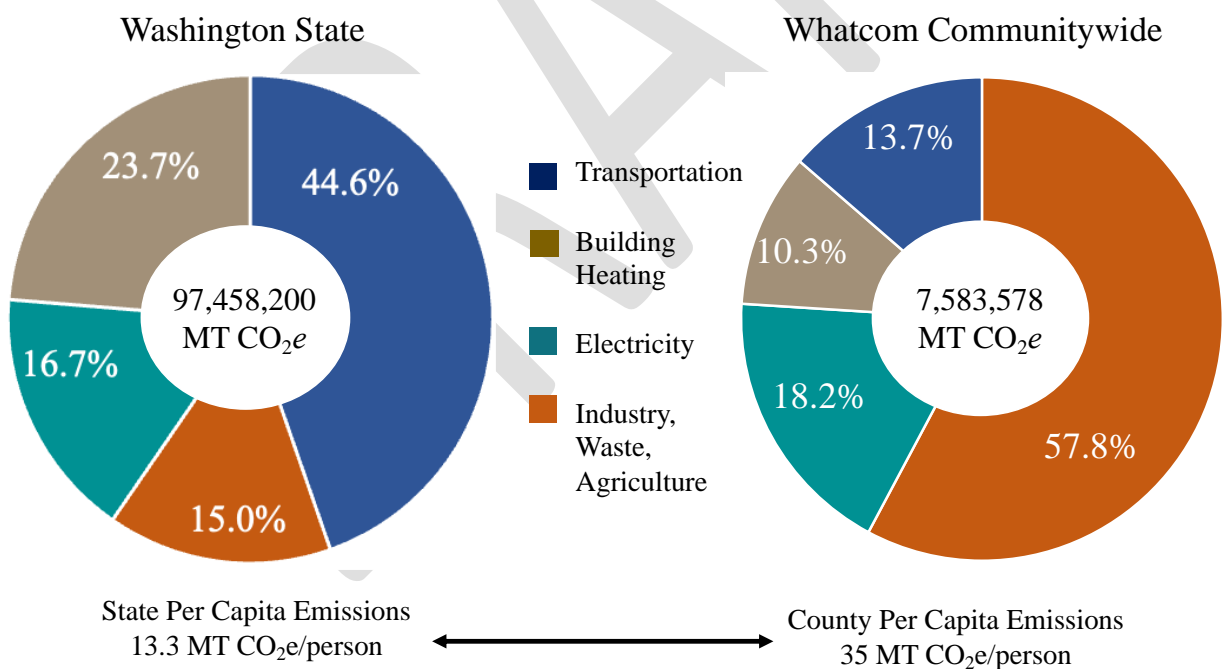


Figure 1.3: A comparison of 2017 statewide and Whatcom communitywide GHG emissions. Building Heating includes all residential, commercial, and industrial buildings use of fossil fuels for heating buildings and water (does not include heating by electricity). The state adds fugitive emissions from refrigerants to the Industry, Waste, Agriculture category, while ClearPath includes these fugitive emissions with Buildings.

County Government Operations Emissions

The Whatcom government operation's GHG emissions in 2017 show a slight decline from 2000 (Table 1). Like the communitywide emissions for Whatcom, the approaches for data collection and evaluation have changed, making it difficult to derive any insights from this trend. For example, in 2007 it was assumed that carbon dioxide was trapped in landfill waste, leading to no or negative emissions. In contrast, the 2017 GHG inventory includes emissions from waste generation and emissions from closed landfills within Whatcom County (Fig 1.4), comprising almost a fifth of the overall government operations emissions.

Some information is available on the implementation of recommendations in the 2007 Climate Action Plan for the County's government operations. One recommendation was to hire a staff member to coordinate the climate strategies, a position that was eliminated during the 2009 economic recession and never replaced. Another recommendation to purchase renewable energy for all County buildings through PSE's Green Direct Program was only fully instituted in 2019.

County purchases of hybrid vehicles and improvements in facilities energy efficiencies since 2007 are reflected in the 2017 GHG inventory, but no evaluation has been done by the County on cost and energy savings from these upgrades. Finally, although the County continues to support "SMARTrips," a program to encourage reduction in staff vehicle miles traveled, there is no data to indicate that the program has changed overall staff commute behavior. Only 10% of County staff participated in this program in 2019. So, the decline in staff commute emissions may be due to any number of factors including the method of data collection, higher fuel efficiency of vehicles, more staff living closer to work, or other factors.

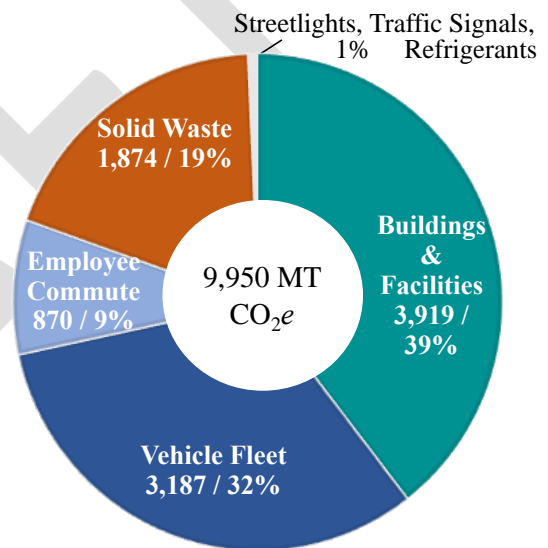


Figure 1.4: 2017 Whatcom Government Operations Emissions (in MT CO₂e)

Comparison with the Last Whatcom County GHG Assessment

The last time Whatcom County did a GHG inventory was in 2006 and the assessment was based on calendar years 2000 and 2001 (Table 1). This inventory was the basis of the first Whatcom County Climate Action Plan (CAP) published in 2007. The actual trends in GHG emissions are difficult to interpret because methods of data collection and analysis have changed over this long time period. Ideally, these inventories need to be done every five years to make valid comparisons and measure the effectiveness of mitigation and adaptation strategies.

The significant increase in communitywide GHG emissions in 2017 is because the earlier report did not include industrial point-source emissions from two large petroleum refineries (~3 million MTCO₂e) and aluminum production (~1 million MTCO₂e) at Cherry Point. This industrial emissions information was not available in 2007.

Even if industry point source emissions were excluded, GHG emissions in Whatcom County still increased at a greater rate than population growth. Any number of reasons or combinations of reasons could account for this increase but evaluating trends or the effectiveness of strategies and actions in the 2007 Climate Action Plan is problematic for the following reasons:

- The model used for the 2000-2001 inventory was a precursor to the current ClearPath model and less sophisticated.
- Methodologies for collecting data have changed. Data source and collection process are not uniformly documented in the 2000-2001 inventory.
- More information is available and required in the 2017 GHG emissions inventory.
- A significant lack of history and data on the implementation of climate recommendations due to County staff employment turnover.

Overall, our high emission rates call for a rapid transition to clean energy in Whatcom County, in tandem with the state's effort to cut statewide emissions of GHG in half by 2030. Transportation is the state's largest emitter, while industrial point source from refineries is the County's, creating a strong rationale for the two levels of government to work together.

GHG Emissions Targets

In order to meet the 100% renewable energy goal established in Whatcom County Ordinance 2017-080¹⁷ and to analyze strategies for GHG reductions, the CIAC proposes the following timelines for communitywide and County government emissions reductions (Fig. 1.5):

Communitywide (Whatcom County) Targets:

- A 45% reduction below 1990 levels by 2030
- A 95% reduction below 1990 levels and net zero emissions by 2050

County Government Targets:

- An 85% reduction below 2000 levels by 2030
- A 100% reduction below 2000 levels by 2050

The County government targets are more aggressive to demonstrate leadership and are consistent with GHG targets established by the City of Bellingham, including an 85% reduction below 2000 levels by 2030 to 1,500 MTCO_{2e} or a reduction of ~8,400 MTCO_{2e}. These estimated reductions do not include the County's participation in PSE's Green Direct wind energy program that started in mid-2019.

Based on County Council guidance, the CIAC will be updating the GHG inventory and Climate Action Plan every five years, making future comparisons of progress feasible.

¹⁷ <https://www.whatcomcounty.us/Archive/ViewFile/Item/14045>

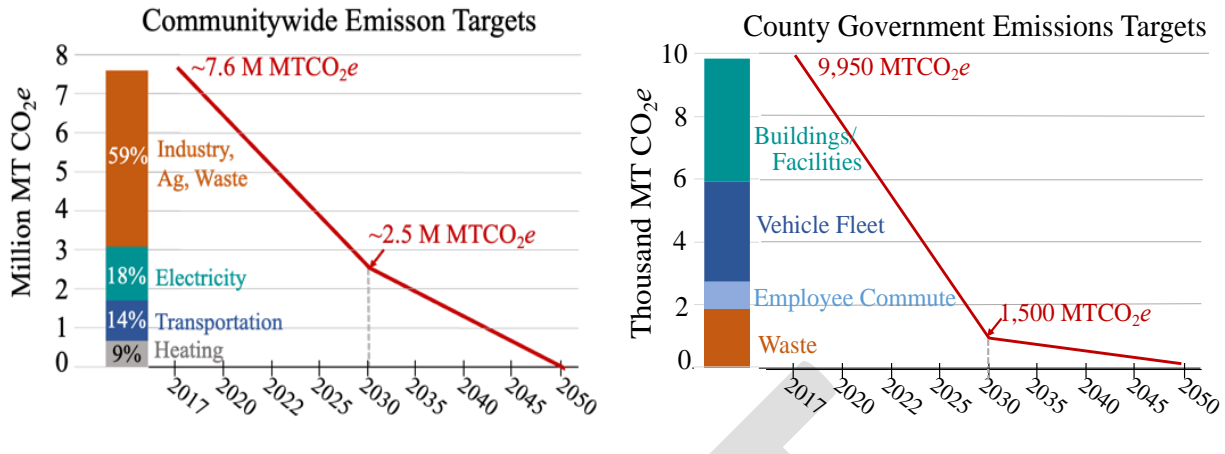


Figure 1.5: Communitywide emissions targets and County government emissions targets

Recent Washington Climate Legislation

Whatcom County's GHG targets are daunting and will be a significant challenge. However, the Washington State government has enacted legislation that will make it easier for our community to meet these aggressive targets. Two very important pieces of legislation were passed by the Washington State Legislature and signed into law by Governor Inslee in 2021. Both the [Climate Commitment Act \(SB5126\)](#) and the [transportation fuel carbon intensity bill \(HB1091\)](#) use variations of a cap and trade approach to set a price on the carbon content of energy used in Washington State.

Generally speaking, under cap-and-trade regulation an overall cap on emissions is set and allowances equal to the emissions cap are issued, which can then be traded among participants. The market price of the allowances becomes the price of emitting another unit of the pollutant, with emitters who can lower their emissions at a relatively low cost will do so and sell their extra allowances to emitters who face high emissions reduction costs. The result is that emissions are reduced to the desired limit—the “cap”—at the lowest possible cost of doing so through allowance “trading.” This approach also provides incentives for emitters to discover better and cheaper ways to achieve the desired emission reductions. An important feature of cap and trade is that limits are not placed on individual emitters or even (usually) on economic sectors—reductions are undertaken primarily by those emitters with the lowest reduction costs, regardless of their industry or location.¹⁸ Existing examples of cap and trade systems for carbon emissions include the [California-Quebec](#) market, the [Regional Greenhouse Gas Initiative](#) in the eastern U.S., and the European Union's [Emission Trading System](#).

The most important feature of these bills is that the caps (reduced gradually over the next twenty to thirty years) are effectively placed on carbon emissions consistent with emissions reductions goals set out in [RCW 70A.45.020](#), on which the reduction goals in this CAP are based. One result is to increase the cost of carbon-emitting activities thereby discouraging them. But the legislation goes beyond requiring a price on carbon emissions. Revenues collected through the sale of allowances (in SB 5126) or carbon intensity credits (HB1091) are earmarked for a variety of possible programs and projects to reduce

¹⁸ There are dozens of references that explain cap and trade in more detail; a basic one is provided by the [Environmental Defense Fund](#)

carbon emissions, increase carbon sequestration, and improve environmental resilience to the impacts of climate change, all while lessening the impacts on overburdened or low-income communities of climate change itself and of the policies designed to reduce those impacts.

Both of these bills call for a series of rulemakings to be conducted by state agencies, which will yield the detailed regulations implementing the legislation. HB1091 is targeted almost entirely at transportation fuels, but SB5126 caps emissions from nearly all sectors for the entire state, which makes it difficult to predict the extent of reductions that will occur within specific sectors in a single county. Both bills will use revenues they generate to fund programs in all economic sectors. Emissions related transportation projects are first in line for funding under SB5126, but the remainder of expenditures will occur across sectors through the climate commitment account, including funding the working families tax rebate, the deployment of renewable energy and grid modernization, increasing industrial energy efficiency, increasing energy efficiency in and the electrification of buildings, assisting workers who lose jobs in fossil fuel related industries, and carbon sequestration projects. SB5126 also establishes a natural climate solutions account, which will fund projects promoting climate resilience and adaptation through flood programs, healthy forests, and natural carbon sequestration.¹⁹

Guiding Principles for Advancing Climate Resilience

Ultimately, this Climate Action Plan should protect the County’s citizens, businesses, environment, and governments from the detrimental impacts of climate change by achieving optimal climate resilience. This Climate Action Plan (CAP) provides guidance on how the County can achieve climate resilience to ensure long-term economic and social prosperity.

The CIAC’s role is to recommend strategies based on commercially available technology that will lead to the greatest reductions in GHG emissions and address the natural and human-built systems that support life and are at greatest risk of damage from climate disruption.

To enhance climate resilience the following seven guiding principles will be considered when developing strategies that prioritize needs and investments.²⁰

1. Act with Urgency, Intention, Transparency, and Accountability

The far-reaching consequences of climate change dictate that we can no longer wait to take bold action. We must also accept the fact that actions taken today won’t bear fruit for at least a few years. Many local governments within the County, as well as the County government itself, have not focused enough on the contribution of climate change to storm surge, flooding, salmon survival, or air quality. To

Guiding Principles

- 1. Act with Urgency, Intention, Transparency and Accountability*
- 2. Lead with Racial Equity, Social & Environmental Justice*
- 3. Respond to Community Needs and Economic Concerns*
- 4. Prioritize Health, Safety and Preparedness*
- 5. Increase County Leadership through Action, Partnerships, and Influence*
- 6. Seek Cross-Cutting Systems-Level Solutions*
- 7. Use the Best Available Science and Data Management Practices*

¹⁹ See Sections (26) – (31) of [SB5162](#) for more detail on funding possibilities for county and local governments.

²⁰ 2020 Strategic Climate Action Plan, King County, WA.

address this existential crisis, aggressive emission reduction targets must be accompanied by demonstrated action, investments, and accountability. To make sure our efforts are effective we need to ensure transparency and accountability. The County will need to make data widely available to the public and adhere to broadly accepted standards.

2. Lead with Racial Equity and Social and Environmental Justice

The long-term health and wealth of low-income communities, especially communities of color, have been disproportionately impacted by pollution from manufacturing, agriculture, and transportation, including the production, transport, and use of fossil fuels.²¹ These historic inequities are aggravated by climate change, which is also disproportionately burdening people of color, both in the US and abroad. In Whatcom County, agriculture is a large sector of the economy and people of color represent a large percentage of the agricultural workforce, making people of color disproportionately vulnerable to crop damage and extreme heat events associated with climate change.

Many factors increase sensitivity to climate change, with systemic racism and economic inequality being two root causes (Fig. 1.6). Local, state, and federal governments have a responsibility to address these inequities in their climate policy making.

Proposed actions to mitigate climate change can either increase injustice in society or reduce it. The tools we use are important. Funding for climate stabilization needs to be progressive rather than regressive and increase equity for historically marginalized communities.

To promote social and environmental justice, this plan seeks to reverse injustices of the past and create a healthier future for all County residents.

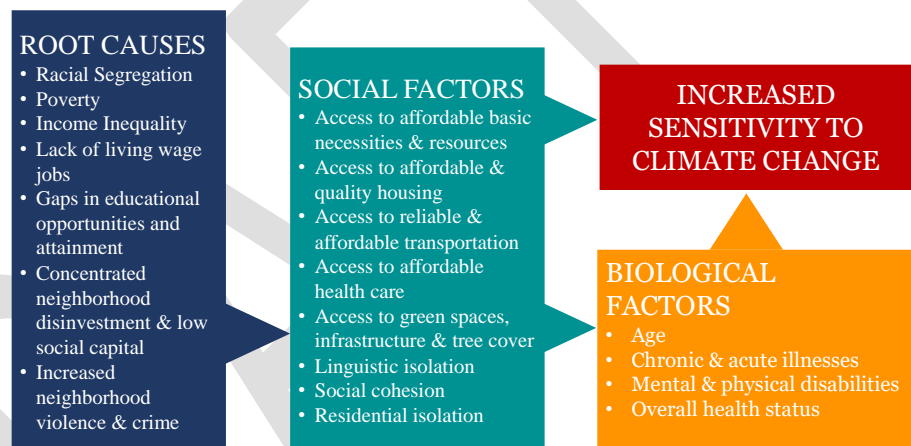


Figure 1.6: Root causes of climate change vulnerability, from *Urban Sustainability Network Directors Guide to Equitable, Community-driven*

3. Respond to Community Needs and Economic Concerns

To develop the background information needed to prepare this CAP, the CIAC began community outreach and engagement in 2019 with the Community Research Project. The stakeholders interviewed represented utilities and industries, individual business owners such as farmers and fishers, city, county, state, and federal staff, tribal leaders, and representatives of nonprofits. To create a viable and enduring

²¹ <https://www.pugetsoundsage.org/true-cost-of-fossil-fuel-use-for-communities-of-color/>

climate action plan, it will be critical for County staff to do additional community outreach and communication.

The financial risk associated with such effects of climate change as coastal and river flooding and wildfires could be substantial for the County, putting a strain on our emergency, public health, and many other County services.

Modeling efforts have shown that what have in the past been considered 100-year floods of the Nooksack River will eventually occur every 10 years.²²

Sea-level rise and coastal storm surge intensify river flooding by causing a restriction or

“backup” in the Nooksack River flow. Water continues to flow down rivers but meet a rising tide causing it to back up and/or spread out as it spills over levees and dikes (Fig. 1.7).²³

Climate change also increases the risk of wildfires, which can be especially frequent in wildland/urban interfaces (WUI). Seventy to 90% of all wildfires are human caused.²⁴

Potential financial risks can be reduced if the County incorporates the likely impacts of climate change in every aspect of planning, whether it is critical infrastructure, such as roads, bridges or ferries, new developments, or even planning associated with emergency services and response. For example, the shoreline development plan can no longer ignore climate change. The County must consider damage from sea level rise and storm surge over the next few decades prior to approving coastal developments and associated road access. Taxpayers will ultimately pay for poor decisions made today or delays in needed action. Smart land use planning can be an effective tool for reducing financial risk to the County government and the community at large and the pain of property loss and relocation.

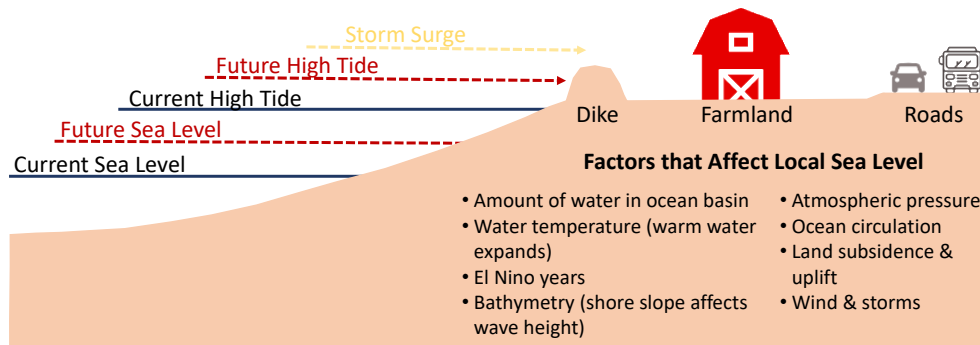


Figure 1.7: Rising Sea Levels and Storm Surge. A 12-inch increase in sea level turns a 100-year coastal storm event into a 10-year coastal storm event. A 24-inch increase in sea level turns a 100-year coastal storm event into an annual coastal event.

²² Dickerson-Lange, S.E. and R. Mitchell. 2013. Modeling the Effects of Climate Change Projections on Streamflow in the Nooksack River Basin, Northwest Washington. Hydrological Processes, Published Online in Wiley Online Library

²³ <http://www.skagitclimatescience.org/skagit-impacts/sea-level-rise/>

²⁴ Human-started wildfires expand the fire niche across the United States, by J.K. Balch, et al, *PNAS*, MARCH 14, 2017. 114(11) 2946-2951.

Whatcom County's economy is in a relatively difficult position as the world pushes to decarbonize. Major investors around the world are starting to divest from fossil fuel companies. As home to two major refineries, the County's strong dependence on fossil fuel jobs and revenue has the potential to make the County economically vulnerable unless the issues related to the economy and jobs are addressed in advance.

In a letter to stockholders²⁵ in January 2020, Larry Fink, asset manager at the mega-investment firm Blackrock, stated that a fundamental reshaping of finance is now underway at Blackrock because *climate risk is investment risk*.

"Climate change has become a defining factor in companies' long-term prospects. Last September, when millions of people took to the streets to demand action on climate change, many of them emphasized the significant and lasting impact that it will have on economic growth and prosperity – a risk that markets to date have been slower to reflect. But awareness is rapidly changing, and I believe we are on the edge of a fundamental reshaping of finance." Larry Fink, BlackRock

4. Prioritize Investments in Health, Safety and Preparedness

A recent analysis found that air pollution from fossil fuels leads to almost 250,000 premature deaths per year in the US.²⁶ Avoiding the increased medical costs and productivity losses associated with burning fossil fuels – even without including climate-related benefits - equates to over \$700 billion per year in economic benefits to the US – far more than the cost of the energy transition to renewables.²⁷

In addition, floods, extreme rainfall events, snowstorms and heatwaves all affect access to health care and emergency services. Climate change is already increasing the frequency of extreme weather events that can destroy both public and private property and infrastructure while also increasing susceptibility to disease and pests.

Insurance companies started tracking climate-related disasters as early as 30 years ago. To protect their liability, these companies have been re-evaluating flood and fire zones and either increasing rates or denying coverage.²⁸ State Farm has stopped insuring homes in Florida and are evaluating similar action in parts of California.²⁹ The economic and societal impacts of US weather and climate have increased

²⁵ Sustainability as BlackRock's New Standard for Investing by Larry Fink, CEO BlackRock.
<https://www.blackrock.com/corporate/investor-relations/blackrock-client-letter>

²⁶ The Devastating Health Impacts of Climate Change by Drew Shindell, Duke University, Aug 5, 2020, testimony to the House Committee on Oversight and Reform.

²⁷ Air pollution is much worse than we thought, Ditching fossil fuels would pay for itself through clean air alone, by David Roberts, Aug 12, 2020, *Vox.com*.

²⁸ How climate change is changing your insurance, PBS News Hour, Nov 27, 2018.
<https://www.pbs.org/newshour/economy/making-sense/how-climate-change-is-changing-your-insurance>

²⁹ State Farm to exit Florida property insurance, by Alistair Barr, MarketWatch, Jan 27, 2009.
<https://www.marketwatch.com/story/state-farm-to-pull-out-of-floridas-property-insurance-market>

substantially over the last few decades with an estimated cumulative cost since 1980 that exceeds \$1.75 trillion.³⁰

As the recent pandemic has illustrated, planning and investments in our emergency and public health systems are critical to lessening the economic and human impacts of natural disasters. Countries with strong public health systems and leadership, such as Taiwan, South Korea, and New Zealand, were in a better position to contain the Covid-19 virus relatively quickly.

Whatcom County has a valuable tool for increasing public health, safety, and preparedness in the face of a changing climate—land use planning. The way we use land is fundamental to our safety and climate change can amplify any problem. Enhanced protection starts by including climate change considerations when approving new developments, roads, bridges, and emergency facilities. Such actions were once viewed as radical and as a result, avoided. The result is that federal agencies are now using our tax dollars to move whole communities out of flood zones.³¹

5. Increase County Leadership through Action, Partnerships, and Influence

The complexity of climate impacts on the built and natural environments cannot be solved by government alone. Solving complex problems such as preserving water quantity and quality will require a broad range of partnerships across jurisdictions. To succeed, the County will need to provide strong leadership and coordination.

The County can also lead through example, by implementing and achieving aggressive goals to reduce carbon emissions in County operations, increase energy efficiency, and require zero-carbon operations in buildings. County-led demonstration projects that increase the availability of renewable energy, promote “green” jobs, and protect Whatcom County’s environment are all necessary leadership actions. The CAP will propose several demonstration projects that would qualify for state, federal or foundation funding, be a benefit to the County, serve as an education and communication tool, and honor the historical roots of the County.

Finally, there are some policy areas where County government has direct control through regulations and others where it can exercise influence. For example, the County can influence changes in state laws and regulations that can help solve climate-related problems, such as state water laws or state laws on financing energy efficiency upgrades. The County can also influence companies to encourage new approaches to reduce GHG emissions.

6. Seek Cross-Cutting Systems-Level Solutions

Systems-level thinking is simply taking into account how different parts of a system or systems interact, and by doing so, develop approaches that can solve multiple problems. For example, any solution that provides for adequate water quantity in agriculture must also address adequate in-stream flow for fish.

³⁰ NOAA Climate.gov, <https://www.climate.gov/news-features/blogs/beyond-data/2010-2019-landmark-decade-us-billion-dollar-weather-and-climate>

³¹ US Flood Strategy Shifts to ‘Unavoidable’ Relocation of Entire Neighborhoods, by Christopher Flavelle, New York Times, Aug 27, 2020, <https://www.nytimes.com/2020/08/26/climate/flooding-relocation-managed-retreat.html?referringSource=articleShare>

Systems-level solutions acknowledges that most problems, particularly environmental problems, are multidimensional. The best climate strategies solve a cross-cutting problem in a way that benefits multiple sectors. Properly implemented, the Climate Commitment Act will be an important part of system level solutions for Washington State.

7. Use the Best Available Science and Data Management Practices

Whatcom County has and continues to fund important science to better understand and address climate change impacts such as Nooksack River flooding and coastal sea level rise. Continued support of this type of research will be critical to planning efforts at the County level. The latest science should be incorporated when climate strategies are evaluated for effectiveness.

Data collection and analysis are not only critical for making decisions but also for evaluating our progress in addressing climate change. Data are often missing or unavailable for evaluating the benefits of various mitigation strategies such as upgrading the energy efficiency of buildings, commute trip reduction programs, waste recycling initiatives, and carbon footprint differences between projects completed by County employees versus private contractors.¹²

Data collected on natural resources in Whatcom County are fragmented and housed in multiple organizations. For example, several organizations in the County collect information on in-stream flow and water quality in the Nooksack River Basin. Recording all of this information in a common database that could be accessed by researchers and the general public could accelerate a greater understanding of this complex river system resulting in problem-solving and action. Snohomish County has such an online platform at tableau.com where information is collected from multiple sources, analyzed, and graphed to indicate trends and get a better understanding of changes occurring over time. Whatcom County should host such a system.

When making all planning and purchasing decisions the County needs to ask how they affect progress toward our climate goals. County decisions must move us toward a lower-carbon, climate-resilient future, while also helping to promote economic prosperity, equity, and social justice. To maintain a prosperous Whatcom County, we must adopt both mitigation and adaptation strategies that maximize our resilience to flooding, water shortages and wildfires, and move closer to a sustainable cleaner energy economy. Our economy and health depend on clean water and air, healthy farmland, and resilient ecosystems. This revised Climate Action Plan is intended to be a roadmap to get started.

SECTION 2 - BUILT ENVIRONMENT

DRAFT

Introduction to the Built Environment

The built environment in this report includes the human-built infrastructure that is a part of everyday life—electricity, buildings, industry, transportation, and waste.

Additionally, land use is considered throughout this Climate Action Plan because its policies play a critical role in both increasing and reducing emissions. Land use can be viewed as a tool to help balance the built and natural environments.

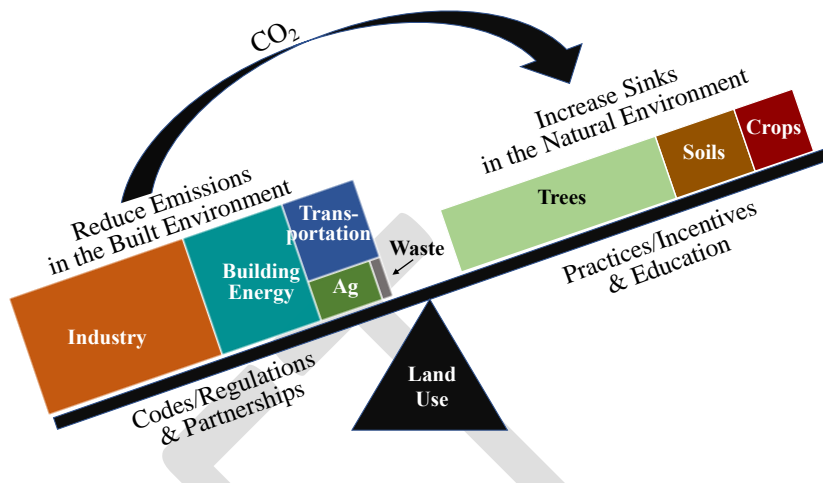


Figure 2.1: Land use can also be viewed as the fulcrum of a GHG balance beam with the built environment on one side and the natural environment on the other.

Land use can also be viewed as the fulcrum of a GHG balance beam with the built environment on one side and the natural environment on the other. Sources of GHG emissions currently outweigh potential sinks for GHG emissions. Smart decisions on land use practices are one of several tools that can help us balance this beam and reach net zero emissions by 2050.

The pie chart (Figure 2.2) showing categories of Whatcom County’s total communitywide emissions for 2017 includes five categories analyzed in the ClearPath modeling for Whatcom County. Industrial point source emissions are by far the largest contributor to Whatcom County’s communitywide emissions, followed by building energy, transportation, agriculture, and solid waste and wastewater. Building energy includes emissions from electricity, fossil fuels used in heating (primarily natural gas), and refrigerants.

Whatcom’s industrial emissions are dominated by two oil refineries which produce gasoline that in turn contributes to the state’s largest emitter, transportation. The state’s largest refinery is owned and operated by *bp*, which understands the need to transition to renewable fuels and is quickly adapting its plans.³²

All parties—the state, County, and private industry—should work together on win-win solutions to reduce GHG emissions from industry, while securing long-term economic benefits for Whatcom County.

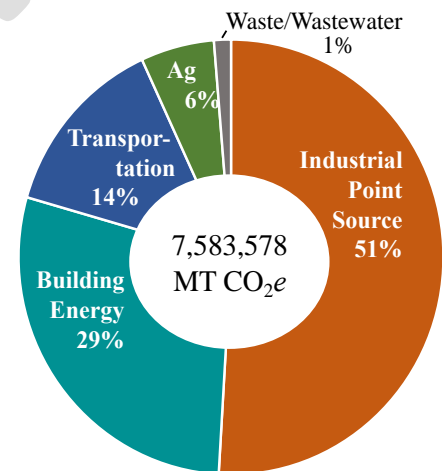


Figure 2.2: Categories of 2017 Whatcom communitywide GHG emissions.

³² *bp* sets net zero carbon target for 2050, by Jillian Ambrose, Feb 12, 2020, *The Guardian*. <https://www.theguardian.com/business/2020/feb/12/bp-sets-net-zero-carbon-target-for-2050>

Our industries and workforce, therefore, have the opportunity to become part of the statewide solution for GHG emissions through the production of low-carbon fuels, which will accelerate our economic competitiveness in the emerging worldwide clean energy economy.

In addition, to reduce GHG emissions from building and transportation sectors, Washington’s 2021 State Energy Strategy emphasizes electrifying end uses to the greatest extent possible.³³ Space and water heating account for the majority of energy consumed in commercial and residential buildings, and commercially available heat pump-based appliances are far more energy efficient than other methods. Electric vehicle adoption will dramatically reduce carbon pollution but increase the demand on the grid. Fossil fuels must therefore be rapidly replaced on the grid for maximum gain.

Hence, electricity is often referred to as the *linchpin* for reducing GHG emissions (Figure 2.3). Large-scale wind and solar combined with energy storage make possible the replacement of most fossil fuel generation. A modern, flexible smart grid infrastructure can more effectively balance electricity supply and demand in real time as conditions change, reducing the high cost of fossil fuel peaking plants.³⁴ These cost competitive smart grid technologies can significantly reduce GHG emissions in Whatcom County.

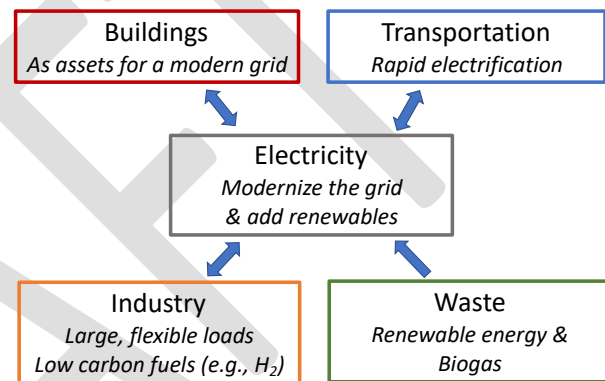


Figure 2.3: Electricity is the kingpin for reducing GHG in the built environment.

While electrification is a major thrust of mitigating GHG emissions, adaptation also has an important role in the built environment. For example, we must consider current and future climate change impacts, such as high temperatures, severe storms, flooding, sea-level rise, and other factors when designing new homes, buildings, and critical infrastructure such as hospitals, emergency response centers, roads, bridges, and broadband.

The built environment areas of Electricity and Buildings, Industry Point Source Emissions, Transportation, and Waste represent systems where mitigation practices are the major emphasis in the climate strategies. The built environment is an ecosystem of interconnected components that can be adapted when developing a sustainable, climate-resilient community. In many respects Land Use connects the built and natural environments as an effective tool for mitigation and a critical component in adaptation to climate change.

Agriculture is another area to consider and is responsible for a small portion of the emissions in Whatcom County; however, agricultural land has the potential to become a net carbon sink for addressing GHG emissions. This area is discussed in Section 3, Natural Environment.

³³ Washington 2021 State Energy Strategy, pg. 48. <https://www.commerce.wa.gov/growing-the-economy/energy/2021-state-energy-strategy/>

³⁴ “Peaker” plants can quickly ramp up electricity generation during periods of high electricity use. PSE has 4 natural gas peaking plants in Whatcom County alone.

Electricity and Buildings

To fight climate change, we must modify our buildings. To do so, we need to do two things —use less energy and make sure what energy we do use is clean, i.e., decarbonized. Buildings will increasingly play a key role in creating a modern, smart grid because most electricity on the grid is consumed in buildings. As a consequence, there is a growing need to view electricity and buildings as an integrated system — where electricity use in buildings can be used to manage the electricity load in a modern grid. Hence, buildings (and their major energy devices) can be operated as grid assets. For these reasons we treat electricity and buildings together.

Both Washington State and the US have mandated a transition of our energy economy to be carbon-neutral by 2050 or sooner. This 30-year economic transition will be difficult, and the exact roadmap is unclear. The overarching strategy is to rapidly electrify end uses while simultaneously removing fossil fuels from the electrical grid.

Over the last century the traditional approach for providing electricity in the U.S. has been top-down centralized generation and delivery of electricity by a utility (Fig 2.4). This approach has served us well but is increasingly susceptible to cascading failures in the grid that are often the result of extreme weather events attributed to climate change. Grid failures can trigger blackouts caused by unseasonably cold weather such as what happened in 2021 in Texas³⁵ to drought-induced wildfires in California and Oregon.

Extreme weather events have resulted in a steep increase in grid failures over the last two decades.³⁶ Accordingly, state, and federal agencies have called for investments in a modern, smart grid that will be resilient to the unpredictable changes in climate. A critical component of creating a resilient electric grid will require much more emphasis on a bottom-up approach that uses buildings as grid assets (Fig 2.4).

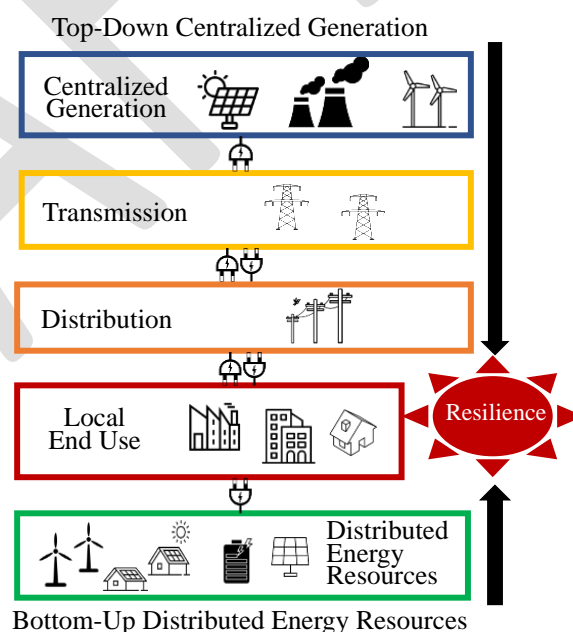


Fig 2.4: A modern, resilient electrical grid depends on both centralized and distributed energy resources.

Washington State’s 2021 State Energy Strategy concludes that *the most effective way to reduce GHG emissions sufficiently is to decarbonize the grid and electrify end uses to the greatest extent possible.* “To

³⁵ Jeffrey Ball, “The Texas Blackout is the Story of a Disaster Foretold,” Feb 19, 2021. Texas Monthly, <https://www.texasmonthly.com/news-politics/texas-blackout-preventable/>

³⁶ Melissa R Allen-Dumas, Binita KC, and Colin I Cunliff. “Extreme Weather and Climate Vulnerabilities of the Electric Grid: A Summary of Environment Sensitivity Quantification Methods,” August 16, 2019. Oak Ridge National Laboratory, ORNL/TM-2019/1252/:<https://www.energy.gov/sites/prod/files/2019/09/f67/Oak%20Ridge%20National%20Laboratory%20EIS%20Response.pdf>

electrify the economy while assuring system reliability and resilience requires a smart, flexible, and optimized grid.”³⁷ Water heating and space heating/cooling use upwards of 70% of building energy; that is why we must focus on wisely electrifying them first.

Using high efficiency appliances on a modern smart grid provides a dual benefit: reduced energy use and better management of electricity supply and demand. Federal and state agencies recommend these aggressive approaches as having the best chance of creating reliability and resilience while cutting GHG emissions and minimizing the need for additional natural gas peaking plants. Key approaches are detailed below that will build a modern grid to provide our community with clean electricity and enhance our ability to adapt to a changing climate.

Our Local Electricity System

Unlike the rest of the US, Washington State has access to abundant hydroelectricity, which dominates all other renewables. Climate change, however, will change the seasonal distribution and availability of hydroelectricity according to forecasts from the Northwest Power and Conservation Council.

The Northwest Power and Conservation Council forecasts that changes to climate will cause major change in the region’s hydro operations:

- Increased winter and spring runoff,
- Increased summer electricity use for cooling,
- Decreased summer and fall river flows exacerbating problems, particularly for fish passage.

Seventy-eight percent of all the electricity generated in Washington uses renewables as the energy source (Fig 2.5). The fuel mix of electricity used in the state is the aggregate of electricity delivered by utilities to end users.³⁸ The Bonneville Power Administration (BPA) manages most of the hydroelectricity resource outside of Seattle. It provides electricity to public utilities in Whatcom County such as the cities of Blaine and Sumas and to Whatcom PUD1. Whatcom PUD1 supplies electricity to the Phillips 66 refinery at Cherry Point. Through an arrangement with other PUDs in Washington State, PUD1 was able to obtain the energy which permitted the building of the original refinery at Cherry Point.

The communitywide GHG emissions from electricity, ~1.38 million metric tons, are the second largest source of GHG emissions after point-source emissions from industry. Electricity use is

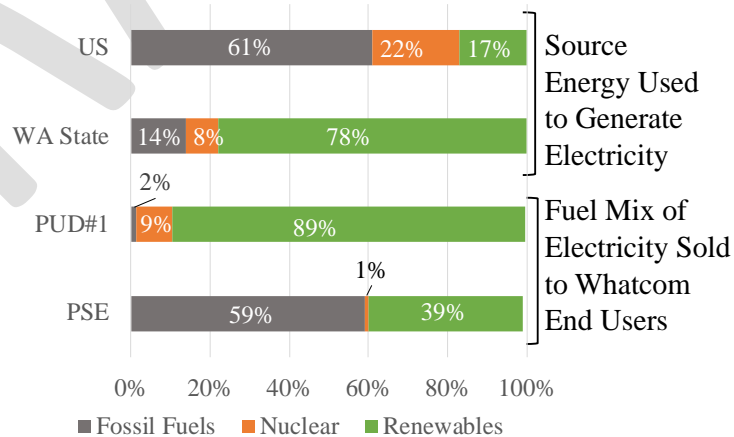


Fig 2.5: Reported 2017 fuel mix for electricity generation and the fuel mix of electricity sold to end users in Whatcom County.

³⁷ Washington 2021 State Energy Strategy, pg. 122. <https://www.commerce.wa.gov/growing-the-economy/energy/2021-state-energy-strategy/>

³⁸ Washington State Electric Utility Fuel Mix Disclosure Reports for Calendar Year 2017, Washington Department of Commerce, November 2018, Report to the Legislature, Brian Bonlender, Director.

roughly split in thirds among residential, commercial, and industrial buildings (Fig 2.6). The majority of residential, commercial, and industrial customers in Whatcom County buy electricity from PSE, a private, investor-owned utility. Given the hydroelectricity generation’s dominance in the state, it is often surprising to local PSE customers that most of their electricity is generated by coal and natural gas, similar to the US-wide generation (Fig 2.5). PSE owns and operates four electricity generating plants in Whatcom County which are fueled by natural gas. The fossil fuel component of PSE’s electricity increased to 66% in 2019.³⁹

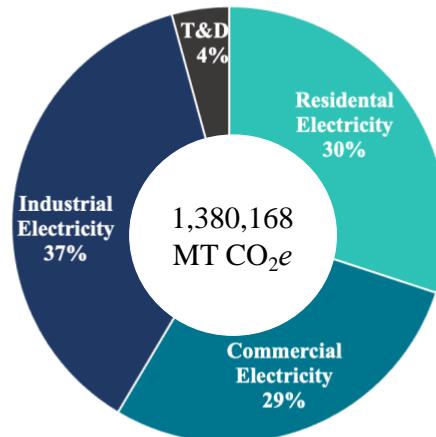


Fig 2.6: Communitywide GHG emissions from electricity use in buildings in 2017, representing 18% of total GHG emissions. T&D are Transmission & Distribution

Decarbonization of electricity in Whatcom County will be a challenge. As electrification needs increase for space and water heating and for transportation, PSE in particular will need to generate more electricity while also rapidly reducing the amount of fossil fuels used to generate the electricity.

Goal and Strategies for Electricity and Buildings

Goal: Reduce communitywide GHG emissions from electricity and buildings 45% by 2030, while creating equity-centered resilience in these sectors. County government will lead this effort and demonstrate action and operational cost savings via energy efficiency and new building concepts for government operations, effectively reducing government operations emissions 85% by 2030.

Six strategies are proposed to support this goal and are aligned with Washington’s 2021 Energy Strategy. The strategies address both the traditional, top-down centralized generation and delivery of electricity, as well as a bottom-up distributed energy resource where buildings become assets to the grid for balancing supply and demand.

Strategies for Electricity and Buildings

1. Assert County leadership in state legislation, regulatory matters (Washington Utilities and Trade Commission and Commerce), and electric utilities operations that enables implementation of Whatcom climate strategies and facilitates a 45% reduction in GHGs by 2030.
2. Create resilience hubs for key community services throughout the County. Collaborate with utilities to identify needed transmission and distribution investments.

³⁹ PSE | Our Diversified Electricity Supply – Puget Sound Energy website: <https://www.pse.com/pages/energy-supply/electric-supply>. Note: Utilities are required to disclose their fuel mix. PSE’s website only displays their most recent annual calculation, which was 2019 at the time of this report. PSE’s 2018 fuel mix also reported 66% fossil fuel generation (coal plus natural gas).

3. Leading by example: electrify end uses in County government buildings, install renewable energy and energy storage where feasible to reduce energy operational costs and GHG emissions.
4. Create a communitywide focus on *buildings as grid assets* to maximize the reliability and resilience of the electric grid and reduce GHG emissions. Accelerate the use of clean Distributed Energy Resources (DERs) and microgrids to reduce peak electricity demand, optimize the grid, and provide electricity to buildings when the utility grid is down.
5. Moving to net zero: upgrade existing buildings by collaborating with local NGOs to accelerate energy efficiency upgrades. Require new buildings to be net zero carbon emissions capable no later than 2027.
6. Pilot key concepts to reduce electricity and buildings GHG emissions through demonstration projects that can scale up rapidly.

Strategy 1: The Need for Leadership in Greening Whatcom's Electric Grid

Although the County has no direct control over the operation of private and public utilities, the County does have influence over local utilities, state legislation, and state utility regulations that will help it achieve its climate goals by reducing GHG emissions from the electricity grid.

The 2019 Clean Energy Transformation Act (CETA) is a good example of where the County in concert with other cities and counties can exert leadership with the Washington Utilities and Transportation Commission (WUTC). CETA requires all electric utilities serving retail customers to eliminate coal-fired electricity by 2025 and be GHG neutral by 2030. GHG neutral means that utilities have flexibility to use limited amounts of electricity from natural gas if offset by other actions. By 2045, utilities must supply electricity that is 100% renewable or non-emitting, with no provision for offsets.

Whatcom County should actively participate in WUTC and Commerce regulatory proceedings for CETA, as well as engage in PSE's Integrated Resource Plan (IRP) and Clean Energy Implementation Plan (CEIP). These proceedings and plans are important opportunities for the public to exert influence on utilities to actually reduce their reliance on fossil fuels.

As we electrify end uses (e.g., space heating and transportation), the resulting impact on emission levels depends on how much carbon is removed from electricity generation. Without the cooperation of local utilities, County efforts to reduce GHG emissions from our energy supply will be difficult to achieve and could fall far short of desired outcomes.

Whatcom County is also home to three public utilities that provide electricity primarily generated by renewables – Whatcom PUD1 and municipal utilities in Blaine and Sumas. To provide consumer choice and reduce GHG emissions, the County should support the evaluation of Whatcom PUD1 expansion within the County. PUDs and municipal utilities in our state generally charge lower prices and use more renewable energy because they buy a large share of less expensive hydropower from BPA (Fig 2.5).

On average statewide, PUD rates are about 10% lower than PSE’s (Fig 2.7).⁴⁰ Delivery costs for public and private power companies are roughly the same – at about \$0.05/kWh. The difference is in the average cost of power, around 6 cents/kWh for PSE and ~4 cents/kWh for PUDs purchasing from BPA.

To reduce GHG emissions, the County should encourage and facilitate the addition of utility-scale renewable energy resources such as solar, wind, and battery, plus necessary transmission, and distribution infrastructure to deliver power to end users. Considerable wind resources are potentially available in Montana, Wyoming, and eastern Washington.

PSE’s retirement of its 700 MW share of the coal-based Colstrip power plant located in Montana frees up transmission capacity that it could use in the robust out-of-state renewable generation market (Fig 2.8). An emerging option for Washington State is to deploy offshore wind turbines in the Pacific (not in the Salish Sea), like the new GE turbine that is able to deliver 13 megawatts of power, six times more electrical power than current land-based windmills in the state.⁴¹

Renewable generation with battery storage can overcome daily issues in electricity peak demand. Washington state’s first utility-scale solar and battery storage site was just completed in Richland. In addition to generating electricity, this facility will offer a training program for solar and battery storage technicians.⁴² A Colorado energy company is also investing in southeast Washington, announcing plans for the 850 MW Horse Heaven Wind, Solar and

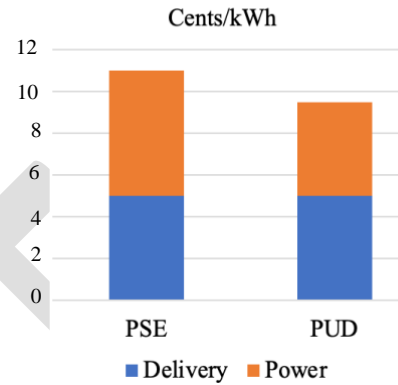


Fig. 2.7: PSE and PUD average cost of electricity in Washington.

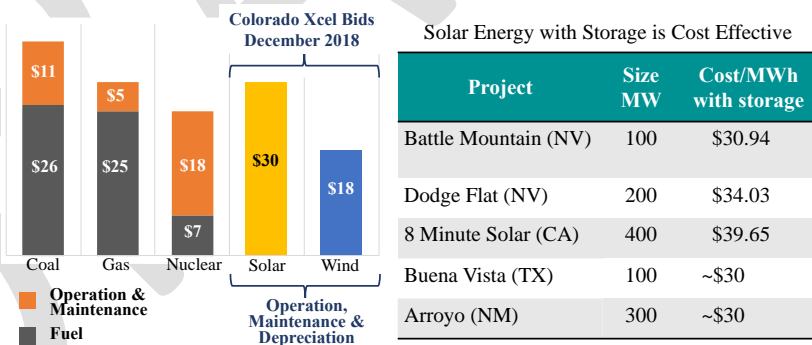


Figure 2.8: Cost of utility-scale renewables from actual bids. Coal, Gas and Nuclear costs are Energy Information Administration data prepared by the Regulatory Assistance Program (www.raponline.org)

⁴⁰ Prepared by the Regulatory Assistance Program (RAP), www.raponline.org, using information from the Energy Information Administration at the US Department of Energy.

⁴¹ Stanley Reed, “GE gives wind turbines a whirl – and upends an industry” The New York Times. Reprint in the Seattle Times January 7, 2021: https://replica.seattletimes.com/popovers/dynamic_article_popover.aspx?artguid=8e7dcee5-6a58-42da-b852-77b1f6fa5206

⁴² Horn Rapids Solar, Storage and Training Project, Energy Northwest, November 2020; <https://www.energy-northwest.com/energyprojects/horn-rapids/Pages/default.aspx>

Battery Farm near the Tri-Cities.⁴³ Solar and wind energy is cost-competitive with fossil fuel generation of electricity as shown in Figure 2.8. The Department of Energy (DOE) has recently set a target of reducing solar costs 60% by 2030.⁴⁴ DOE's previous *2011 SunShot Initiative* met its 75% reduction goal for utility-scale solar cost three years early in 2017.⁴⁵

Key Priorities for County Leadership:

- *Monitor utilities' progress with CETA, while exploring options for greater renewable energy for electricity end-users in Whatcom County.*
- *Support and be an advocate for state legislation that accelerates a reduction in GHG emissions in electricity and buildings.*

Strategy 2: Create Resilience Hubs for Key Community Services

Resilience hubs are defined as additions to community-serving facilities so that they can support residents and coordinate resource distribution and services before, during or after a natural or man-made disaster.⁴⁶ On a daily basis, community resilience hubs provide a space for public meetings and activities that draw neighborhoods together and promote a shared sense of responsibility. A resilience hub can operate independent of the electrical grid temporarily. Examples include public facilities such as community centers or emergency shelters, fire stations, hospitals, schools, and water treatment plants. Resilience hubs can also apply to private facilities such as food processing and cold storage units vital to maintaining the food supply.

Resilience hubs are especially important in areas of the County where there is limited electricity transmission and distribution coverage, areas subject to frequent outages, and/or communities frequently impacted by flooding, heat waves and wildfires. Resilience hubs can be designed to address several of the guiding principles that were outlined in Section 1, such as health, safety and preparedness, community needs, and racial equity and social and environmental justice. They can serve as life-saving cooling centers for homeowners and renters who lack or cannot afford air

The Lummi Island workshop "Brainstorming a Pathway for an Energy Resilient Future" (April 2021) is an excellent example of active community involvement to determine their desired future. The focus was to bring together various organizations to learn best practices to develop a solar/ battery microgrid from neighboring OPALCO. The proposed Lummi Island microgrid would provide resilience for the electric grid and a source of energy for a new hybrid electric ferry. Whatcom County can show leadership by facilitating and supporting this process.

⁴³ Carissa Lehmkuhl, "Richland's new solar and battery project is first of its kind in Washington State," YAKTRINEWS.com, Nov 11, 2020, <https://www.yaktrineews.com/richlands-new-solar-and-battery-project-is-first-of-its-kind-in-washington-state/>

⁴⁴ DOE Announces Goal to Cut Solar Costs by More than Half by 2030, March 25, 2021. <https://www.energy.gov/articles/doe-announces-goal-cut-solar-costs-more-half-2030>

⁴⁵ The SunShot Initiative, DOE's Solar Technologies Office (<https://www.energy.gov/eere/solar/sunshot-initiative>).

⁴⁶ ISDN Resilience Hubs, Urban Sustainability Directors Network, <https://www.usdn.org/resilience-hubs.html>.

conditioning. The County should work with local utilities to identify these areas to help prioritize resilience hubs.

Resilience hubs enhance social equity. For example, facilities with rooftop solar and/or batteries can be used to reduce electricity costs. Large solar arrays on multiple facilities could serve as a basis for a large community solar project to benefit renters and low-income households and create greater equity within the community. The planning of resilience hubs must engage community members, vulnerable populations, and consider GHG emissions reductions. Resilience hubs can and should have the goal of building community or social infrastructure and cohesion.

Key Priority for Resilience Hubs:

- *Create resilience hubs by fortifying key emergency and community services to provide clean energy daily for community benefits during normal times and backup power and shelter during disasters.*

Strategy 3: Leading by Example – Electrification of County Facilities

Whatcom County government operations can show both leadership and action by electrifying County buildings. The County should start by developing a multi-year master plan for upgrading, consolidating, or replacing government facilities to maximize energy efficiency *and* eliminate GHG emissions. Electrification of space and water heating, rooftop solar, battery storage, and EV charging infrastructure will not only save taxpayer money by reducing long-term County operating costs but serve as an example to local businesses on how they too can also increase resilience and reduce GHG emissions while reducing costs and saving money.

Key Priorities for Whatcom Government Operations:

- *Develop a multi-year master plan for upgrading and/or consolidating County government facilities to maximize energy efficiency, renewable energy and storage, and EV charging infrastructure to reduce greenhouse gases.*
- *Commit to net zero carbon emissions for new County government buildings and facilities.*

Strategy 4: Use Buildings as Grid Assets

To maximize reliability and resilience in the electrical grid, while at the same time reducing GHG emissions, a truly win-win strategy is to aggressively deploy Distributed Energy Resources (DERs) and develop microgrids.⁴⁷ As shown in Fig 2.9, DERs can be employed by the utility (top-down generation) or at the building/facility scale (bottom-up generation). Rapid adoption of DERs and microgrids cannot be accomplished without innovative

“DERs are not a boutique version of, or a distraction from, utility-scale renewables; they are a necessary complement, and an enabler and accelerator.” They save building owners money, create local jobs, improve equity, reduce peak demand, while increasing individual and community resilience. David Roberts, Volts

⁴⁷ David Roberts, “Rooftop solar and home batteries make a clean grid vastly more affordable; Distributed energy is not an alternative to big power plants, but a complement.” Volts, May 28, 2021.

financing mechanisms, just as automobile and home financing dramatically expanded their respective markets in the last century.

DERs encompass the following three categories:⁴⁸

- **Energy Generation (or Supply):** Rooftop solar, wind turbines, mini-hydro, and biomass boilers.
- **Energy Storage:** Batteries, fuel cells, EVs, or phase change materials that can release or absorb energy when changing physical state. Energy management software can switch batteries quickly to discharging energy, thus making electricity available to the distribution grid if needed.
- **Energy Management:** “Smart” meters, inverters, and appliances; home energy management software; microgrid control systems.

A distinct advantage of DERs is that they can be deployed relatively quickly, incrementally, and at specific locations such as the resilience hub discussed above, targeting areas in the County that have frequent electric outages, and/or addressing equity and social justice needs.

A microgrid is a miniature, semi-independent grid. Microgrids combine energy generation and storage and have a control system that enables the facility to operate independently of the utility grid during outages or, alternatively, reduce loads during peak demand.

A microgrid may consist of a single building such as your home or a local fire station, multiple buildings such as a campus or neighborhood, or a community solar and/or battery storage facility, such as the Snohomish County Arlington microgrid⁴⁹ or the Decatur Island OPALCO microgrid.⁵⁰ Since 2010 the Pentagon has acknowledged that climate change poses a threat to military readiness and operations.⁵¹ As a result, military bases have become one of the key drivers of microgrid growth in the U.S.⁵² And Washington state’s Clean Energy Fund strongly supports microgrids for grid modernization, such as

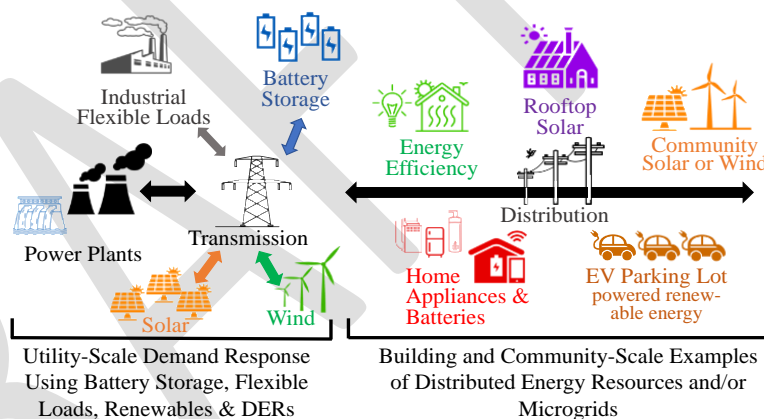


Fig. 2.9: Distributed energy resources and microgrids can be used to maintain electricity load in a modern, smart grid.

⁴⁸ David Roberts, “Wildfires and blackouts mean Californians need solar panels and microgrids,” Oct 28, 2019, [Vox.com](https://www.vox.com).

⁴⁹ Arlington Microgrid Project, www.snopud.com/PowerSupply/ar-microgrid.ashx?p=3326

⁵⁰ OPALCO’s First Local Microgrid is Complete! OPALCO Newsroom, <https://www.opalco.com/opalcos-first-local-microgrid-is-complete/2021/02/>

⁵¹ Pentagon declares climate change a ‘national security issue,’ by Ellen Mitchell, Jan 27, 2021. <https://thehill.com/policy/defense/536188-pentagon-declares-climate-changes-a-national-security-issue>

⁵² US Military Microgrids – Why? <http://microgridprojects.com/military-microgrid-army-navy-air-force-microgrids-drivers/>

Avista’s campus microgrid and PNNL’s Transactive Energy Campus.⁵³A microgrid involves “customers generating, storing, and managing their own power, either individually or in networked groups of any size.”⁵⁴ Figure 2.10 shows the microgrid’s point of connection to the main grid, or *behind-the-meter*. The energy supply and demand circles overlap showing four major energy using devices (hot water, HVAC, battery, and EV) responsible for the majority of building energy use. Wisely managing and communicating with these devices minimizes peak usage by effectively storing electrical or thermal energy for anticipated uses. Critical loads are end uses important enough to have priority on backup power during outages.

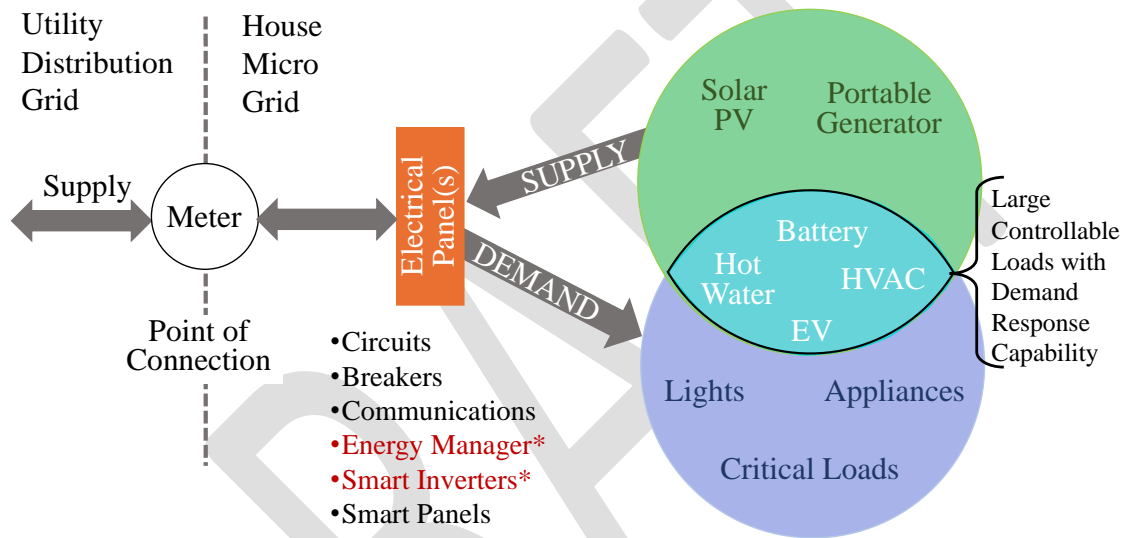


Figure 2.10: Future (Electrified & Smart) Home for reduced GHGs, lower energy costs, and resilient. *New microgrid products are available from Tesla, Enphase, Instant ON, to name a few.

Accelerating the deployment of DERs and microgrids can provide power during outages and reduce or defer the high cost of electricity transmission and distribution upgrades. The 2021 State Energy Strategy intends to avoid the electrical grid outages and rolling blackouts highlighted by the California wildfires, by adding DERs quickly and creating microgrids for maximum benefit to a modernized grid.

Demand for electricity in the County varies by season, day, and time. In Whatcom County, the electric utilities experience peak electricity demand during winter cold spells. This winter peak is of limited duration, driven by predictable weather events and has been managed using natural gas peaking plants.

Daily peak electricity demand usually occurs for a few hours in early morning and early evening. As renewables such as wind and solar are added, the peaks become more steep due to excess solar on the grid during mid-day when demand typically drops – resulting in the so called “duck curve.”⁵⁵ Demand

⁵³ Green Mountain Power’s pioneering steps in transactive energy raise big questions about DERs value, The Vermont utility’s program will show what distributed energy resources are worth in customer-to-customer transactions; by Herman Trabish, March 4, 2020, Utility Dive.

⁵⁴ Roberts, “Wildfires and blackouts mean Californians need solar panels and microgrids.

⁵⁵ Jim Lazar, “Teaching the Duck to Fly”

response, essentially moving non time-dependent uses such as water heating and battery charging to off-peak hours, can reduce daily electricity peaks with minimal cost.

A BPA demonstration of demand response, conducted in cooperation with Pacific Northwest utilities including PSE, showed how daily peak loads for water heating could be shifted in a simple and cost-effective manner *without* affecting the customers' lifestyle.⁵⁶ The vast majority of customers were satisfied with the pilot and would likely join a program based on this technology. The business case for this water heater project showed a benefit-cost ratio of 1.74 compared to a simple peaking generation plant. The key is how to transform the appliance marketplace quickly and then recruit customers to a utility's demand response program first for water heaters, then progressing to other energy intensive appliances.⁵⁷

As of January 2021, all water heaters sold in Washington state are required to have a standard communication interface for demand response. Utilities should offer a demand response program and give customers the option to participate. Technologies such as demand response, in combination with energy storage, can be used to manage peak load more cost effectively, more quickly, and with a much lower carbon impact and should be implemented before considering adding possibly unnecessary additional natural gas peaking plants.

Key Priorities for Distributed Energy Resources and Microgrids:

- *Support efforts to deploy DERs, including expansion of broadband to facilitate DER expansion (while also benefiting remote work, education, and commerce).*
- *Work with utilities to accelerate use of demand response to reduce daily peak electricity demand and modernize control of the grid.*
- *Deploy energy storage in targeted locations where batteries, can provide more than one function (e.g., store solar for evening use and provide backup during outages)*

Strategy 5: Moving to Net Zero Carbon Emission from Buildings

Overall energy use by buildings (electricity, natural gas) accounts for 27% of the communitywide GHG emissions. Most of the electricity on the grid is consumed in (or near) buildings. Across the U.S., buildings are the fastest growing sector of GHG emissions. If electricity generation is decarbonized and the grid modernized, rapid electrification of buildings reduces GHG emissions and allows buildings to become grid assets that can play a role in managing electric load as discussed in strategy 4.

⁵⁶ BPA Technology Innovation Project 336, CTA-2045 Water Heater Demonstration Report, November 9, 2018, pg. iii. <https://www.bpa.gov/EE/Technology/demand-response/Pages/CTA2045-DataShare.aspx>

⁵⁷ Trevor Higgins, et al., To Decarbonize Households, America Needs Incentives for Electric Appliances, Rewiring America and Center for American Progress, June 2021. <https://www.americanprogress.org/issues/green/reports/2021/06/03/500084/decarbonize-households-america-needs-incentives-electric-appliances/>

New building construction only accounts for about 1% of the total building stock nationally every year, so our approach to reducing emissions in buildings must also focus on existing stock.⁵⁸ The overarching goal for new and, where feasible, existing buildings is to transition to be net zero carbon (NZC) emissions. *NZC buildings are so energy efficient to operate that onsite or offsite renewable energy can offset total energy use over a year's time period.*⁵⁹ Some newer buildings are so efficient that rooftop solar panels can make the building net positive energy production over a year-long period, even in Bellingham.⁶⁰ In order to reach NZC, these buildings maximize energy efficiency, install renewable energy generation as practical, and/or procure offsite renewable energy.⁶¹

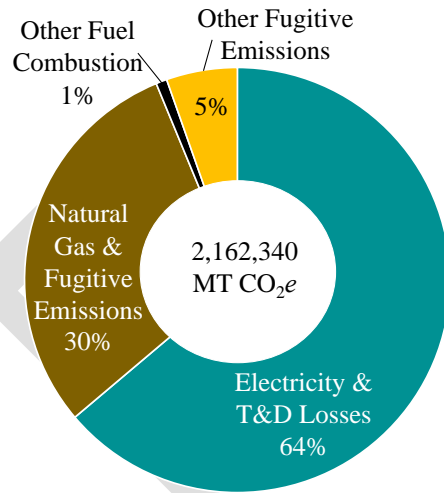


Fig. 2.11: Building GHG emissions from energy use. Other fugitive emissions are refrigerants.

A building with a positive energy profile can be used to offset embodied carbon (carbon in construction materials and the building process), or power an EV. New building materials are being developed that will reduce embodied carbon. For example, cross-laminated timber (CLT) is increasingly being produced by the timber industry and used in buildings as a replacement for high-carbon materials like steel and cement. Use of CLT in buildings would also support Whatcom's local forest industry.

Energy efficiency has long been the first step in reducing energy use in existing buildings. An evaluation of whole building performance includes peoples' needs, the electrification of major appliances, readily available grants and financing, and the potential for carbon reduction. Energy improvements may involve upgrades to insulation, windows, doors, and lighting, as well as energy efficient furnaces and water heaters. Increasing social equity and improving occupant health should be emphasized. Community organizations, like the Community Energy Challenge, Opportunity Council and PSE's Efficiency Boost program provide energy audits, rebates, and low-income weatherization assistance. In addition,

The Importance of Addressing Existing and Older Buildings

"I ran numbers recently on an 1100 sq/ft home that was built in 1878. It was using 16 times the energy compared to today's code-minimum homes. Changing out its old oil heater in favor of a ductless heat pump, with no changes to the envelope, would reduce the carbon use of the home by about 70%, based on the current fuel mix in Washington." Ted L. Clifton, Clifton View Homes, Coupeville, WA.

⁵⁸ Calculation of 1% based on US Census data: <https://www.census.gov/quickfacts/fact/table/US/HSD410218> and <https://www.census.gov/construction/nrc/pdf/newresconst.pdf>

⁵⁹ Shifting to Zero: Zero Carbon Building Policy Toolkit, Shift Zero, www.shiftzero.org

⁶⁰ TC Legend Builds Homes for a Carbon Neutral Future; <https://www.tclegendhomes.com/>

⁶¹ Shift Zero Policy Toolkit, <https://shiftzero.org/toolkit/>

Sustainable Connections sponsors a Green Building Slam⁶² every year to educate the public on energy efficient buildings.

Space heating/cooling and water heating on average account for 70% of energy consumption in U.S. homes.⁶³ Water heaters and gas furnaces that are at the end of their life span should be replaced with new high-efficiency electric appliances wherever possible. Water heaters do not need to heat water 24 hours per day, every day. Modern, smart water heaters can pre-heat and store hot water before daily periods of peak demand, which can be coordinated in areas where utilities offer demand response programs. The benefit is less cost to the consumer and the water heater can be used as grid asset to manage the peak electricity load.

New electric heat-pumps, have energy efficiencies of up to 300% and are capable of both heating and cooling, saving energy and reducing fossil fuel use. Cooling will become more important as summer temperatures rise and wildfires create air pollution during late summer and fall. Many new HVAC (Heating, Ventilation, Air Conditioning) systems incorporate the latest air filtration to improve public health, particularly for those who need it most. Even if an aging gas furnace is still functioning, electric heat-pump based “mini-splits” (also called ductless heat pumps) can significantly reduce the use of natural gas, provide zonal heating and cooling, and reduce overall energy use. Mini-splits are cost-effective, easily installed, and can be added incrementally – thus enabling more rapid electrification.

The initial cost of new HVAC systems is often an obstacle, so financing is a critical component of their adoption. The Property Assessed Clean Energy program, or PACE, actively used in several states, but not in Washington, allows participants to finance energy efficiency and renewable energy projects through property assessments that last the functional life of a project. So, if an owner upgrades to a high-efficiency heat pump that has a 25-year life span, payments become part of the property assessment that transfers to a new owner if the property is sold. This program allows owners to install energy efficiency improvements to reduce their energy costs, even if they plan to sell the property in the near future (a frequent obstacle to upgrading). Legislation called C-PACER for commercial properties was passed by the state legislature in 2020 but vetoed due to COVID-19 budget constraints. Regardless, Whatcom County may pilot a C-PACER program in 2021 that will accelerate energy efficiency improvements. To underscore, *more and better financing is critical*, and promotes equity for low-income households.

Building codes are the most effective tool for creating energy efficiency and are essential for meeting the 2030 GHG targets and beyond. According to the U.S. Department of Energy, today’s energy codes provide over 30% energy savings compared to codes of a decade ago.⁶⁴ In addition, current codes save home and business owners approximately \$5 billion annually in operation cost. The County needs to

⁶² <https://sustainableconnections.org/events/green-building-slam/>

⁶³ Use of Energy Explained. Energy use in homes, Energy Information Administration. <https://www.eia.gov/energyexplained/use-of-energy/homes.php>

⁶⁴ Building Energy Codes Fact Sheet, US Department of Energy: <https://www.energy.gov/eere/buildings/downloads/building-energy-codes-fact-sheet>

incorporate new building codes adopted by the state of Washington and recognize the need for increasing resilience from natural and climate impacts.

Energy efficiency upgrades should also consider GHG emissions. *Instead of using kilowatt-hours and therms saved, energy efficiency success should be measured by carbon emissions reduced.* This type of measure would likely favor electrification, as has been the case with the Sacramento Municipal Utility District,⁶⁵ and can incentivize lower carbon intensity in the existing building stock. Climate change and population growth suggest that much more is needed to make buildings grid assets and resilient to natural and man-made disasters.

Key Priorities for Net Zero Carbon Emissions from Buildings:

- ***Develop a robust financing plan that 1) supports major electric appliance upgrades, 2) promotes the transition of buildings to net zero carbon emissions operations and 3) is equitable for low- or fixed-income households.***
- ***Support and work with nonprofit organizations to expand energy efficiency upgrades and electrification of space and water heaters to residential and commercial buildings.***
- ***Implement latest WA state building codes into County building codes, with NZC and all-electric by the 2027 code where electricity distribution is available.***

Strategy 6: Demonstration Projects

Many of the strategies outlined for electricity and buildings are innovative and promise to deliver great benefits in our efforts to reduce GHG emissions. They continue to build on current best practices and also on the latest science and engineering breakthroughs. But because they are new, many of them have not been proven at large scale. Rather than wait for large-scale demonstrations that we can follow, we need to take the lead and implement the most important technologies in these strategies as small demonstration projects that will provide experience, public acceptance, and make it easier to scale-up rapidly in the future.

Grid flexibility is the core to resilience and to the deep decarbonization needed to meet our targets.⁶⁶ Making buildings grid assets is an important part of a modern, flexible grid. Upgrading building energy systems leverages both public and private investments to develop a smart modern grid with efficient appliances that can be managed individually or together in groups for greater impact.

The following sample projects are designed to explain and demonstrate the potential for reducing GHG emissions as existing buildings become grid assets. These projects also kick-start strategies 3 and 5 to electrify existing homes and buildings, strategy 4 to add DERs throughout the community in an equitable manner, and strategy 2 to create resilience hubs that are self-sustaining during emergencies, but also provide low- and middle-income residents with low-cost renewable energy on a daily basis.

⁶⁵ SMUD first in US to change efficiency metric to “avoided carbon,” The new metric expected to encourage building electrification. <https://www.smud.org/en/Corporate/About-us/News-and-Media/2020/2020/SMUD-first-in-US-to-change-efficiency-metric-to-avoided-carbon>

⁶⁶ Grid Modernization Implications for WA State Energy Strategy, Carl Imhoff, PNNL, October 9, 2020.

1. Electrification Prequalification Project

Define electrification incentives for high-efficiency heat pumps (for hot water and HVAC) to enable more rapid market adoption. Prequalify heat-pump products, installers, and associated financial incentives for use by Community Energy Challenge analysts to speed new appliance deployment and market transformation. Prequalified products will have built-in demand response capability for future DR programs.

2. Solar/Battery Microgrid Project

Demonstrate daily peak shaving and reduced load on the distribution grid, plus provide backup to the building's critical loads during power disruptions for selected homes. Install microgrid (energy manager, smart inverter) and renewable energy generator (solar and/or battery). Split federal/state incentives between solar and battery to stimulate deployment of distributed energy storage throughout the grid as prices continue to decline in the future.⁶⁷

3. Resilience Hubs Project

Fund a project to identify and prioritize potential resilience hub sites for critical community services in Whatcom County.⁶⁸ Consider both public and private community services, similar to examples from the state of Maryland's Resiliency Hub Grant Program⁶⁹. Resilience hubs use large microgrids with DERs to meet community needs for improving equity and social justice (e.g., community solar), providing important resilience during disruptions to the grid, and reducing GHGs daily with renewable energy and efficiency. Whatcom County must lead by example, implementing its most important resilience hub site quickly. Funding should be sought for other top priority hub sites and coordinated with the State's Office of Disaster Resilience.

Key Priorities for Demonstration Projects:

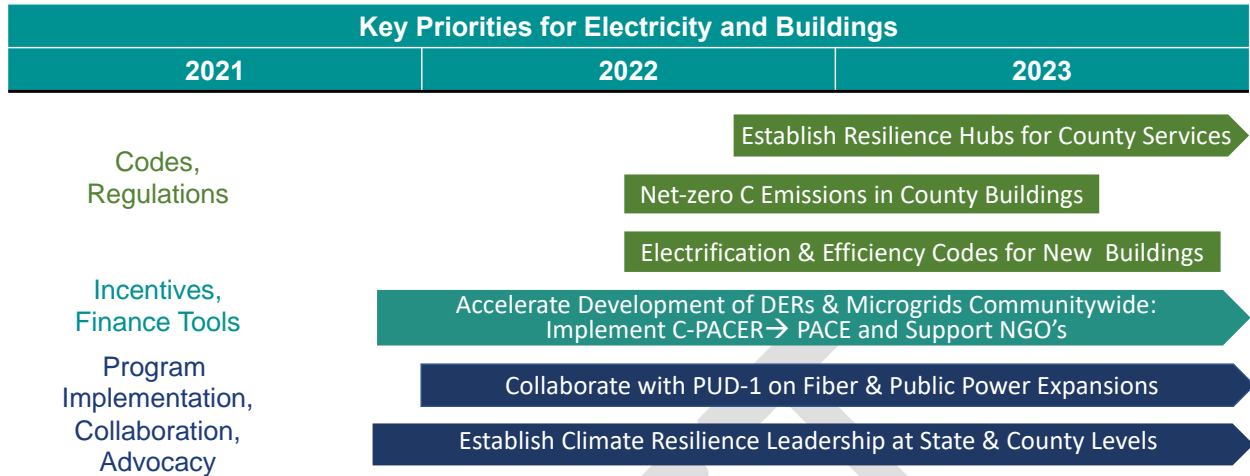
- ***Design and implement demonstration projects that will rapidly advance strategies 3 through 5 in a manner that promotes public acceptance and equity.***
- ***Plan and implement a resilience hub at the most important County site to reduce long-term energy operating costs, provides critical backup during power outages, and demonstrates the value of buildings as grid asset.***

⁶⁷ Ted Clifton on Zero Energy Plans and the Future of Zero Energy Homes, by Joe Emerson, September 2017, Zero Energy Project; Also confirmed in 2021 per email from Ted L. Clifton, Coupeville, WA, DOE Award Winning Builder in Pacific Northwest has advocated this since at least 2017.

⁶⁸ Consider California's "Resilience before Disaster – The Need to Build Equitable, Community-Driven Social Infrastructure" as a guide in the evaluation.

⁶⁹ <https://energy.maryland.gov/Pages/Resiliency-Hub.aspx>

Timeline for Electricity and Buildings Priorities



Conclusion

Most of the electricity we use is consumed in our buildings. We must modify our buildings to use less energy and ensure their energy mix is green. To achieve the energy transition our state has mandated, it requires we utilize electricity and buildings as grid assets. The best way to achieve our goals is to rapidly electrify end uses while simultaneously removing fossil fuels from the electrical grid.

This discussion on Electricity and Buildings focuses on how to reduce GHG emissions using financing solutions, code revisions, and technologies already used by other communities; strategies for enhancing social equity during the transition; and new technologies such as distributed energy generation and storage. Electrification of our buildings is particularly promising since we have many tools – incentives and regulatory measures, by which to assist in a just transition away from fossil fuels. Both Washington State and the US are applying an overarching strategy to rapidly electrify end uses while simultaneously removing fossil fuels from the electrical grid.

We believe that some of the simplest recommendations can be implemented to bring down GHG emissions while tackling the planning and policy work required to enable the shift to occur by 2030.

Industry Point-Source Emissions

Whatcom County has a GHG problem greater than many of the counties in the state. Cherry Point is home to two refineries, an aluminum smelter and a gas-fired thermal power plant that combined, were responsible for an astounding 51% of Whatcom County's GHG emissions in 2017 (Figure 2.2). There are three counties in Washington State with this concentration of GHG pollution and all are home to one of the five refineries. They include Whatcom, Skagit, and Pierce Counties.

Point-source emissions are those GHG emissions released from manufacturing processes and are defined by the US Environmental Protection Agency (EPA) as "any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory smokestack." Industries that produce 25,000 metric tons (MT) of CO₂ equivalent (CO₂e) emissions yearly are required to report their emission data to the US EPA.

Emissions from industrial buildings' energy use (e.g., electricity, natural gas) are categorized separately by EPA and included in Electricity and Buildings. Industrial point source emissions are GHG emissions released from manufacturing processes.

For decades our refineries and former aluminum smelter have provided immense economic benefit to the County and its citizens, but they also have been major contributors to climate change. This puts us in a paradoxical situation. The community is working diligently to reduce its GHG emissions, but our point-source industries still are discharging massive quantities of GHG pollutants into our atmosphere, making it impossible to reach net-zero emissions by 2050 without dramatic changes.

The worldwide transition to a clean energy economy is ramping up rapidly and this is a pivotal moment for Whatcom County to assert leadership to improve our environmental and economic future. It's a worldwide competition and our hope is that Whatcom County will act on this unique opportunity.

State and County Roles

Washington derives its authority to regulate GHG emissions from the US EPA. The Washington State Department of Ecology requires entities that emit 10,000 tons per year of CO₂e to comply with state reporting and recordkeeping for GHGs. In 2016 Washington's Department of Ecology adopted a Clean Air Rule that established GHG emission standards for "petroleum producers and importers" among other entities. The rule was challenged in 2018 but in January 2020 Washington's Supreme Court ruled that the State has the authority to regulate direct (point-source) emissions. The rule requires direct emitters reduce GHG emissions by 5% every three years. That reduction can be satisfied by purchasing reduction credits.

Unfortunately, a 1.7% reduction in GHG emissions annually by point-source emitters hardly addresses the urgent nature of our climate crises and would only reduce these emissions by 14% by 2030 using these emission goals. Far more than incremental reductions are needed to reduce these immense point-source GHG emissions.

The State Department of Commerce recently released its 2021 Energy Strategy. In the effort to deeply decarbonize, the state's strategy promotes the development of clean fuel refining and carbon capture, storage and utilization (CCSU) and focuses on the production of green hydrogen and renewable fuels

from biomass among numerous other innovative goals.⁷⁰ Washington's recently enacted low carbon fuel standard will only increase the demand for renewable fuels.

The Washington [Climate Commitment Act of 2021](#) is a comprehensive cap and invest system that will go into effect January 2023.⁷¹ This Act will establish a [cap and trade emissions market](#) in the state. Industries that emit 25,000 metric tons of GHGs or more will receive free emissions allowances equal to their emissions in 2022. The refineries at Cherry Point are subject to foreign and out-of-state competition and fall under the category of "Emissions-Intensive Trade-Exposed" (EITE) in this Act. EITE industries will receive free GHG credits through 2035 and not be subject to the cap on emissions to prevent relocation to non-regulated regions. Regardless of the EITE exception, this Act sets up a timetable for reducing GHG emissions and may increase the transition to renewable energy. The State's leadership and commitment to implementing bold solutions to our climate problems should inspire and motivate our County leadership ambitions.

Whatcom County also has a role in regulating Industrial point-source GHG emissions through its zoning codes and the authority the State has granted in administering the State Environmental Policy Act or SEPA. The "Cherry Point Amendment" would require a conditional use permit for the expansion of existing fossil fuel refineries that would result in a cumulative increase by more than 10,000 barrels per day of crude distillation capacity or transshipment capacity. New fossil fuel refineries, piers, docks, or wharves are prohibited at Cherry Point as well as coal-fired power plants. Conversion of a renewable fuel refinery or renewable transshipment facility to fossil fuel is also prohibited.

Whatcom County has the opportunity to create an historic solution to this industry problem. In order for Whatcom County to reduce its GHG emissions, the industries responsible for point-source emissions need to use new greener technologies for refining processes now, and plan to respond to future demands by reducing the production of refined petroleum products⁷² as internal combustion engine (ICE) technology and gasoline continue to lose market share.⁷³

2017 Assessment for Industrial Point-Source Emissions

As mentioned previously, the County's point-source industries were not included in the 2007 Whatcom County Action Plan (CAP) because disclosure of this information was not required to be reported until 2010. Table 2.1 shows 2017 emissions by specific point-source industries; they total 3,862,348 MT CO₂e. Since the completion of the GHG Inventory, the Alcoa Intalco aluminum smelter halted production in 2020. With this closure, point-source emission countywide will drop by over a million metric tons of CO₂e in future GHG assessments. Unfortunately, that substantial reduction was associated with the loss of over 700 jobs.

⁷⁰ Washington 2021 State Energy Strategy, Department of Commerce. December 2020.

⁷¹ After a decade of failures, Washington state passes a cap on carbon emissions, by Kate Yoder, April 27, 2021, Grist. <https://grist.org/economics/after-a-decade-of-failures-washington-state-passes-a-cap-on-carbon-emissions/>

⁷² Northwest states need a plan to move beyond gas, by Laura Feinstein and Eric de Place, December 9, 2020, Sightline

⁷³ Gasoline is becoming worthless, by Rick Newman, February 3, 2021, Yahoo! Finance News,

Table 2.1. 2017 Industrial Point-Source Emissions by Source and by Facility (in Mt CO₂e)⁷⁴

Sources of Emissions	Alcoa Intalco	Bp Cherry Point Refinery	NW Pipeline GP Sumas C/S	Phillips 66 Ferndale Refinery	Whitehorn Generation Station	Totals (by emission sources)
Stationary fuel combustion	N/A	1,251,561	N/A	383,963	1,715	1,637,239
Aluminum production	1,025,298	N/A	N/A	N/A	N/A	1,025,298
Petroleum refineries	N/A	239,213	N/A	305,344	N/A	544,557
Petroleum & natural gas systems	N/A	N/A	3,903	N/A	N/A	3,903
Industrial waste landfills	9,648	N/A	N/A	N/A	N/A	9,648
Hydrogen production	N/A	641,703	N/A	N/A	N/A	641,703
Totals (by facility)	1,034,946	2,132,477	3,903	689,307	1,715	3,862,348

From the data in the Table 2.1, it is clear that *bp* is the single greatest point-source emitter of GHGs in the County and also in the state during 2017. *bp* is a larger refinery and emits nearly three times the amount of GHGs as Phillips 66's refinery. Therefore, *bp*'s Whatcom County-generated GHG pollution poses a serious, long-term problem for our community. Hopefully, this may simultaneously provide a remarkable opportunity to partner with *bp* to facilitate the transformative change that is necessary to meet the challenges of global warming. The ultimate goal is to facilitate the transition to low-emission industries by promoting green technologies as well as the sustainable energy jobs it will create for Whatcom residents.

As mentioned in [Section 1](#), *bp* is supporting a major shift to renewable energy production. Their intention is to reinvent *bp* and reduce their GHG emissions to net zero by 2050 or sooner. This includes reducing their oil production 40% and investing \$5 billion this decade. *bp* intends to spend 80% of this \$50 billion by 2025 and grow their hydrogen operations.⁷⁵ In addition, they plan to partner with 10 to 15 major cities around the world.⁷⁶ As *bp*'s US headquarters, *bp* partnered with the City of Houston to implement its CAP goals and is providing a \$2 million grant and two staffers to the Houston's Office of Sustainability to that end.⁷⁷

⁷⁴ Table 2.2 from Cascadia Consulting's GHG Inventory

⁷⁵ *bp* Commits Big Investments Towards Its 'Net Zero Emissions By 2050' Target, by [David Blackmon](#), October 10, 2020, Forbes.

⁷⁶ Partnering with countries, cities and industries by William Lin, September 2020, *bp* week. <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/investors/bpweek/bpweek-partnering-with-cities-countries-industries.pdf>

⁷⁷ City of Houston Partners with *bp* to Advance Climate Action Plan Goals by Mayor's Office Press Release, July 22, 2020.

These actions are strategic on *bp*'s part, not just a sudden conversion to environmental values but an economic necessity. Weak natural gas and crude oil prices are a harbinger of the future for the industry. According to the law firm Haynes and Boone, in the first eleven months of 2020 forty-five oil and gas companies filed for bankruptcy.⁷⁸ Simultaneously wind and solar technologies are surging and will be further supported in future infrastructure bills which include efforts to remove electricity generated from fossil fuels from the grid by 2035 and strictly regulate methane emissions.⁷⁹

Despite *bp*'s international aspiration, their Whatcom County refinery has not yet announced any effort to reduce its GHG emissions. It is hoped that *bp*'s Cherry Point refinery would address this problem. The VP of Corporate Analysis at Wood MacKenzie describes *bp* as the only organization of its "stature that has gone so far, or committed so unequivocally, to transforming itself in the face of the energy transition."⁸⁰ Therefore, *bp* should be open to a conversation about their local emissions and possible solutions. If corporate headquarters is buying charging stations, partnering to create large amounts of green hydrogen, funding major American city's Climate Action Plans, reducing oil production, eliminating all new exploration, and divesting itself of \$25 billion in assets over the next five years, then the Cherry Point facility, the newest refinery in the United States, should be thinking about innovations to reduce its GHG emissions.

Goal and Strategies for Industry Point Source Emissions

Goal: Eliminate 90% of the GHG emissions from the refineries by 2050.

It is internationally acknowledged that the world's energy sector must be transformed rapidly to meet our collective goal of preventing a 2°C (3.6°F) increase in global temperature above pre-industrial levels. That translates into a goal of a 95% reduction below 1990 CO₂ levels by 2050. Remarkably, most of the nations of the world are now working to vastly overhaul their fossil-fuel-based economies in less than 30 years.

Whatcom County's refinery-derived CO₂ emissions pose a considerable challenge to meeting that goal and hence we offer detailed strategies designed for our specific situation. All strategies are offered from a collaborative mind set, utilizing creative problem-solving, and underpinned by an optimistic vision of what a carbon-neutral energy industry could look like.

Strategies for Industry

1. Facilitate a solutions-focused collaboration with *bp*'s Cherry Point plant manager, energy experts in academia, and state and federal governments to discuss ways to achieve a 50% reduction in their point source GHG emissions by 2030.

⁷⁸ Trump's unplanned gift to Biden: Clean energy on the rise by Ben Lefebvre and Kelsey Tamborrino, December 29, 2020, <https://www.politico.com/news/2020/12/29/trump-biden-clean-energy-451546>.

⁷⁹ Ibid.

⁸⁰ *bp* Commits Big Investments Towards Its 'Net Zero Emissions By 2050' Target, by [David Blackmon](#), October 10, 2020, Forbes.

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2. Promote the research, development, and collaboration needed to build a hydrogen electrolysis facility to create green hydrogen in Whatcom County.
 3. Establish a regional center for research, development and demonstration (RD&D center) to accelerate the development of low carbon fuels and building materials modeled after Washington's Maritime Blue Strategy.

Strategy 1: Facilitate a solutions-focused collaboration with *bp*'s Cherry Point plant manager, energy experts in academia, and state and federal governments to discuss ways to achieve a 50% reduction in their point source GHG emissions by 2030.

Whatcom County's goal should be to aid in any possible manner the implementation of the greenest technologies available to reduce GHG emissions from our refineries, particularly *bp*. Such a public-private collaboration, focused on designing and implementing pathways to carbon neutral solutions, has the potential to benefit all parties and aligns with the climate goals of Whatcom County, Washington State, the federal government and *bp*'s net-zero ambitions.

The purpose of an in-depth discussion with *bp* is to motivate this international organization to specifically focus on its GHG emissions impacts to Whatcom County, Washington State, and the adjacent communities of Blain, Ferndale, and Bellingham. While *bp* is the major emitter of GHGs in Whatcom County and Washington State, it is also one of the most climate-conscious petroleum companies in the world, but to date their carbon-reduction efforts have not been focused on their Cherry Point refinery. Since *bp*'s Cherry Point refinery is the newest in the nation and is therefore anticipated to be in operation well into the future, their emissions have the potential to be a chronic problem for our community. For this reason, a public-private dialogue and collaboration is warranted.

This solutions-focused discussion is needed to understand the history of previous efforts, the feasibility of possible actions, the resources required and potential sources of funding, the need for technical partnerships, and any legislative policy or appropriations needed to reduce the industry's GHG emissions.

Numerous resources are available to the county that can provide the support and creative problem solving necessary to expedite this task. They include the technical expertise of Western Washington University's Institute for Energy Studies, the University of Washington, Washington State University, and the Whatcom PUD1. This dialogue should also include appropriate representation from relevant federal and state agencies. For example, Washington State's Departments of Commerce and Ecology as well as the Governor's Office could be instrumental in aiding with resources needed to implement a significant GHG solution as could the federal government through the National Laboratories of the Department of Energy and/or the White House.

The moment is uniquely ripe for public-private collaboration given the climate focus of Governor Jay Inslee and the Biden Administration. Reducing GHG is a priority for this president who has made a commitment to a historic investment in energy and climate research and innovation. Retooling existing refining process to reduce emissions by utilizing green technologies is exactly the type of task that warrants extensive federal, state, local, and private partnership.

One area that should be discussed is enhancing energy efficiency in industrial processes. The US EPA's EnergyStar program is a voluntary program that provides energy management tools and strategies for the petroleum refining industry, among others. The program provides guidance on organization-wide energy management systems. It employs sub-metering, monitoring and control systems that can reduce the time required to perform complex tasks hence reduce energy consumption and GHG emissions.⁸¹ The list of potential energy reductions (and associated emission reductions) is extensive and includes suggestions related to power recovery in high pressure operations such as fluid catalytic crackers and hydrocrackers, the use of combined heat to power (CHP) cogeneration plants, or medium- to high-temperature heat pumps to electrically crack petroleum feedstock.

The Phillips 66 refinery at Cherry Point has been awarded an EPA EnergyStar certificate for their voluntary efforts to reduce greenhouse gas emissions through energy efficiency. The certification indicates that the refinery performed in the top 25 percent of similar facilities nationwide for energy efficiency and met specific environmental performance levels set by the EPA.⁸² *bp* has not participated in this program but no doubt has instituted some if not many of the energy efficiencies suggested. It's highly recommended that *bp* voluntarily engage in this program to show their commitment to reducing GHG emissions in Whatcom County.

As mentioned earlier, electricity use by industry is not categorized as a point-source emission, so the use of clean electricity will not reduce this category but would reduce industrial electricity emissions that are shown in [Figure 2.6 in Electricity and Buildings](#). Currently the *bp* refinery uses energy purchased on the spot market or from PSE, neither of which provide carbon-free electricity. In fact, both sources of energy are fossil fuel intensive, and the electricity generated is usually derived from greater than 60% fossil fuel. By comparison PUD1's electricity generation is only 2% fossil fuel.

Nearly a century ago Congress authorized the Bonneville Power Administration (BPA) to sell power to utilities and a few large industries. Whatcom PUD1's electricity is purchased from BPA and provided to Phillips 66 at Cherry Point. *bp*'s location at Cherry Point offers the company with a unique opportunity to explore utilizing low carbon electricity provided by PUD1 to effectively reduce their GHG emissions.

Whatcom PUD1 is currently engaged in strategic planning related to their electricity capacity needs for the future. The PUD1 should seriously evaluate expanding its capacity to provide significant quantities of clean, green electricity to decrease the carbon footprint of our local industries. PUD1 is uniquely positioned to provide significant climate solutions to the State and the County. And for that reason, PUD1 in coordination with the County should attempt to engage *bp*.

BPA lines currently serve the curtailed Alcoa plant, and the distance required to extend those lines to *bp* is minimal, although costly. There may be an opportunity to use the mechanisms provided by Washington State's [2021 Climate Commitment Act](#) to help finance extension of these power lines.

⁸¹ Energy Efficiency Improvement and Cost Saving Opportunities for Petroleum Refineries by Ernst Worrell, Mariëlle Corsten, and Christina Galitsky, USEPA, February 2015. p 15.

⁸² <https://www.phillips66.com/sustainability/energystar>

Clearly creative thinking is warranted to reduce the more than 2 million metric tons of CO₂e emitted by *bp* annually in Whatcom County.

Ultimately, it may take the assistance of the federal government to accelerate the greening of refining processes. The federal government has long intervened in the energy market, some of these tax subsidies have existed for a century.⁸³ Tax subsidies provide a means to encourage domestic energy production. But in order for the tax code to align with fossil-free energy goals, tax subsidies need to be overhauled to provide incentives to reduce GHG emissions and enable new climate-compatible energy technologies. Currently the code allows companies to deduct a majority of the costs incurred from drilling new wells domestically. Instead, the federal government should subsidize the creation of utility scale renewable energy farms and/or the implementation of green hydrogen production at refineries.

Strategy 2: Promote the research, development, and collaboration needed to build a hydrogen electrolysis facility to create green hydrogen in Whatcom County.

Hydrogen is used predominately in petroleum refining in the hydrocracking and hydrotreating processes. It is also used in transportation as rocket fuel and in hydrogen fuel cell powered forklifts and vehicles. Although a minor component of transportation there is considerable effort to expand hydrogen use in that sector to reduce the amount of GHGs in the atmosphere. Hydrogen fuel cells are the most likely replacement for diesel-powered semitrucks, trains, and ships. Multiple federal reports name transportation as the largest new market opportunity for hydrogen.

California has taken the lead in promoting hydrogen use. It has over 40 hydrogen fueling stations and dozens under construction to support the 7,500 hydrogen cars on the road. Los Angeles Department of Water and Power has pledged to transition to a hydrogen fueled power plant from its coal-fired Intermountain Power Plant, the first effort of this kind.⁸⁴ Airbus announced in September 2020 that it plans to develop a commercially-viable, hydrogen fuel cell airplane within five years.⁸⁵

Washington State has also seen the value of hydrogen. In 2019 Washington State authorized public utilities districts (PUDs) to produce, distribute and sell renewable hydrogen. Douglas County's PUD received \$250,000 in the 2020 Supplemental Capitol Budget for its Renewable Hydrogen Project.⁸⁶ The project provides a model for other PUDs along the Columbia River but also for PUDs interested in developing solar and wind power. In September 2020 Douglas County's PUD and Toyota received a \$1.9 million grant from the Centralia Coal Transition Board to develop the first hydrogen fueling station in Washington State.

Hydrogen Varieties

⁸³ Fact Sheet | Fossil Fuel Subsidies: A Closer Look at Tax Breaks and Societal Costs, Environmental and Energy Study Institute, July 29, 2019.

⁸⁴ Los Angeles wants to build a hydrogen-fueled power plant, LA Times, Sammy Roth, 4/10/19).

⁸⁵ Airbus bets on hydrogen to deliver Zero-Emission Jets, Bloomberg News, Charlotte Ryan and Will Mathis, 12/4/20

⁸⁶ Renewable Hydrogen Production Facility Groundbreaking, by Meaghan Vibbert. March 8, 2021. <https://douglaspud.org/Pages/Renewable-Hydrogen-Production-Facility-Groundbreaking.aspx>

The carbon footprint of hydrogen is dependent on the method of production. There are three main varieties of hydrogen are referred to as grey hydrogen, blue hydrogen and green hydrogen.

Currently, 95 percent of all hydrogen produced in the US is created through the intensive CO₂-emitting process of steam methane reforming (SMR). The resulting gas is referred to as **grey hydrogen** because of its high GHG footprint (Table 2.2). The process uses natural gas (methane) and steam (heated water) to produce hydrogen and carbon monoxide (CO). The CO converts in a subsequent reaction with steam to create CO₂ and H₂.

Table 2.2. Calculated GHG emissions by H₂ production method. Emissions from blue H₂ can vary widely with the age and efficiency of the SMR process. Upstream methane emissions are not included in the SMR estimates.

Grey hydrogen generation produces large quantities of CO₂ and should not be used as a replacement for natural gas (methane). Because of this, grey hydrogen has a greater carbon footprint than using natural gas-to produce electricity.⁸⁷

Type of H ₂	Method of H ₂ Production	GHG Emissions (kg CO ₂ /kg H ₂)
Green Hydrogen	Electrolysis with Renewable Energy	0
Blue Hydrogen	SMR with CCS	1.7
Grey Hydrogen	SMR	9.3

Another fundamental concern is that the SMR process utilizes methane (CH₄). Methane is a far more powerful GHG but not as long-lived CO₂, although it does decompose to CO₂. When it leaks to the atmosphere, it traps 84 times as much heat in the atmosphere than CO₂ as over a 20-year period. It is estimated that methane is responsible for 23 percent of all observed changes to the Earth’s climate over the last century.⁸⁸ The point is, natural gas leakage occurs along the entire path from mining to end use, and is an environmental threat along that pathway.

To reduce the amount of CO₂ released in the production of grey hydrogen, efforts have focused on carbon capture, storage and utilization (CCSU)⁸⁹ to reduce the environmental impact. Grey hydrogen treated by CCSU is referred to as **blue hydrogen**. CCSU is simply a process to capture the CO₂ from the SMR process and either permanently store it in deep geologic formations or utilize the CO₂ to form other products. Unfortunately, markets for such large quantities of CO₂ do not currently exist in many areas of the county, including Washington state. The economics of the carbon capture and storage (CCS) process are also daunting, requiring large amounts of energy. Future advances in technology may reduce the cost of hydrogen produced by SMR with CCS.

Green hydrogen is created by using emissions-free electricity (electricity generated from solar, wind, hydroelectric dams or nuclear) to run a current through water to break the bond between the hydrogen

⁸⁷ Estimating the Carbon Footprint of Hydrogen Production by Robert Rapier, Forbes, Jun 6, 2020

⁸⁸ https://climate.nasa.gov/climate_resources/225/video-methane-sources/, July 20, 2020.

⁸⁹ The US Department of Energy defines CCSU as a process that captures carbon dioxide emissions from sources like fossil-based power plants and either reuses or stores it so it will not enter the atmosphere. CO₂ storage in geologic formations includes oil and gas reservoirs, coal seams and deep saline reservoirs – structures that have stored these oil, gases, and brines for over millions of years. <https://www.energy.gov/carbon-capture-utilization-storage>

and oxygen atoms to produce hydrogen gas in a process called electrolysis. The hydrogen gas is then compressed to create a fuel that can be stored or used in fuel cells where it is converted to electricity. Water vapor is discharge as opposed to CO₂. There are no batteries involved in fuel cell vehicles and hydrogen fuel is pumped similar to gas-consuming vehicles.

Currently electrolysis requires massive amounts of electricity. As a result, most electrolysis installations in Washington State are in areas where excess emissions-free electricity is available for no or low cost. This excess emissions-free electricity may come from grid curtailments of solar, wind and hydroelectricity when production of electricity exceeds the demand needed for the electric grid. For example, the 5 MW hydrogen electrolysis facility being built in Douglas County in eastern Washington will use excess hydroelectricity generated by high river flows in the winter and early spring, which are only intensifying with climate change.

The Clean-Energy Potential of Green Hydrogen and World-Wide Demand

As the world becomes more and more concerned with reducing GHG emissions the demand for green hydrogen has grown dramatically to replace coal, oil, and natural gas with this carbon-free fuel. Countries around the world, various states, and numerous industries are banking on hydrogen as an energy carrier and storage medium, in places where there will be a surplus of renewable electricity available. Europe is taking the lead in developing a hydrogen economy.⁹⁰ France, Germany, Italy, Portugal, and Spain as part of their hydrogen strategy anticipate investing \$44 billion in green and blue hydrogen programs in the next decade.⁹¹

The International Energy Agency roadmap for net zero energy by 2050 predicts that hydrogen use will increase globally from less than 90 million MT in 2020 to more than 200 million tons in 2030.⁹² In the US, almost two thirds of the annual 10 million tons of hydrogen is used for petroleum refining. Most of the remainder is used in other industrial processes such as ammonia and methanol production, metal refining, glass production and electronics fabrication.⁹³

The cost of generating green hydrogen has fallen by 40% since 2015 and is anticipated to fall an additional 40% by the end of 2025.⁹⁴ Hydrogen Europe, a coalition of private companies,

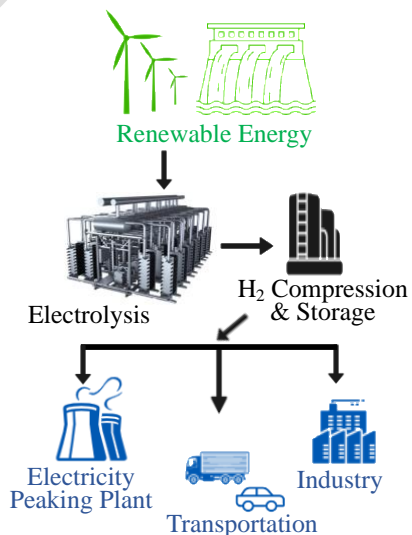


Figure 2.12. Liquid H₂ production, storage, and use.

⁹⁰ Who will be the Hydrogen superpower? The EU or China, by Soren Amelang, August 31, 2020, <https://energypost.eu/who-will-be-the-hydrogen-superpower-the-eu-or-china/>

⁹¹ Europe emerges as leader in hydrogen economy by Kevin Adler, December 15, 2020, [lhsmarkit.com](https://www.lhsmarkit.com).

⁹² Ruth, M, Jadun, P, Gilroy, N, et al. 2020. The Technical and Economic Potential of the H₂@Scale Concept within the United States. Golden, CO: National Renewable Energy Laboratory, NREL/TP-6A20-77610.

⁹³ Net Zero by 2050, A Roadmap for the Global Energy Sector. International Energy Agency, 2021. <https://www.iea.org/reports/net-zero-by-2050>

⁹⁴ Ibid.

research institutions and national agencies are working to push through the barriers of no to low demand for hydrogen and lack of infrastructure to achieve their climate goals and generate a substantial number of new jobs.

bp is on the cutting edge of green hydrogen technology in Germany. In November 2020, *bp* and Ørsted announced they will collaborate on a 50 MW electrolyzer in Germany to replace 20% of the refinery's existing fossil-fuel-derived hydrogen.⁹⁵ This is *bp*'s first full-scale commercial hydrogen venture. It is anticipated to be functional by 2024. Additionally, by 2030 *bp* anticipates having 10% of the clean hydrogen market in "core hydrogen markets" as it pursues carbon-neutrality by 2050.

This is not the only hydrogen electrolysis plant in Germany. Shell is part of a consortium that is building the world's largest hydrogen electrolysis plant at its Rheinland refinery. The REFHYNE project will replace Shell's two existing SMR processes and significantly reduce its CO₂ emissions. It will also allow the company to provide leadership in the refining industry's transition to clean energy.

These and numerous other green hydrogen ventures are igniting across the world despite concerns about the cost of generating electricity to produce hydrogen. But there is increasing optimism that green hydrogen may become significantly cheaper.

Bill Gates and Hong Kong billionaire Li Ka-shing recently provided funds to back H₂Pro, an Israeli start up, that is using a new method to produce green hydrogen. The method reduces the energy required by adding an additional thermal step. H₂Pro anticipates making green hydrogen for \$1 per kilogram by the end of the decade, far cheaper than the \$2.5 to \$6.80 2019 price of a kilo of green hydrogen.⁹⁶ If this venture is successful most of the criticism of hydrogen energy will likely evaporate. It is this type of innovative endeavor that will give *bp* a competitive edge in the burgeoning renewable fuels market of the near future.

It is acknowledged that strategy 2 is the most aspirational and challenging of the three strategies outlined in this chapter, but the concept is consistent with goals of numerous states and countries as well as supported by the 2021 Washington State Energy Strategy. Certainly, this initiative would warrant the full-scale support of the county, state, and federal governments as producing green hydrogen will enable numerous benefits and should be one of the main focuses of Strategy 3.

Strategy 3: Establish a regional center for research, development and demonstration (RD&D center) to accelerate the development of low carbon fuels and building materials modeled after Washington's Maritime Blue Strategy.

Whatcom County has a long history of supporting energy production. It has been home to a petroleum refining economy since the mid-1950s starting with the construction of the Phillips 66 plant and followed in the early 1970s with the addition of the *bp* plant. These two Fortune 500 companies support

⁹⁵ *bp* and Ørsted Launch Green Hydrogen Partnership by John Parnell, Greentech Media, November 10, 2020

⁹⁶ Gates-backed startup joins race to make hydrogen cheaper by Akshat Rathi and Will Mathis, Bloomberg Green, March 8, 2021

over 2,600 high-paying manufacturing jobs and have created a significant portion of our economic prosperity.⁹⁷

As the world accelerates its efforts to reach net-zero emissions in the coming years petroleum consumption will decline as will refineries and refinery jobs. This fact was confirmed in a recent study that showed over the coming decade, the fossil fuel industry is expected to lose about 140 jobs per year in Washington.⁹⁸ *bp*'s corporate announcement to reduce their fossil fuel production worldwide by 40% over this decade will undoubtedly reduce their workforce – unless *bp* simultaneously invests in new clean fuels production.

The purpose of forming a RD&D center is to develop and initiate an integrated strategy around the production of low-carbon fuels and building materials. Washington's Maritime Blue is an excellent example of such a center and can be used as a template. "Maritime Blue gathers businesses, public entities, community organizations, researchers and training institutions together to build a low-carbon marine industry that remains economically competitive. Our County should be involved in this RD&D center due to Whatcom's strong maritime industry. To date, Maritime blue has assembled 55 industry members along with four research institutions, 14 organizational partners and 22 public sector partners and leveraged \$6.5 million in public funding for programming and projects."⁹⁹ This public-private partnership has received \$32 million in private capital and \$6 million in business sales for the first 11 innovative start-ups. It is clear that this center can serve as a framework to decarbonize other industries in the state, including the production of clean fuels.

In his 2021 book *How to Avoid a Climate Disaster*, Bill Gates confirms the necessity of public/private partnerships that have the capability to bring in the people who know how to innovate, especially in the early stages of development and deployment.¹⁰⁰ Government assistance is a necessity because of the size and the scope of the overhaul needed to decarbonize the energy sector. The federal government could fund various projects through its numerous agencies and can also aid in overcoming barriers, producing prototypes, creating tax credits and incentives, providing loans, research grants, and lab facilities.

The Washington 2021 State Energy Strategy supports replication of the Maritime Blue framework to accelerate and support emerging low-carbon industrial opportunities for other industries in the state. Whatcom County is in an excellent position to take advantage of this approach with our current petroleum refineries, agriculture, and forestry industries. As

Forming an RD&D center around clean fuels and building materials is facilitated by: Pacific Northwest National Laboratory, one of 17 national energy laboratories, large regional research universities including WWU, and technical colleges and training facilities, such as Bellingham Technical College. In addition, the Clean Tech Alliance has over 1,100 members that facilitate the growth of clean technologies and jobs.

⁹⁷ Employment at Cherry Point by the Center for Economic and Business Research, Western Washington University, March 2019. [https://cbe.wvu.edu/files/2019 Cherry Point Employment Impact Study.pdf](https://cbe.wvu.edu/files/2019%20Cherry%20Point%20Employment%20Impact%20Study.pdf)

⁹⁸ Robert Pollin and Heidi Garrett-Peltier, and Jeannette Wicks-Lim, 2017. "A Green New Deal for Washington State." University of Massachusetts Amherst, <https://www.peri.umass.edu/publication/item/1033-a-green-new-deal-for-washington-state>.

⁹⁹ Washington 2021 State Energy Strategy, pg 99.

¹⁰⁰ Bill Gates, 2021. *How to Avoid a Climate Disaster*. Alfred A. Knopf, New York, p 202.

stated earlier in this chapter, electrification of heat-based processes and increasing the overall efficiency of refining petroleum would reduce GHG emissions. Also stated previously Washington's low carbon fuel standard will promote greater emphasis on biofuel and hydrogen fuel production. The agriculture and forest product industries both produce feedstocks that can be used in biofuel production. The current problem is the cost involved in collecting and transporting this waste to a facility that produces biofuels. Innovations that make it less costly and easier to produce biofuels at the farm or municipal level provide opportunities for economic development.

Pacific Northwest National Laboratory's Bioproducts Sciences and Engineering Laboratory (BSEL) focuses on the science and engineering for deriving energy from agricultural and forest residues, and municipal and industrial waste streams. The BSEL facility has a scaled-up engineering facility that can test new processes for converting waste to biofuel, which is a critical step prior to deploying new technologies.¹⁰¹ Researchers at BSEL have technical expertise in advanced biotechnology, catalysis, and thermal processing which enable advances in biofuel production.



Figure 3.13. Biofuel process testing at PNNL's Bioproducts, Sciences, and Engineering Facility.

Breakthroughs in technologies to reduce the power needed and subsequent cost of hydrogen fuels are also important. For example, Washington State University researchers have discovered and tested a new inexpensive catalyst for an electrolysis exchange membrane that does not rely on expensive precious metal catalysts such as platinum and iridium and also does not require use of corrosion-resistant metal plates.¹⁰² Promising breakthroughs like these that lower the cost of hydrogen production need to be deployed and evaluated at scale to really fully understand the cost savings a feasibility of these new approaches.

Cross-laminated timber (CTL) is a fast-growing opportunity for the lumber industry in Washington State. This proposed RD&D center should also consider innovations in producing cross-laminate timber (CLT) to replace steel in many building projects and reduce embodied carbon in building materials. CLT will not replace steel in skyscrapers but can significantly reduce the use of steel in multilevel apartment or commercial buildings. For example, the Brock Commons Tallwood House at the University of British Columbia in Vancouver BC is 18 stories high and houses over 400 students.¹⁰³ The first two stories of this

¹⁰¹ PNNL Researchers are Turning Kitchen Waste into Biofuels, February 22, 2021, <https://www.pnnl.gov/news-media/pnnl-researchers-are-turning-kitchen-waste-biofuels>

¹⁰² "Water splitting advance holds promise for affordable renewable energy," by Sara Zaske, WSU News, March 9, 2020: <https://news.wsu.edu/2020/03/09/water-splitting-advance-holds-promise-affordable-renewable-energy/>

¹⁰³ Brock Commons Tallwood House fact sheet: https://sustain.ubc.ca/sites/default/files/brock_commons_tallwood_house_apr_2018_web_003.pdf

hybrid building are cement with CLT used for subsequent stories. The wood structure portion of this LEED gold residence building was completed in only nine and a half weeks.

An important aspect of the economic transition of decarbonizing industrial processes and producing low carbon fuels and building materials is the creation of new skilled, living wage jobs. Workforce development must be at the forefront of this new RD&D center. Washington state and the federal government are continuing to invest heavily in preparing workers for the growth in clean energy jobs. To succeed and bring new economic development to Whatcom County, the RD&D center will need to provide educational opportunities through the funded startups that emerge from this innovation center.

Finally, in developing a RD&D center, we must take into account the many attributes of Whatcom County that can attract new carbon-free industries. PUD1 offers clean electricity that can be used in manufacturing processes. Our agriculture and forest products industries can help supply the feedstocks for clean fuels and new building products. Our ports and rail systems provide transportation for new products. And finally, the outdoor recreation opportunities, resources and climate provide the high quality of life important to many families and skilled workers.

Conclusion

We must acknowledge the importance of this moment and let it motivate us to be as creative and strategically-sound as possible in designing the next steps to deeply decarbonize and transform the energy sector. We need to look with fresh eyes at new processes not merely the mechanics but the soundness of the process of each technical energy innovation. We are in fact outlining a peaceful technologic revolution to the cleanest, healthiest, and most sustainable way of doing things.

This discussion on industrial point source emissions has focused on how to reduce GHG emissions from petroleum refineries and help Washington state transition to a clean fuel economy. We believe that some of the simplest strategies can be implemented and easily bring down GHG emissions while simultaneously beginning to turn the wheels on the process of envisioning, designing, and implementing the green energy industrial sector that Whatcom County and the state of Washington needs for a healthy and safe future. This rapid transition is inevitable and necessary. But it is also a competition with winners and losers. Whatcom County must compete vigorously in order to define our path.

2019 Washington Clean Energy Jobs

11x more clean energy jobs in Washington than fossil fuel jobs

10% of Washington clean energy workers are veterans, nearly double the national average

8.3K rural Washington residents work in clean energy

7 OUT OF 10 clean energy employees in Washington work at companies with fewer than 20 employees

45% of Washington's clean energy workforce is located outside of the Seattle metro area

5 OUT OF 10 counties by clean energy jobs per capita have populations fewer than 100,000 – including Jefferson County which has 23 clean energy jobs for every 1,000 employable residents

Transportation

Whatcom County’s climate action goals, strategies, and actions are intended to reduce GHG emissions in alignment with federal, state, municipal, and other existing community efforts. The Washington 2021 State Energy Strategy describes numerous proposals (most of which require action by the Washington State Legislature) that lead to GHG emissions reductions, including many in the area of transportation.

Transportation is critical to human civilization. We must have efficient ways to move goods and people. This movement requires energy, and in our current transportation system, the primary mode of transportation is single-occupancy internal combustion engine (ICE) vehicles that use fossil fuels as an energy source. One of the major drawbacks to the use of ICE vehicles is their emissions of a variety of pollutants, including large quantities of greenhouse gases (GHGs) such as CO₂ and nitrogen oxides (NO_x).¹⁰⁴

In 2017, transportation was the third largest source of Whatcom County’s GHG emissions (at 13.7%); only industrial sources (50.9%) and electricity consumption (18.2%) were larger (Fig. 2.2). Because Whatcom County’s transportation demand is projected to increase in the coming years with a growing population,¹⁰⁵ addressing mobility needs while reducing transportation emissions should be a primary target of Whatcom County’s climate change mitigation efforts.

The combustion of fossil fuels by on-road vehicles is the leading contributor to transportation emissions (see Figure 2.14¹⁰⁶). Another essential component of transportation-related emissions is land use. Land use patterns, such as road networks, housing density, and zoning laws, determine transportation accessibility and behavior. Therefore, reducing transportation emissions will require changes in Whatcom County’s land-use patterns. Land use issues, including those related to transportation, are

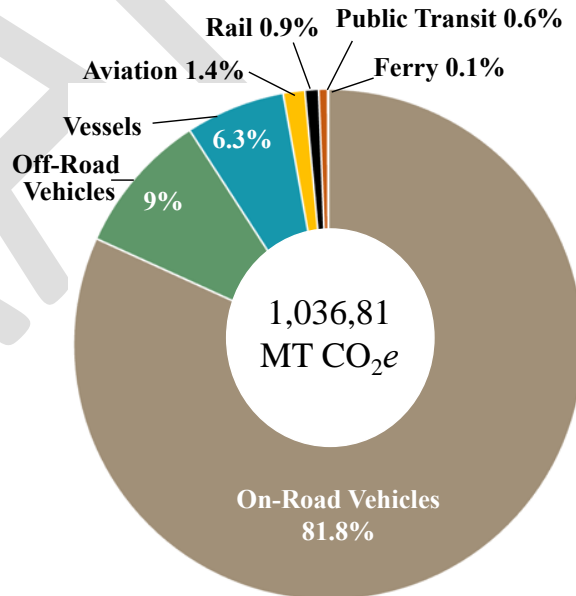


Figure 2.14: Whatcom transportation emissions in metric tons of CO₂e.

¹⁰⁴ When we estimate the benefits of GHG reductions we should also include the co-benefits of reducing the health effects of local pollution.

¹⁰⁵ Whatcom Council of Governments, June 9, 2017, Whatcom Mobility 2040 <https://whatcommobility.org/2040-2/2040activity/>

¹⁰⁶ Whatcom County Greenhouse Gas Inventory Report, 2020, p. 12 Fig. 5. https://www.whatcomcounty.us/DocumentCenter/View/48029/WhatcomCountyGHGInventory_DRAFT_June2020 Note that “off-road” vehicles are “agricultural, construction, commercial and industrial, lawn and garden, and recreational vehicles and equipment.”

addressed in detail in a later [chapter](#) of this report.

Generally, there are two ways to reduce transportation emissions associated with a trip: reduce vehicle miles traveled (VMT) or reduce the emissions per vehicle mile traveled (E/VMT)¹⁰⁷.

- Strategies for reducing vehicle miles traveled could be achieved in various ways, such as through land-use changes, using public transit instead of single-occupancy vehicles, or expanding remote work options.
- Strategies and actions that reduce the emissions per vehicle mile traveled include switching to alternative modes of transportation, such as bicycling and walking, or using alternative fuels for transportation, such as electricity or hydrogen.

Multiple state and local government agencies engage in transportation (and other) planning processes, all of which include consideration of climate-related issues. The goals and strategies in this Climate Action Plan are compatible with and supportive of those found in other agencies' plans.

- Many counties and cities are addressing climate change through land use and transportation planning or by adding optional elements to their Growth Management Act comprehensive plans.
- The Washington State Department of Transportation has both a Transportation Plan¹⁰⁸ and an Active Transportation Plan;¹⁰⁹ the latter is concerned with active transportation, defined as walking, biking or skateboarding to get from one place to another. While active transportation considerations often play a role in overall transportation planning (e.g., the inclusion of bike lanes on public thoroughfares), it is also beneficial for safety reasons to maintain active transportation routes apart from those used by motorized vehicles.
- Transportation planning in Whatcom County is overseen by the Whatcom Council of Governments (WCOG). WCOG maintains a long-term transportation plan, called the Whatcom Mobility 2040 Plan,¹¹⁰ as well as shorter term (~5 years) Transportation Improvement Programs¹¹¹ that prioritize projects to be undertaken. In addition, the Whatcom Transit Authority 2017 Strategic Plan¹¹² (to be replaced by in 2021 by the adoption of WTA 2040, a long-range strategic plan) incorporates climate considerations through analyses of the potential for electric buses and the installation of solar panels at major WTA facilities and bus stops.

¹⁰⁷ A simple but useful way to think about total transportation emissions (E) is as the mathematical product of vehicle miles traveled (VMT) and emissions per vehicle-mile traveled (E/VMT): $E = VMT \times (E/VMT)$. Note that the equation also implies that when E/VMT is at or very close to zero, reductions in VMT have little impact on emissions; they would still reduce traffic congestion, accidents, etc.

¹⁰⁸ Washington Department of Transportation, 2015, Washington Transportation Plan 2035 <https://washtransplan.com/>

¹⁰⁹ Washington Department of Transportation, 2021, Draft Active Transportation Plan, <https://engage.wsdot.wa.gov/active-transportation-plan/>

¹¹⁰ Whatcom Council of Governments, Whatcom 2040 Mobility Plan. https://wcog.org/wp-content/uploads/WM40_COMPLETE.pdf

¹¹¹ Whatcom Council of Governments, Transportation Improvement Programs. <https://wcog.org/planning/tip/>

¹¹² Available at <http://www.ridewta.com/business/reports/plans>

Whatcom County's Bicycle/Pedestrian Advisory Committee is in the process of updating the County's Pedestrian and Bicycle Plan¹¹³, which was last revised in 2011. In December of 2019, the City of Bellingham produced a Climate Action Task Force Report that includes recommendations regarding transportation issues, and the City also regularly updates its own Transportation Improvement Program.

Recent Legislation

Three important climate related bills with direct or indirect impacts on the strategies and actions contained in this document were passed by the Washington State Legislature in its recently concluded 2021 session. Two of these take direct aim at transportation emissions.

- An act relating to preparedness for a zero-emissions transportation future (HB 1287) requires state agencies and electric utilities to plan for increased EV charging capacity, requires new multifamily residential buildings to include EV charging capability, and establishes a goal that all publicly and privately owned passenger and light duty vehicles of model year 2030 or later sold, purchased, or registered in Washington state be electric vehicles.
- An act relating to reducing GHG emissions by reducing the carbon intensity of transportation fuel (HB 1091) establishes a tradeable credit based clean fuel standard (CFS) and contains provisions designed to help expand EV charging capabilities, including those in underserved areas.
- The third bill, known as the Climate Commitment Act (SB5126), establishes a cap-and-trade carbon pricing system requiring that refineries (along with utilities, natural gas companies, and other facilities emitting more than 25,000 metric tons CO₂e¹¹⁴) obtain tradeable permits to cover the quantity of emissions associated with the production and consumption of their products. The total number of permits issued by the state will decline over time in line with state emission reduction goals. Both SB5126 and HB 1091 contain provisions that will fund a variety of climate change related activities, including at the local level, from the revenues gained in the sale of allowances or credits. This system will result in effectively putting a price to be paid for each ton of GHGs emitted from the electricity, natural gas, and motor fuel sold anywhere in Washington, including Whatcom County.

Governor Inslee signed the legislation,¹¹⁵ and this will be the start of a complicated implementation process. First, both HB1091 and SB5126 require, prior to their becoming effective, the passage of a state transportation funding act meeting certain standards. In addition, state agencies must conduct rulemakings to implement specific portions of the legislation. Rulemaking processes typically last from several months to more than a year, especially for complicated pieces of legislation,¹¹⁶ and they offer opportunities for interested parties to comment on proposed regulations.

¹¹³ Available at <https://www.whatcomcounty.us/DocumentCenter/View/239/Whatcom-Pedestrian-Bike-Plan-PDF?bidId=>

¹¹⁴ CO₂e refers to CO₂ equivalence; quantities of GHGs other than CO₂ are converted to CO₂ equivalent quantities based on their climate warming impacts.

¹¹⁵ The governor vetoed the portion of HB 1287 requiring EVs, along with portions of SB 5126 concerning state-tribal consultations.

¹¹⁶ For example, rulemaking processes stemming from the 2019 Clean Energy Transformation Act are still underway.

The basic purpose of carbon pricing and clean fuel standards approaches to GHG emissions reductions is to incorporate the previously unaccounted for costs of pollution into decisions made by producers and consumers, with the increased costs being passed to consumers. Producers, in trying to keep their prices lower, have an incentive to reduce emissions from production processes and, where possible, from the usage of their products. To the extent that carbon pricing results in higher final product prices, consumers have an incentive to use less of that product. One negative impact of carbon pricing is that it is regressive—it takes a larger share of low-income consumers’ incomes than it takes from high-income consumers. SB 5126 contains environmental justice provisions to favor overburdened communities in the awarding of projects funded from revenues collected by the state under the legislation.

At the time of this report, the legislative outcomes regarding federal climate change efforts remain uncertain, but current proposals contain a wide variety of provisions designed to decrease the shares of GHG producing fuels in our nation’s energy system. Nevertheless, some federal grant money is already available from the Federal Highway Administration for EV charging infrastructure on the national highway system, which in Whatcom County consists of Interstate 5.¹¹⁷

Goal and Strategies for Transportation

Goal: Reduce transportation-related GHG emissions 45% below 1990 levels by 2030, including eliminating fossil fuels from County government transportation operations where technology permits, while ensuring climate-resilient transportation systems.

Strategies proposed toward achieving this goal involve both benefits (benefits beyond those directly related to climate change are often referred to as “co-benefits”) and potential obstacles or drawbacks. Some co-benefits of the proposed transportation strategies are cleaner air and increased use of active transportation, leading to positive health outcomes. The reduction in local pollution is significant, especially for historically marginalized communities who have often borne a greater share of the negative impacts of that pollution.

While the primary goal of eliminating fossil fuels from transportation is to reduce GHG emissions, the co-benefit of reductions in local and regional air pollution are important. These pollutants include nitrogen oxides (NO_x), volatile organic compounds (VOCs), particulate matter (PM) and air toxics, all of which have negative health effects caused by breathing dirty air. For example, nitrogen oxides and VOCs react in sunlight to form ozone, which is the primary component of smog, which can cause a variety of health problems.¹¹⁸ These effects are more pronounced in areas close to busy thoroughfares, which tend to have higher housing concentrations occupied by disadvantaged populations.

¹¹⁷ US Dept. of Transportation, Federal Highway Administration. “Federal Funding is Available for Electric Vehicle Charging Infrastructure On the National Highway System,” April 21, 2021.

https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/resources/ev_funding_report_2021.pdf

¹¹⁸ For a good basic discussion of these impacts, see US EPA, “How Mobile Source Air Pollution Affects Your Health” <https://www.epa.gov/mobile-source-pollution/how-mobile-source-pollution-affects-your-health>

It should be noted that while these strategies are largely aimed at mitigating GHG emissions, some of them also present opportunities for adaptation, which will make Whatcom County more resilient to the expected impacts of an already changing climate.

The four transportation strategies below address three broad areas: reducing VMT directly, moving toward alternative modes of transportation, or switching to alternative fuels. A detailed discussion of specific actions recommended under each of these strategies can be found in the appendix.

Strategies for Transportation

1. Reduce vehicle miles traveled (VMT) by promoting alternatives to single occupancy vehicle (SOV) transportation.
 2. Promote increased use of electric, hybrid, and alternative fuel vehicles.
 3. Improve County vehicle fleet utilization while transitioning to non-fossil alternatives and reducing GHG emissions associated with County projects.
 4. Use County resources to participate in and advocate for inter-governmental efforts at the state level for policies and programs to reduce GHG emissions associated with transportation.
-

Strategy 1: Reduce vehicle miles traveled (VMT) by promoting alternatives to Single Occupancy Vehicle transportation

Single occupancy vehicles (SOVs) are the most common form of transportation because of their convenience and affordability, and road networks have been designed primarily for them. In addition, lower density land use patterns in the County often make walking, biking, or using public transit more difficult than in higher density urban areas. Strategy 1 focuses on promoting alternative transportation modes – one approach to reducing SOV use. Increasing the accessibility, affordability, and convenience of multimodal transportation options, such as bicycling, walking, or riding public transit, and even by eliminating the need for transportation through improved information technology options, can in principle incentivize their increased use. Although little data exists on the extent to which such improvements would stimulate the use of alternative modes in Whatcom County, we do know that good transportation infrastructure has been shown to attract new businesses and investment.¹¹⁹

Careful planning to expand and enhance County trail networks now will increase possibilities for both recreation and commuting by alternative means to the SOV, whereas delay will likely increase costs and lead to reduced siting options. Additionally, improvements to public transit and rail, such as increasing frequency, reducing costs, and promoting the ease of single trip multimodal use (e.g., park and ride lots or secure bicycle storage near transit links) can make these transportation options preferable to SOVs.

¹¹⁹ Grant Powell, March 3, 2021. “Build It and They will Come; Why Infrastructure Should Come First.” Forbes online: <https://www.forbes.com/sites/grantpowell/2021/03/03/build-it-and-they-will-come-why-infrastructure-should-come-first/?sh=15d4bce57e9d>

In addition to providing better infrastructure for multimodal commuting (i.e., the supply side), it is important to find ways to encourage commuters to change their behaviors (the demand side) by using that infrastructure and through increases in telecommuting. The pandemic has forced employers to explore how best to adapt their workforces to remote working. As the pandemic abates, some of these new habits are likely to remain in place, presenting opportunities to help achieve climate goals. On the webpage introducing its recent case study of Expedia,¹²⁰ Nelson/Nygaard Consulting Associates states, “Work from home policies that sat undefined in the wings for decades have been forced centerstage practically overnight. While this is a time of uncertainty for organizations large and small, it is also an ideal time to plan for the future.” The study, which was conducted before the pandemic, documents ways in which careful data analysis and behavioral approaches (e.g., strong employee engagement and a pay-as-you-park system) led to large reductions in SOV commuting by Expedia employees, both before and after moving the company headquarters from Bellevue to Seattle’s Interbay district.

Although Whatcom County’s largest city does not have the traffic congestion of Seattle, major employers such as Peace Health and Western Washington University are considering more active transportation management programs that can actually change commute behavior. The County should work internally as well as with employers to encourage the adoption of new, more aggressive programs to promote climate-friendly commuting behaviors and to overcome barriers to these changes.¹²¹

Key Priorities for Strategy 1:

- ***Expand local and regional trail networks for non-motorized transportation to create safe active transportation to schools and enhance bicycle and pedestrian commuting infrastructure.***
- ***Work with major employers to create programs that incentivize multimodal commuting, expand telecommuting, and allow flexible scheduling.***

Strategy 2: Promote increased use of electric, hybrid, and alternative fuel vehicles.

This strategy aims to reduce emissions of fossil fuel burning SOVs by increasing the transportation share of electric, hybrid, and alternative fuel vehicles that generate lower GHG emissions. Reaching emissions reduction goals will require the increased use of alternative modes of transportation; however, we must recognize that SOVs will still be used for transportation for some time.

Because they see their market changing through a combination of buyer preferences and government mandates,¹²² many automobile manufacturers have announced plans to increase EV production and

¹²⁰ Nelson\Nygaard, Luum, and Expedia. April 2021. Expedia Group Case Study: How a phased commute program led to longstanding behavior change. <https://nelsonnygaard.com/expedia-group-case-study/>.

¹²¹ Whillans, Ashley et al. “Nudging the Commute: Using Behaviorally-Informed Interventions to Promote Sustainable Transportation,” Harvard Business School, Working Paper 21-002. https://www.hbs.edu/ris/Publication%20Files/21-002_d78ef6ca-b99a-4b13-93eb-be1027914a18.pdf

¹²² Traugott, Jay. “Third US State Banning Combustion-Engine Car Sales,” *CarBuzz*, Jan 3, 2021. <https://carbuzz.com/news/third-us-state-banning-combustion-engined-car-sales>. Since this article was published, Washington state has become the fourth state on the list—legislation to ban the sale, purchase, or registration of any non-electric vehicle of model year 2030 or later is awaiting Gov. Inslee’s signature.

reduce or eliminate the production of internal combustion vehicles. For example, Toyota, with one of the largest market shares globally, is introducing new EV, hybrid, and hydrogen fuel cell models including for their trucks.¹²³ General Motors was the first American manufacturer to announce their commitment to produce 30 new global EVs by 2025¹²⁴ and pledged to stop making oil powered passenger cars, vans, and sport utility vehicles by 2035.¹²⁵

By working with the community, local electric utilities, and the private sector, the County can accelerate the adoption of EVs, encourage the construction of electric vehicle charging infrastructure, and help ensure the growth of a skilled EV-related workforce. Since Whatcom County will be reliant on SOVs for some time, and on-road vehicles currently generate the most emissions in the transportation sector, implementing this strategy will be crucial to achieving this goal's emissions reductions.

The number of electric vehicle registrations more than doubled from 2017-2020, but the figure for 2020 still represents only about 0.5% of total Whatcom County vehicles (Fig 2.15)¹²⁶.

Reducing transportation emissions by 45% by 2030 would require the replacement of somewhere between 50,000 and 100,000 fossil fuel vehicles with EVs (assuming VMT remain unchanged).

While the higher initial purchase costs of EVs are generally offset over the life of the vehicle by lower operating, fuel, and maintenance costs, the higher upfront cash outlay can nevertheless serve as a deterrent to EV purchases. The County should therefore explore establishing a group buying program, such as the one in place in Fort Collins, Colorado,¹²⁷ that would result in discounts to EV prices.

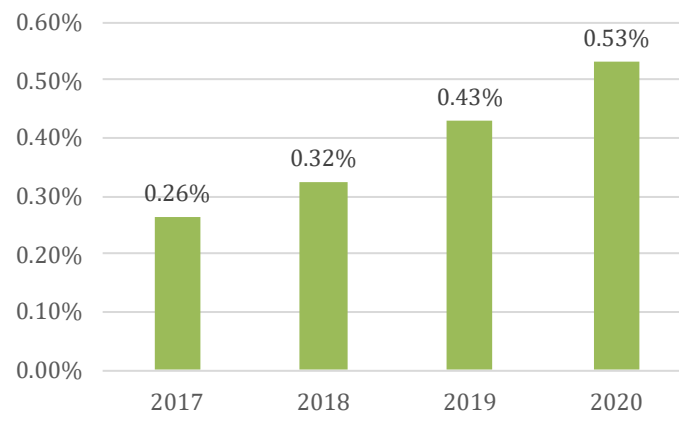


Figure 2.15: Whatcom County EV registrations by calendar year 2017-2020, Percent of total vehicles

¹²³ Hogan, Mack. "Hybrid and Electric Toyota Pickup Trucks Are Coming," *Road and Track*, Apr 20, 2021.

<https://www.roadandtrack.com/news/a36176318/hybrid-and-electric-toyota-pickup-trucks-are-coming/>

¹²⁴ Our Path to a All-Electric Future, zero crashes, zero emissions, zero congestion. <https://www.gm.com/electric-vehicles.html>

¹²⁵ General Motors to eliminate gasoline and diesel light-duty cars and SUVs by 2035, by Steven Mufson, Jan 28, 2021. *The Washington Post*. <https://www.washingtonpost.com/climate-environment/2021/01/28/general-motors-electric/>.

¹²⁶ Based on data taken from Washington Department of Licensing, Vehicle and Vessel Fee Distribution Reports at <https://fortress.wa.gov/dol/vsd/vsdFeeDistribution/ReportList.aspx>. This data comes from Motor Vehicle Registration by Class and County reports.

¹²⁷ Marmaduke, Jacy. "Electric vehicles for sale at reduced prices in Fort Collins during group buy event," *Fort Collins Coloradoan*, Oct. 30, 2020. <https://www.coloradoan.com/story/news/2020/10/30/fort-collins-electric-vehicle-group-buy-offers-lower-prices/6071879002/>.

Key Priority for Strategy 2:

- *Sponsor pooled purchasing of EVs, facilitate additional EV charging infrastructure, promote training opportunities to create an EV workforce, and electrify school bus fleets.*

Note: While Strategies 1 and 2 are aimed at reducing transportation emissions generated by the community, the next strategies present significant opportunities for the County to lead by example.

Strategy 3: Improve County vehicle fleet utilization while transitioning to non-fossil alternatives and reducing GHG emissions associated with County projects

Strategy 3 is focused on what the County can do to modify its operations to reduce emissions: improve County vehicle fleet utilization while transitioning to non-fossil-fuel alternatives and reduce GHG emissions associated with County projects. Doing so will not only reduce emissions but will also allow the County to serve as a visible example for businesses and other government units of what can be accomplished in moving toward transportation decarbonization. The most important step to take under this strategy is to analyze the existing fleet of County vehicles to optimize its use and to begin the replacement of fossil fuel vehicles with EVs or alternative fuel vehicles. Washington HB1091, concerning low carbon fuels, may provide funding for vehicle conversion.

Some of the proposed County actions in this area (e.g., adopting EVs for fleet use or replacing fossil fuel powered equipment) might also serve as pilot projects, allowing for further exploration of these GHG reduction approaches while illustrating how they might be best applied for other governments and the private sector.

The County is already moving in the direction of electrifying the Lummi Island Ferry, which is a recommended transportation action. This is especially important because the new ferry will be in use well after 2050, the target date for net zero emissions. In addition, we are recommending that contractors performing work for the County report the quantities and types of fuel used for County funded projects and that the County consider imposing standards regarding emissions reductions by contractors.

Key Priorities for Strategy 3:

- *Perform analyses designed to optimize County fleet use and incorporate EVs and alternative fueled vehicles and implement the recommendations thereof.*
- *Replace the Lummi Island Ferry with either an all-electric technology or a hybrid that can be converted to all-electric.*
- *Require fuel use reports from County contractors and incorporate emission reduction standards into County contracts.*

Strategy 4: Use County resources to participate in and advocate for inter-governmental efforts at the state level for policies and programs to reduce GHG emissions associated with transportation.

Strategy 4 calls on the County to use County resources to participate in and advocate for inter-governmental efforts at the state level for policies and programs to reduce GHG emissions associated with transportation. The County already participates in such efforts, such as the Whatcom Council of

Governments’ transportation planning process and should continue to do so while advocating for the increased inclusion of climate change goals. The State Energy Strategy includes multiple recommendations relating to inter-governmental cooperation.

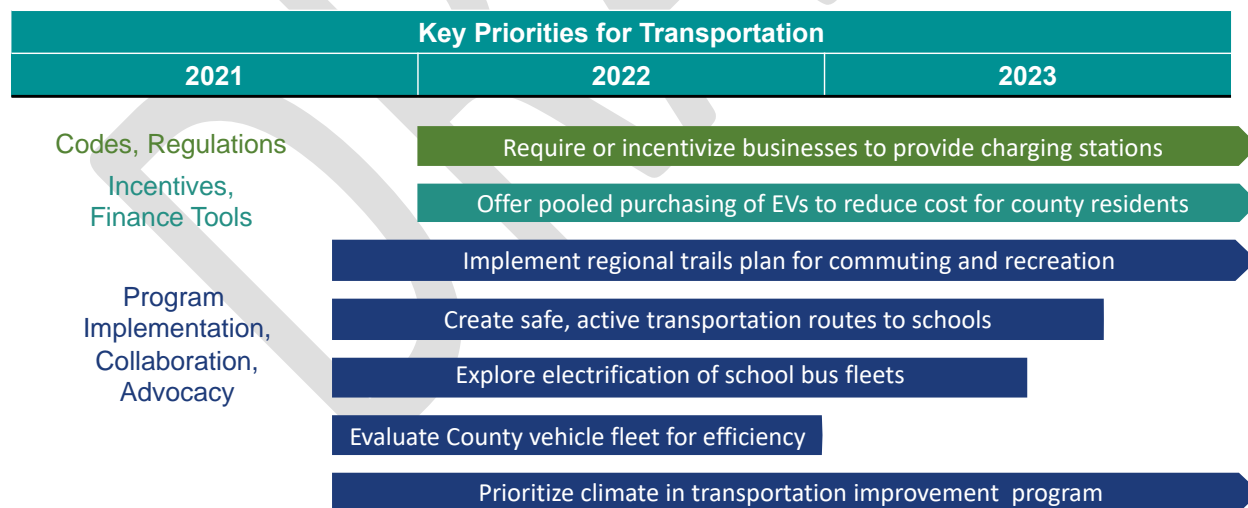
Strategy 4 also recommends taking advantage of opportunities for funding and other types of assistance made available at the state level. For example, the low-carbon fuel bill HB1091 passed by the legislature in 2021 provides for the possibility of receiving funds and other assistance for transportation decarbonization, both in the County fleet and for the general public.

Key Priority for Strategy 4:

- *The County should continue existing inter-governmental cooperation and seek out new opportunities to work with other agencies of government, while taking advantage of new funding opportunities made possible by recent Washington state legislation.*

Although the stated transportation strategies are fairly specific (and the actions described in the Appendix even more so), it is important to understand that the broader policy and social environments in which they will be implemented are changing. For this reason, policy makers must remain flexible. The recent change of administrations will result in more aggressive climate change policy at the federal level. Washington state government is adding important provisions to its climate-related agenda through legislation and regulation. Old-line automakers are planning to increase EV production while reducing their output of ICE vehicles.

Timeline of Transportation Priorities



Conclusion

The strategies presented in here are based on an extensive review of other communities’ climate action plans, the Community Research Project report¹²⁸, the recently released Washington 2021 State Energy

¹²⁸ Whatcom County Climate Impact Advisory Committee, 2019, Community Research Report; available at <https://www.whatcomcounty.us/3162/Meetings-Additional-Information>

Strategy¹²⁹, transportation-related plans or proposals produced by various agencies in Washington State and Whatcom County, and other information sources.

The pandemic has accelerated changes in work life and shopping behavior that will lead to a reduced need for transporting people, and longer-term trends will lead to lower rates of personal auto ownership, especially in urban areas. For all of these reasons and others, it will be critical to regularly and frequently reevaluate the strategies and actions recommended here.

DRAFT

¹²⁹ Washington State Department of Commerce, 2021, 2021 State Energy Strategy
<https://www.commerce.wa.gov/growing-the-economy/energy/2021-state-energy-strategy/>

Waste

The World Bank predicts that without urgent action, global waste will grow by 70% by 2050.¹³⁰ High-income countries are responsible for more than one-third of the world's waste. Plastics are especially problematic because most forms of plastic cannot be recycled and end up in landfills. Many corporations have sold us on a throw-away culture and convinced us that it is solely our responsibility to recycle the packaging they use for their products. Accountability for plastic waste packaging in particular, must shift back to the corporations that produce the packaging and the individual products that use the packaging. The way we handle waste is currently unsustainable.

Excellent detailed descriptions of waste disposal in Whatcom County can be found in the Comprehensive Solid and Hazardous Waste Management Plan¹³¹ and the Community Research Project.¹³² Unlike these reports, this discussion will focus only on the key waste areas that contribute to our 2017 communitywide GHG inventory.

Our Current Waste Disposal System

Whatcom is one of only two counties in the state that has a privatized solid waste management system, which includes curbside pickup, transfer stations, and transport to landfills for burial (Fig 2.16). With the exception of the City of Blaine, the cities in Whatcom County manage their solid waste collection system.

No one is required to have trash or compost bins in rural areas, even though waste haulers are required to offer this service. Point Roberts is an exception where everyone must pay for waste pickup to make this service profitable.

Greenhouse gas emissions from waste falls into two general categories: Solid Waste and Wastewater. Waste accounts for only 1% of the total Whatcom GHG emissions, yet it is still an important environmental issue that should be addressed.

The overall basic strategy for solid waste management is reduction and recycling. Much of our current waste is buried in landfills in eastern Washington and Oregon, including a large quantity of the waste we attempt to recycle.

¹³⁰ What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050, by Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. Urban Development; Washington, DC: World Bank: <https://openknowledge.worldbank.org/handle/10986/30317>

¹³¹ Comprehensive Solid and Hazardous Waste Management Plan, Whatcom County, WA, June 14, 2016. <https://whatcomcounty.us/DocumentCenter/View/6723/Whatcom-County-Comprehensive-Solid-and-Hazardous-Waste-Management-Plan>

¹³² 2019 Community Research Project, Chapter 3 Waste Reduction and Recycling, by Vicki Thomas. <https://whatcomcounty.us/3162/Meetings-Additional-Information>

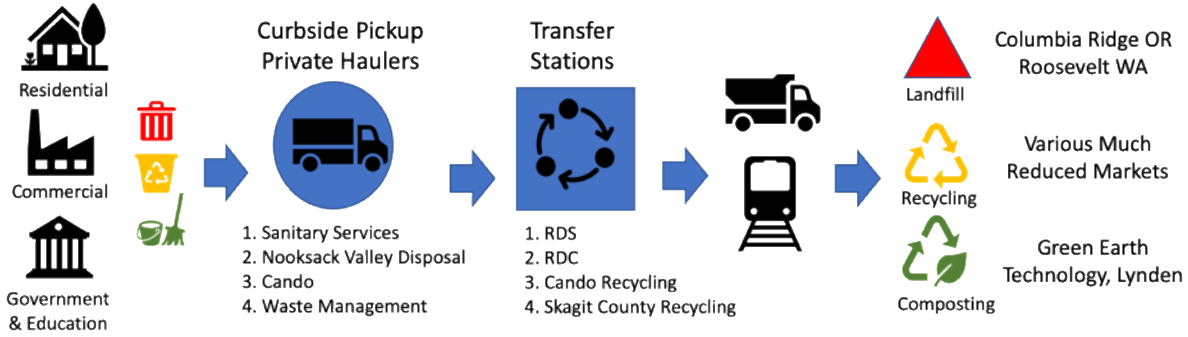


Figure 2.16: Depiction of the Whatcom County privatized solid waste management system.

Emissions from Solid Waste

Solid Waste is the major contributor, representing 91% of the overall GHG emissions from waste in Whatcom County. Solid waste is basically anything we put in garbage bins, whether the item is recyclable or not. It can also include industrial and sewage sludge, construction waste, vehicle parts and contaminated soils.

While plastics can make up a large volume of non-degradable landfill waste, organic waste accounts for most of the GHG emissions from landfills. Statewide, organic waste accounts for over 40% of the residential waste stream. Reduction of food waste is a priority and most often occurs through composting or redistribution of food to pantries, missions, and soup kitchens. The SSC curbside food and yard waste program, Food Plus, is voluntary and services about 19% of the households in the County.

Solid waste GHG emissions can be broken down into generation, transport, and processing (Fig. 2.17). All new landfill material from Whatcom County is sent to large landfills in eastern Washington or Oregon. Waste statistics for Whatcom County² indicate that waste per household has trended downward as the public becomes more educated and aware of this problem.

At 70%, solid waste generation is the largest component of County waste management related emissions. Even though the solid waste is disposed of in landfills located outside of Whatcom County, the County is still responsible for the emissions from this waste.

Methane is the largest component of GHG emissions from buried waste, followed by smaller amounts of carbon dioxide. These GHG emissions are based on the overall composition and mass of the annual solid waste.

Only organic waste is used in calculations for methane emissions. Inert wastes in landfills are not expected to produce GHG emissions unless they are combusted in the future.

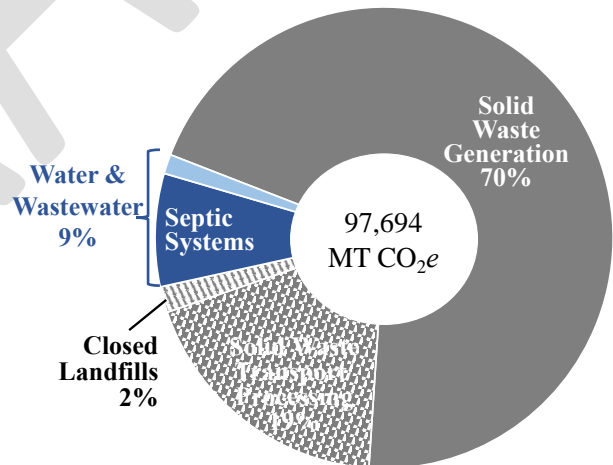


Figure 2.17: Whatcom communitywide emissions from solid waste and water and wastewater.

Transport of the solid waste by rail or truck to landfills in eastern Washington and Oregon accounts for approximately 16% of the emissions with the remaining 3% from processing at the landfill.

Landfills are also subject to the recent Climate Commitment Act if their emissions exceed 25,000 MT CO₂e. The State legislature plans to adopt a program specific to landfills which would suspend application of the carbon cap. Without this legislation, landfills will be subject to the carbon cap unless they capture at least 75% of their emissions or produce electricity or natural gas from these emissions.

The landfill at Roosevelt in Klickitat County disposes of most of Whatcom’s solid waste. This landfill takes shipments of solid waste from five states and British Columbia.¹³³ The Roosevelt landfill is now capturing the methane emitted from decomposing waste that could provide biogas to as many as 19,000 households. PSE has signed a contract to purchase this methane and will own the renewable credit.

Whatcom County has no open landfills and will not open any in the future due to issues related to shallow groundwater. The County Health Department is responsible for monitoring the six closed landfills that contain solid waste. These closed landfill emissions represent less than 2% of the total waste GHG emissions for our County. The GHG emissions from landfills peaked shortly after closing and then continued to decline as organic material has degraded. By 2030, GHG emissions from these closed landfills are expected to decline by 30%.

Whatcom Landfills	Closed
Cedarville	1990
Birch Bay	1983
Point Roberts PW	1990
Point Roberts Park	1990
Y Road Landfill I	1970
Y Road Landfill II	1989

Emissions from Water and Wastewater

Water and wastewater emissions include fugitive emissions or leaks and other irregular releases of gases or vapors from septic systems (8%), and minor emissions from a combination of wastewater treatment lagoons, process N₂O from effluent discharge to rivers and estuaries, combustion of biosolids and sludges, and wastewater treatment. Methane is produced when microorganisms biodegrade organic matter in septic systems, which in turn escapes to the atmosphere. The total amount of methane emissions is based on the population served by the septic systems in the County.

Together the minor sources only account for an additional 1% of total waste emissions. Wastewater lagoons create a small quantity of emissions from a combination of biological, physical, and chemical processes. Wastewater treatment plants in Everson, Newhalem, and Lynden discharge treated wastewater, which contains nitrous oxides directly into lakes, rivers, and Puget Sound. Nitrous oxides are GHGs. The Post Point Wastewater Treatment Facility reported combusting biosolids in 2017 which also releases small amounts of CO₂.

¹³³ Giant landfill in tiny Washington hamlet turns trash to natural gas, as utilities fight for a future, by Hal Bernton. Seattle Times updated article, March 5, 2021. <https://www.seattletimes.com/seattle-news/turning-trash-to-natural-gas-utilities-fight-for-their-future-amid-climate-change/>

Goal and Strategies for Waste Emissions

Goal: Reduce by 40% the volume of communitywide solid waste transported to landfills and the growth in methane emissions from wastewater by 2030 through the use of education, incentives, and regulations on disposal.

Strategies for Waste Reduction and Reuse

1. Reduce the volume of non-recyclable single-use items and product packaging materials by increasing restrictions on disposal and communitywide education.
 2. Reduce the growth of food waste through better utilization, collection and composting.
 3. Understand the impact of methane emissions from septic systems in the County.
 4. Provide incentives to builders for the reuse of building materials in new construction.
-

Strategy 1: Reduce the volume of non-recyclable single-use items and product packaging materials

The average American is responsible for approximately 250 pounds of plastic waste each year. Over 75% of this plastic, based on weight, ends up in landfills across the US equal to around 27 million tons per year. Only about 9% of this plastic is recycled, with the remaining 16% combusted for energy.¹³⁴ These percentages will vary depending on the available regional markets that can use recycled plastics, such as for carpet or fleece clothing manufacturing. Actual recycling information for Whatcom County plastic waste is not available but could be requested from local solid waste disposal companies.

We do know the categories of plastic waste that are never recycled: plastic wrap, plastic bags, flexible packaging, small plastic items such as bottle caps, utensils, and plastic packaging to name a few. Clamshells used for fruit, cupcakes, cut lettuce, and sandwiches are also often not recycled. Ridwell, a new recycling service that is planning to expand in Bellingham, collects hard-to-recycle items at your doorstep, such as batteries, light bulbs, plastic bags, films, and threads (clothes, shoes, textiles).¹³⁵

The first strategy for solid waste is to restrict the use of single use plastic items and product packaging materials that cannot be recycled. To support this strategy, more detailed information is needed from material handlers on the composition and volume or weight of non-recyclables that are shipped annually to landfills. By ordinance, the County can as appropriate require the use of compostable single-serving containers and utensils by restaurants, stadiums, and local businesses. The County can also do more to educate the community on identifying product packaging that cannot be recycled, which may reduce demand for the product or alternatively, convince manufacturers to use recyclable packaging.

¹³⁴ Plastics: Material-Specific Data, U.S. EPA, most recent data from 2018 used. website: <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/plastics-material-specific-data#PlasticsTableandGraph>

¹³⁵ Ridwell, <https://www.ridwell.com/>

County government operations should require a higher percentage of recycled materials in products and packaging purchased by the County government. To reduce plastic bottle waste, the County should also install water refill stations at all County parks.

Strategy 2: Reduce the growth of food waste

Food waste has the greatest impact on the solid waste GHG emissions from landfills. The Whatcom Community Food Assessment in 2017¹³⁶ estimated that organic waste makes up more than half of our community's waste stream. Only about 19% of Whatcom households use SSC's voluntary Food Plus program and it is unknown how many additional households have their own composting bins.

The Whatcom Community Food Assessment listed the following key challenges to reducing food waste:

- A continued increase in food waste partly resulting from the “all you can eat” mentality that results in the waste of prepared foods from buffets, grocery store outlets, delis, etc.
- Some regulations to protect food safety and promote good nutrition also led to food waste.
- Food service businesses are hesitant to reduce meal portion size or add labor hours to collect and compost food waste.
- A lack of incentives for renters to use recycling/food composters or lack of space in apartment buildings to accommodate multiple bins for separating waste.
- The contamination of food waste with non-recyclable items.
- Lack of curbside collection in rural areas of the County.

Community education is one strategy in reducing food waste. More direct solutions to reduce food waste would be to expand funding for food recovery and redistribution programs and expand requirements for the disposal of food waste via curbside recycling or on-site composting. In rural areas on-site composting may include the use of anaerobic digesters that can turn food waste and manure into usable bioenergy.

Strategy 3: Understand the impact of methane emissions from septic systems

Rural septic systems were a small but significant contributor at 8% to the overall GHG emissions related to our waste stream. Currently there are about 30,000 total septic systems in the County. Septic systems are required to be inspected every year for pressurized systems and every 3 years for gravity-based systems. These inspections help identify leakage problems that can result in contamination of water systems.

Understanding the scale of the problem of methane emissions from septic systems requires more information on the rate of growth of these systems in the County. For septic systems located in urban growth areas, the County should create incentives for households to switch to municipal sewage systems when available. This could include a surcharge for septic systems when a municipal sewage system is available. However more information is needed on the scale of the problem and the cost/benefit in respect to lowering GHG emissions and reducing water pollution.

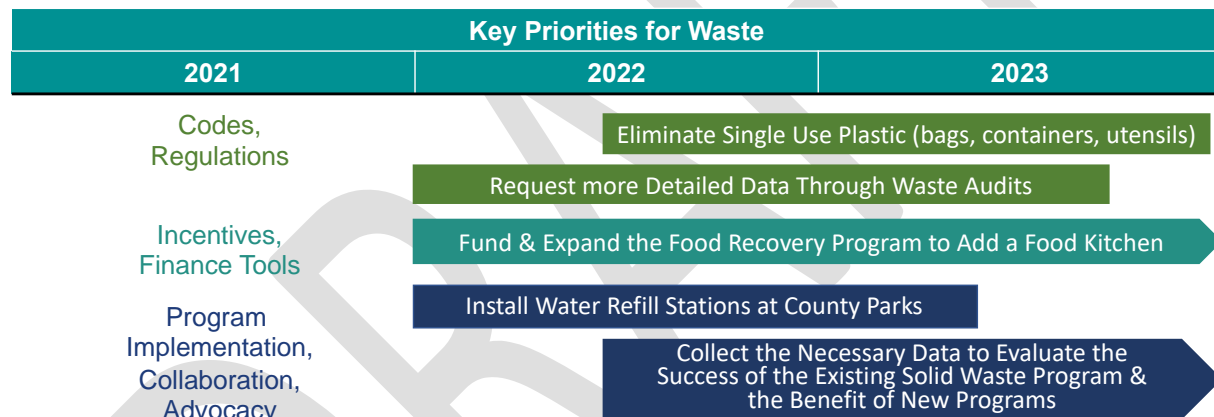
¹³⁶ Whatcom Community Food Assessment, 2017 Update Report prepared by the Whatcom Food Network CFA Update Subcommittee. <https://co.whatcom.wa.us/DocumentCenter/View/54385/Community-Food-Assessment-2017>

Strategy 4: Provide incentives to builders for the reuse of building materials

An actual breakdown of the amount of waste generated by building demolition and construction is lacking for Whatcom County. However, the latest statewide Waste Characterization Study estimates that up to 10% could be from construction.¹³⁷ To prevent disposal of this waste at undesignated disposal sites and encourage recycling of building materials, the County’s Flow Control Ordinance (No. 91-041) could be revised to include construction and demolition debris.

The recycling of building materials is a valuable service in Whatcom County and deserves community support. One of the largest retail stores is The RE Store in Bellingham which provides a wide range of used building materials recovered from building remodels and demolition. According to the Building Industries Association of Whatcom County, area builders are mindful of estimating materials and creating as little waste as possible. This association’s Green Built program provides environmental benefits on many fronts including reducing waste.¹³⁸

Timeline of Waste Priorities



Conclusion

State law requires the County to develop a comprehensive solid and hazardous waste management program that is updated every five years. The County’s solid water management program relies primarily on educational programs to reduce waste including many actions implemented over the five-year time period between report updates. Little information is publicly available on the effectiveness or success of these actions. Our community may not see the waste because it is not landfilled here. However, the emissions are still attributed to our County and should be mitigated. Lack of data on some areas of emissions warrant further study and deliberate data gathering. Best practices should be applied to the issue to accomplish the goal of 40% reduction in our waste streams. However, until basic information such as annual per capita waste in Whatcom County is provided, it will be difficult to monitor the effectiveness of strategies and actions for GHG reduction.

¹³⁷ 2015-2016 WA Statewide Waste Characterization Study, Publication 16-07-032, Department of Ecology, pg. 89.

¹³⁸ 2019 Community Research Project, Chapter 3 Waste Reduction and Recycling, by Vicki Thomas.

<https://whatcomcounty.us/3162/Meetings-Additional-Information>

Land Use

Incorporating climate change into County land use policy, regulations, comprehensive planning, and project implementation has the potential to address resilience while helping to mitigate and adapt to the impacts of climate change. Conscientious land use policies and regulations can significantly reduce environmental harm while also enhancing the local economy and quality of life.

Development and land use change can often alter the natural environment, degrading land with high ecological, economic, and resilience value. Changes in land use can also threaten food systems, access to clean water, carbon sequestration, critical wildlife habitat, recreation, and cultural sites. A meaningful response to climate change will require strategic changes in the County’s land use code and comprehensive plan, prioritizing climate resilient development in the built environment and increasing protection of the natural environment and working lands.

Goal and Strategies for Land Use

Goal: Increase the mitigation of GHG emissions by natural systems and promote climate resilience by preserving and protecting the health and function of ecosystems through sustainable land use and development policies.

Strategies focus on four sectors: development, transportation, infrastructure, and natural resources.

Strategies for Land Use

- 1. Sustainable Land Development:** Design and implement a sustainable and climate resilient regulatory framework for new County developments (residential, commercial & industrial) that includes improved building energy use, greater density, multimodal mobility options, and minimal impact to natural ecosystems.¹³⁹
- 2. Transportation:** Employ County land use policy and regulations to enhance active and public transportation systems and infrastructure and increase transit ridership.
- 3. Green Infrastructure:** Require a climate-focused risk assessment using future climate scenarios for all new County infrastructure (e.g., roads, bridges, emergency services, etc.) over the projected lifespan of the new infrastructure that reduces environmental impacts and risks.
- 4. Natural Resources:** Protect climate-sensitive areas of high ecological value such as riparian corridors, floodplains, shorelines, wetlands, and migration corridors using science-based future climate scenarios.¹⁴⁰

Growth in Whatcom County is inevitable, so considering climate change in comprehensive planning and land development is key to ensuring protection of the natural environment and reduction of the overall

¹³⁹ “Sustainable development is the organizing principle for meeting human development goals while simultaneously sustaining the ability of natural systems to provide the natural resources and ecosystem services on which the economy and society depend.” (https://en.wikipedia.org/wiki/Sustainable_development)

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (<https://www.iisd.org/about-iisd/sustainable-development>)

¹⁴⁰ Refer to [WWC Chapter 16.16 Critical Areas](#), [WWC Title 23 Shoreline Management Program](#), and our Resource Lands policies and regulations.

risk and vulnerability to climate change. In the built environment, low-density development is one of the key contributors to carbon emissions.

While the Washington State Growth Management Act (GMA) dictates how cities and counties can grow, it is important to continue efforts to reduce sprawl by increasing housing density in more urban areas, promoting an accessible multi-modal transportation system, and ensuring that existing and new infrastructure is climate resilient and meets an established “green” criterion.

Planned interventions to promote sustainability and resilience in the built environment have many benefits including reducing greenhouse gas emissions, altering harmful human behavior, and improving overall quality of life.

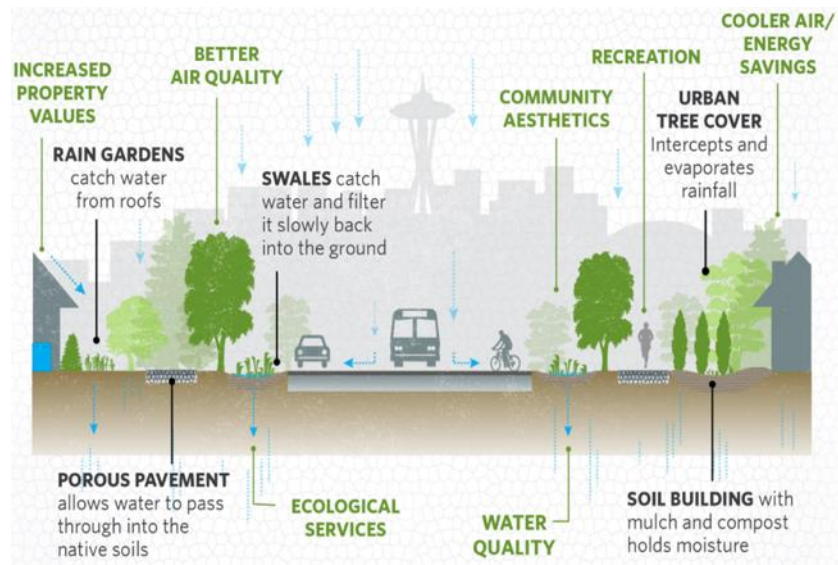


Figure 2.18: Example of sustainable development components, such as green infrastructure, worth considering in a sustainable development framework or model. Source: The Nature Conservancy

Strategy 1. Create a Climate Resilient Regulatory Framework for Sustainable Land Development

Mitigation and adaptation to climate change will require the County to prioritize low impact and sustainable community development, which involves thinking about how a community is designed from a land use perspective. Buildings, transportation systems, and infrastructure must minimize impact and environmental harm while maximizing efficiency. Sustainable development reduces greenhouse gas emissions by reducing sprawl, enhancing carbon sequestration through open green space and urban forests, conserving energy, water, and natural resources, and preserving critical ecosystem services. The County needs to establish and implement a sustainable development framework and code that informs and dictates future development. Furthermore, the County, in conjunction with the cities, must assess the suitability of land for development based on climate resilience characteristics.¹⁴¹ Coordinating with the cities when it comes to Countywide development is key. City urban growth areas (UGAs) consist of the city

¹⁴¹ This assessment should be informed by and in conjunction with the Whatcom County [Review & Evaluation Program \(Buildable Lands\)](#). “Components of the Review and Evaluation Program include updating county-wide planning policies, annual collection of data, developing a buildable lands program methodology, reviewing achieved densities, evaluating land suitable for development, and issuing a final report by June 30, 2022. The information contained in the final Review and Evaluation Program Report will inform the next update of the Whatcom County Comprehensive Plan, which is due by June 30, 2025.”

and surrounding unincorporated area designated by the county as UGA, appropriate for annexation and urban development. There are also three non-city UGAs that are not associated with a city.¹⁴²

Replacing Conventional Design with Conservation Design

Conventional design refers to “residential developments where all the land is divided into house lots and streets, with the only open space typically being undevelopable wetlands, steep slopes, floodplains, and storm water management areas.”¹⁴³ Problems with the conventional design include poor pedestrian infrastructure, minimal to nonexistent open green spaces, and fewer natural environments for plant and wildlife habitat.

By contrast, conservation design “refers to residential developments where... half or more of the buildable land area is designated as undivided, permanent open space”, which can be achieved by “designing residential neighborhoods more compactly.”¹⁴⁴

Conservation subdivisions are allowed, but the County needs to actively promote, incentivize, or require conservation designed land use and incorporate green infrastructure into the development strategy. While conservation design is desirable in all County zones, it is particularly important for rural areas and resource lands, to help protect high ecological value lands and increase climate resilience.



Figure 2.19: Architectural renderings depict a town filling in with development while preserving open space. Source: Steve Wright, Conservation Subdivisions: Good for the Land, Good for the Pocketbook.

Green Spaces and Urban Forests

Development with more open and green spaces, such as urban forests, parks, and community gardens, can increase carbon sequestration and enhance surrounding habitat. The County can promote carbon capture and sequestration in public areas by adding new goals and policies to the comprehensive plan that promote open green spaces, urban forests, street trees, and low impact landscaping practices.

In addition to carbon sequestration, tree canopies provide a number of environmental, economic, and human health benefits, including 1) helping manage storm water by intercepting rainfall from ground run off, 2) reducing the urban heat island effect, thus decreasing heating and cooling costs,

¹⁴² For City UGAs, the city has sole authority relating to development that happens within the city limits. The county has land use authority over the portion of the UGA outside city limits; however, the seven cities have policies in place that generally do not allow extension of public water and sewer outside city limits. The result is that urban residential development typically does not occur in these UGAs until annexation.

¹⁴³ Arendt, Randall. Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks. Washington, D.C.: Island Press, 1996

¹⁴⁴ Ibid

air temperatures, and air pollution, 3) increasing property values, 4) providing wildlife habitat, and 5) improving quality of life.¹⁴⁵

The County can promote urban forests by expanding and strengthening Countywide tree canopy requirements and retention in existing and new developed areas. This will require an implementation timeline, encouraging best practices for tree health and maintenance, collection of canopy data, and tracking tree removal and replacement to best understand short-term canopy changes.¹⁴⁶

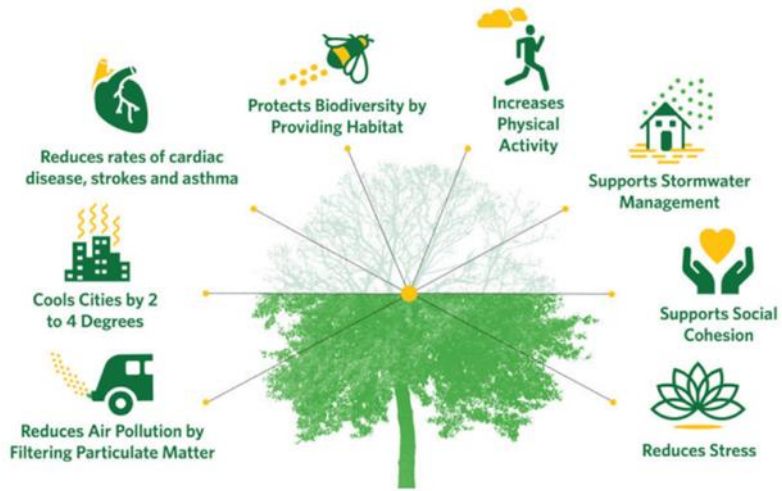


Figure 2.20: Source: The Nature Conservancy

Reevaluating tree regulations can protect existing canopy and ensure that trees are replaced with right sized and more climate resilient native trees. The County can also collaborate with the seven cities and private landowners to create a network of street trees, adding trees on roads with County right of ways, and increasing tree planting requirements and incentives for all public and private projects, especially transportation projects.

Codes and Zoning

Updating and strengthening land use codes and housing regulations can further encourage dense, sustainable, low impact, and energy efficient development. The County should prioritize strategies and expand incentives for compact development where consistent with the Growth Management Act. Strategies could include density bonuses, inclusionary zoning, clustering subdivisions to preserve green spaces, urban villages or mixed housing such as smaller homes on smaller lots, accessory dwelling units, duplexes, town homes, and multifamily complexes. These strategies should be encouraged in developable lands within urban growth areas (UGA). For non-UGA portions of the County, **developers can cluster with a reserve**, but it is important to note that "Rural" and "Residential Rural" zones do not allow duplexes or anything more than a single accessory dwelling per lot with conforming density.

The County can also encourage cities to develop their own infill housing toolkit, subsidize the cost of sidewalks for qualifying developments, and explore public-private partnerships for parking, wetland mitigation and restoration, and stormwater management. Densely developed communities can reduce water and energy consumption, improve utility efficiencies, increase use of alternative transportation

¹⁴⁵ Urban Watershed Protection, Urban Tree Canopy, <https://www.cwp.org/urban-tree-canopy/>

¹⁴⁶ Whatcom County Water Resource Protection Overlay districts currently have tree canopy regulations including replacement and retention rules, but they can be expanded and strengthened. For example, regulations still allow for removal of trees younger than 50 years old without replacement requirements. Refer to tree removal and retention in [Chapter 20.51 Lake Whatcom Watershed Overlay District](#) to inform a countywide tree policy.

modes, and improve community infrastructure such as interurban trails and pathways for bicyclists and pedestrians.

A compact community equipped with a robust alternative transportation system, combined with access to reliable broadband, can significantly help reduce single occupancy vehicle miles travelled, therefore reducing the demand and use of fossil fueled vehicles and subsequently reducing carbon emissions.

In addition to reviewing and updating land use codes and regulations, the County should require a climate impact vulnerability assessment for all new large-scale development¹⁴⁷ including a lifecycle analysis of greenhouse gas emissions in industrial development and incorporating carbon offsets in carbon-intensive commercial or industrial uses. Increasing impact fees for major projects in rural areas and building incentive programs such as fast-tracking permits and reducing permit fees for sustainable, low impact development will shift development behavior.

The County can also decrease the risk of property damage by wildfires by updating and adopting building codes consistent with the Wildland Urban Interfaces (WUIs), including incorporating WUI recommendations into the construction, alteration, movement, repair, and maintenance of any building structure within these areas.¹⁴⁸

Key Priorities for Sustainable Land Development:

- ***Establish and implement a sustainable development framework and code that incorporates green infrastructure, greater development density and energy efficiency, and low impact to natural systems.***
- ***Promote, incentivize, or require conservation designed land use and expand tree canopy in existing and new development areas.***
- ***Require a climate impact vulnerability assessment for all new large-scale development and increase impact fees where climate vulnerability is high.***

Strategy 2. Enhance Active and Public Transportation Systems

Land use is an important consideration when it comes to the planning, development, and implementation of an active and multimodal transportation system. As discussed in [Transportation](#), Whatcom County must consider ways to reduce vehicle miles travelled (VMT) by single occupancy vehicles with internal combustion engines. There are three main ways to reduce VMT: 1) restrictive land use policy in unincorporated portions of the County, 2) incorporating transit-oriented land use planning and development, and 3) compact development of building amenities close to residential neighborhoods.

The Whatcom Mobility 2040 report predicts a substantial increase in VMT resulting from the projected growth in households and employment. This increase in VMT would be even greater in unincorporated

¹⁴⁷ A climate impact vulnerability assessment should be highly encouraged, but not required, for smaller scale development including for single-family houses on existing lots. It should be noted that these assessments might increase cost of residential housing development. Housing affordability is already a barrier to many residents in Whatcom County, and we acknowledge this as an unintentional consequence.

¹⁴⁸ The state legislature instructed the Department of Natural Resources to map wildland urban interfaces by county with the stated purpose of mitigating wildfire hazard. [RCW 19.27](#) / [Senate Bill 6109](#) passed in 2018

areas if not for the rural land protections in the Washington’s Growth Management Act.”¹⁴⁹ Future transit service is also influenced by land-use decisions.



Figure 2.21: Transportation demand management and VMT/GHG reductions.

The County can improve transportation efficiency including increased accessibility to transit services and enhanced bicycle and pedestrian infrastructure by incorporating the transit- oriented development framework in land use planning. According to the Washington State Energy Strategy, “Transportation efficiency can be implemented in two basic ways. The first is to reduce the need for travel, which means either shortening the distance that people and goods have to travel (e.g., through improved urban design) or avoiding the need for trips altogether (e.g., via telemedicine). The second way is to shift travel to more efficient modes, such as public transit or maritime freight transport, which can move more passengers or goods per trip.”¹⁵⁰ Furthermore, it has been found that in order to achieve “VMT reduction goals, the most effective and lowest-cost strategy is to combine land-use policy (focusing on compact, transit-oriented development (TOD)), enhancement of transit service and travel-demand management policies including vehicle usage charges.”¹⁵¹

The County should consider requiring a multimodal transportation plan for all new planned multi-unit residential, commercial, or industrial development. A transportation plan can help identify and ensure

¹⁴⁹ Whatcom Council of Governments, Whatcom Mobility 2040, https://whatcommobility.org/wp-content/uploads/2020/11/WM40_COMPLETE.pdf, 25

¹⁵⁰ Washington State Energy Strategy, Department of Commerce, <https://www.commerce.wa.gov/wp-content/uploads/2020/12/Washington-2021-State-Energy-Strategy-December-2020.pdf>, 52

¹⁵¹ Ibid, 52

community access to public transit options, and determine the impact on traffic congestion, access to basic services, and emergency response including safe evacuation routes. Transportation plans can also facilitate connectivity between communities, ensuring that people can travel efficiently. Efficiency and accessibility are major factors in determining if people will choose something other than a single occupancy vehicle for their regular commute trips.

Establishing transit-oriented land use policies and standards can influence development near transit corridors or develop new transit corridors that can serve a concentrated population. One example might be to require that new residential projects consisting of 25 units or more be located within a half mile of a transit node, shuttle service, or bus route with regularly scheduled daily service. Alternatively, the County may encourage or require developers to coordinate with the Whatcom Transportation Authority to see where additional bus routes and bus stops may be established relative to new residential, commercial, and industrial development.

In addition to transit service, access to safe bicycle and pedestrian infrastructure will encourage more people to bike or walk. The positive health impacts and reduction of obesity resulting from biking and walking are well documented. Trails for non-motorized travel should be planned and developed where possible in new, expanding, or existing community development. This may require a revision to setback requirements or collaboration with cities or state agencies where existing rights of way exist. Implementing “Complete Streets” development principles and standards can help the County achieve a more user-friendly alternative transportation system, especially for more rural communities. Complete Streets “are designed and operated to prioritize safety, comfort, and access to destinations for all people who use the street” and “may include sidewalks, bike lanes (or wide paved shoulders), special bus lanes, comfortable and accessible public transportation stops, frequent and safe crossing opportunities, median islands, accessible pedestrian signals, curb extensions, narrower travel lanes, roundabouts, and more.”¹⁵²

Public multimodal transportation may not be an option for everyone in every community. As such, when people require use of a passenger vehicle, the County should encourage carpooling and increased use of electric vehicles. The County should consider establishing additional park and rides as well as ensuring that building and land use codes support the installation of electric vehicle charging stations in more places. Siting electric vehicle charging stations in multifamily housing complexes and public hubs such as park and rides, parks, and shopping centers can maximize their convenience and use.

Finally, actions outlined in the Washington State Energy Strategy can help future transportation funding and planning in Whatcom County. For these actions, the County should consult the State and other local governments including the seven Whatcom cities and Skagit County. State actions include “take steps to incentivize and remove barriers that restrict TOD” and “link cross-jurisdictional coordination and community engagement with funding related to the planning and implementation of land-use policies, TOD, transportation demand management (TDM) measures (including vehicle usage charges or similar policies), transit and active transport infrastructure development and other measures designed to reduce VMT and enhance accessibility and mobility.”¹⁵³

¹⁵² <https://smartgrowthamerica.org/program/national-complete-streets-coalition/publications/what-are-complete-streets/>

¹⁵³ Washington State Energy Strategy, <https://www.commerce.wa.gov/wp-content/uploads/2020/12/Washington-2021-State-Energy-Strategy-December-2020.pdf>, 55

The County should also be aware that the Energy Strategy recommends that “the Legislature should fund WSDOT and Commerce to provide centralized assistance for jurisdictions to support development and implementation of model code related to corridor planning, ‘smart growth’ zoning and land-use policies, TOD and related infrastructure development.”¹⁵⁴ These potential funding sources are critical to ensuring implementation of this plan’s transportation and infrastructure goals, strategies, and actions as they pertain to land use.

Key Priorities for Transportation:

- *Improve the accessibility of transit and active transportation including promoting safe bicycle and pedestrian infrastructure and implementing the Regional Trails Plan*
- *Require a multimodal transportation plan that facilitates alternative transportation (e.g., park and ride, connection to bike and walking trails, bus stops and electric charging) for all new planned multi-unit residential, commercial, or industrial development.*

Strategy 3. Infrastructure that is Climate-Resilient and Reduces Environmental Impact

The County needs to establish a “green” or climate resilient infrastructure criterion and develop a plan that identifies, protects, connects, and re-greens the landscape. Green infrastructure can help the County combat climate change while also protecting the environment, wildlife habitat, and natural resources. Green infrastructure includes bioswales, rain gardens, and permeable pavements, all of which help filter polluted stormwater runoff close to its source, and green roofs that can help sequester carbon.

Bioswales and raingardens also provide habitat for certain birds and other species and even provide linkages to large habitats if planned accordingly. Green infrastructure also includes renewable energy systems, grid modernization (generation, transmission, and distribution), electric vehicle charging stations, broadband (which enables smart technology), and wastewater treatment. Culverts are also critical infrastructure, and when removed or replaced, can improve habitat and fish passage.

As a part of the green infrastructure plan, the County should identify critical infrastructure, such as



No migration – fish stuck below the culvert



Freedom to migrate up and down restored!

Figure 2.22: Source: Nooksack Salmon Enhancement Association

roads, bridges, and emergency services at risk in climate impact zones and develop plans to flood proof, relocate or remove. It is also important to retrofit, or develop new, roads, bridges, and culverts to be climate resilient and to incorporate sea level rise, storm surge, and flood predictions into design require-

¹⁵⁴ Washington State Energy Strategy, 55

ments. All new County infrastructure should adhere to the new criteria, which would be designed to protect critical watersheds and ecosystems.

Green infrastructure can be integrated into both new and existing structures to reduce greenhouse gas emissions. For example, developers and building owners can install green roofs or solar panels to mitigate carbon emissions.

Additionally, access to broadband opens up opportunities for smart grid, smart buildings, and smart transportation and infrastructure, which use internet of things technology to collect and analyze data from devices or sensors using high-speed broadband.¹⁵⁵ The data can help cities and counties address issues such as traffic congestion, but it can also improve energy efficiency and resilience to climate change.¹⁵⁶

Additional sustainability outcomes include smarter water management, environmental monitoring, multi-modal and advanced transit, and smart buildings.¹⁵⁷ Green infrastructure can come in many forms with many benefits, that the County should consider when planning and developing new infrastructure or replacing old infrastructure.

Key Priorities for Infrastructure:

- ***Establish climate resilient infrastructure criteria to focus investments and protect, connect and re-green the landscape.***
- ***Identify critical infrastructure at risk in climate impact zones and develop a plan to retrofit, relocate or remove.***
- ***Incentivize installation of renewable energy systems and increase access to municipal owned broadband to facilitate grid modernization and become a “Smart County.”***

Strategy 4. Protect Climate-Sensitive Natural Resources of High Ecological Value

In the natural environment, we must limit development in critical areas, agricultural lands, and forests in order to protect water, natural resources, habitat, wildlife, and ecosystems. Many ecosystem services are already adversely impacted by human activities, and there is growing concern that climate change will further compromise the benefits of intact ecosystems. At the same time, there is growing evidence that restoration of habitat can help mitigate the effects of climate change while helping to avoid significantly greater costs of future climate impacts.¹⁵⁸ It will take significant investment and devotion of more resources to protect Whatcom County farmland, forestlands, shorelines, and riparian corridors.

Currently, the County has a mitigation program for developers who want to develop on wetlands that allows them to invest in the enhancement of degraded wetlands or restore wetlands in other locations. While there is no evaluation as to whether key ecosystem services provided by the wetlands are sufficiently restored, enhancing mitigation requirements for all new development in the County will help

¹⁵⁵ Yesner, Ruthbea, “Accelerating the Digital Transformation of Smart Cities and Smart Communities,” Microsoft. <http://info.microsoft.com/rs/157-GQE-382/images/Accelerating-the-Digital-transformation-of-smart-cities.pdf>

¹⁵⁶ Ibid

¹⁵⁷ Ibid

¹⁵⁸ <https://blogs.ei.columbia.edu/2019/06/28/nature-based-solutions-climate-adaptation/>

minimize degradation to the natural environment. The County should also consider expanding the mitigation programs to include other places where we need to retain or restore ecosystem services.

Section 3 discusses in more detail the importance of protecting Whatcom County's water resources, fisheries, agriculture, forestry, and ecosystems. From a land use perspective, zoning lands strategically can help limit development in sensitive areas and protect ecosystem services and natural resources essential to building climate resilience. One way to permanently conserve critical lands is through exploring a compensatory re-zone program where landowners subject to a re-zone receive a portion of the estimated value of rights removed.¹⁵⁹

Furthermore, limiting or concentrating development ensures that critical working lands, including forest and agricultural lands, are not converted to residential or commercial use. Aside from the carbon sequestration benefits, productive agricultural lands are key to preserving the local food system. Forestry lands not only sequester carbon and fuel the local timber economy, but also serve as critical habitat for wildlife. It is important to recognize that sustainable forest management practices and timber harvesting can help mitigate the impacts of wildfires including threats to human health, air quality, and agricultural production.

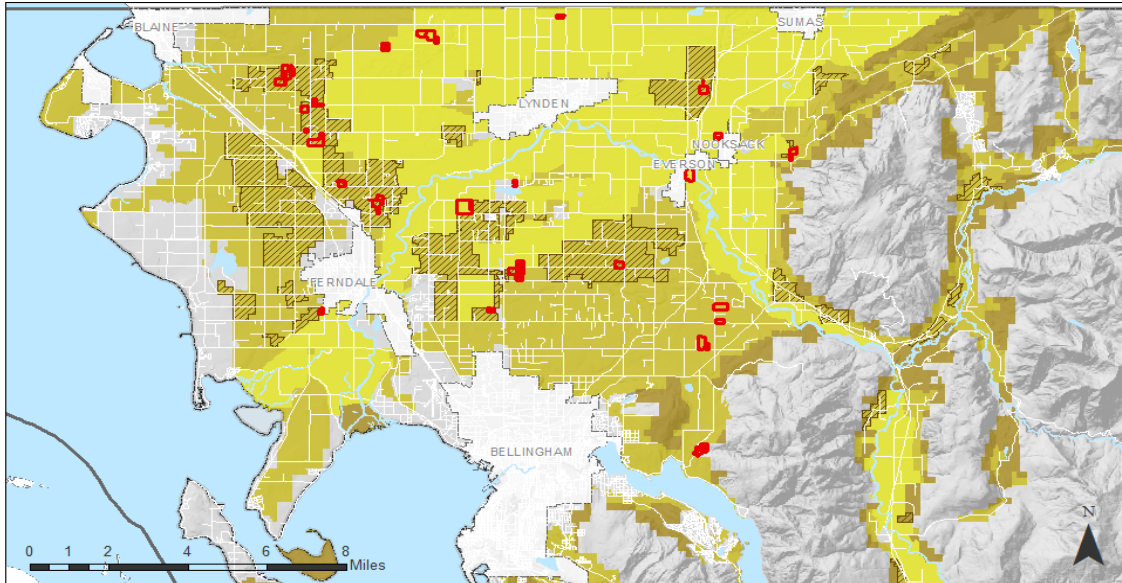
Whatcom County's significant increase in population over the last few decades has resulted in the loss of working lands. In 2002, Whatcom County established the Purchase of Development Rights program. "The PDR program is a voluntary program that compensates property owners for the value of their unused development rights and protects the land through the placement of permanent conservation easements. Conservation easements are perpetual contract agreements where a landowner agrees to protect the values present within the property, such as working farmlands, working forestlands, and important ecosystems. By protecting these areas, we are protecting local economies and local ecosystems for current and future generations."¹⁶⁰ To ensure the success of the PDR program, the County would benefit from increasing its capacity by providing additional funding and staff support.

In addition, the County can protect natural resources through strategic conservation and land use planning. First, the County needs to consider climate change vulnerability and adaptation when updating plans pertaining to shoreline management, shoreline restoration, watershed management, salmon recovery, critical areas ordinances, floodplain management, and flood hazard assessments. More specifically, with guidance from the State, Whatcom County should thoroughly incorporate climate change, salmon recovery, and net ecological gain throughout the Comprehensive Plan and the corresponding development regulations, including the Shoreline Management Program, Critical Areas Ordinance, and other County codes.

Net ecological gain is defined as a standard for a comprehensive plan in which the ecological integrity is improved and enhanced as a result of mitigation measures, leaving it better off than before. The County would benefit from developing an ecosystem conservation plan that prioritizes protection of critical habitat and vulnerable wildlife. All future planning and development in Whatcom County, especially in rural areas, should be informed through a climate resilience and natural resource enhancement lens.

¹⁵⁹ Many of these strategies and actions, such as compensatory rezones, will require a source of funding. Subsequent chapters will consider potential finance tools as current county budget and resources are already constrained.

¹⁶⁰ <https://www.whatcomcounty.us/573/Purchase-of-Development-Rights-Oversight>



Purchase of Development Rights Program

Easements Purchased 2004-2020

Zoning

- AG
- R2A, R5A, R10A
- RF
- Other zoning not displayed

Boundaries

- Purchased PDR Easement
- City Boundary
- Rural Study Areas
- Rural Study Areas are in R2A, R5A, R10A zoning



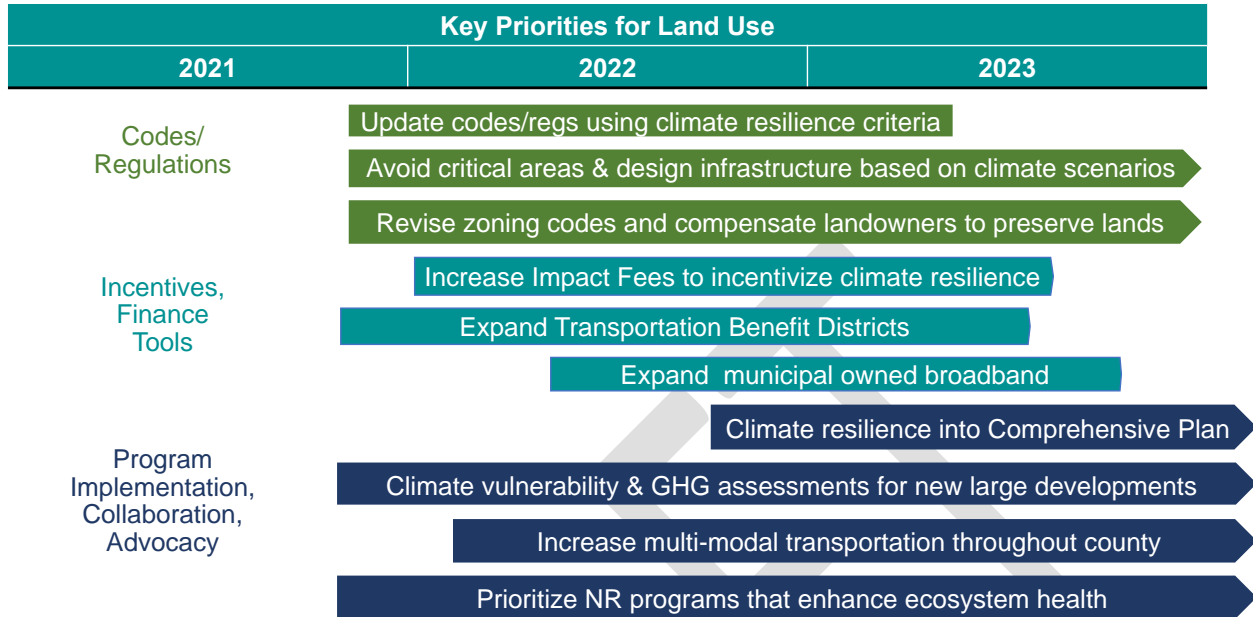
USE OF WHATCOM COUNTY'S GIS DATA IMPLIES THE USER'S AGREEMENT WITH THE FOLLOWING STATEMENT: Whatcom County disclaims any warranty of merchantability or warranty of fitness of this map for any particular purpose, either express or implied. No representation or warranty is made concerning the accuracy, currency, completeness or quality of data depicted on this map. Any user of this map assumes all responsibility for use thereof, and further agrees to hold Whatcom County harmless from and against any damage.

Figure 2.23. Whatcom County PDR map.

Key Priorities to Protect Climate-Sensitive and High-Ecological Value Natural Resources:

- **Significantly reduce and limit developments in climate impact zones, critical areas, wetlands, floodplains, agricultural lands, and forestry areas in order to protect key ecosystems services, critical core habitat and wildlife corridors.**
- **Increase capacity of Whatcom County's Purchase of Development Rights program**
- **Assess climate change vulnerability and adaptation when updating the County's various plans that involve natural resources.**
- **Incorporate climate change, salmon recovery, and net ecological gain throughout the Comprehensive Plan and Whatcom County Code**

Timeline of Land Use Priorities



Conclusion

Solutions for climate change mitigation and adaptation require planned intervention in the built environment and protection of the natural environment. “Whatcom County’s land use and development policies will play an important role in building resilience to projected climate impacts like warming temperatures, shifting precipitation patterns, wildfires, floods, and droughts.”¹⁶¹

Whatcom County’s land use planning, policies, and regulations intersect all sectors considered in this Climate Action Plan including electricity and buildings, industry, transportation, infrastructure, water resource management, working lands, and ecosystems. In order to fully mitigate and adapt to climate change, the County must be strategic in all future growth and development, and integrate watershed management, salmon recovery, and climate action planning within the broader land use planning processes.

The goal is to concentrate development within the urban growth areas in order to preserve working lands and critical areas. Climate and natural resource-informed comprehensive planning and land use policies can help protect productive working lands, natural resources, and ecosystem services. The County must address its large and growing carbon footprint by reducing the environmental impacts of buildings, industry, land development, transportation, and infrastructure. Considering climate change and natural resources in all County land use policies is necessary to meet greenhouse gas emission reduction goals and ensure mitigation, adaptation, and resiliency to climate change.¹⁶²

¹⁶¹ Whatcom County Land Use and Agriculture Vulnerability to Climate Change Factsheet

¹⁶² <https://unfccc.int/topics/land-use/the-big-picture/introduction-to-land-use>

SECTION 3 - NATURAL ENVIRONMENT

DRAFT

Introduction to the Natural Environment

Whatcom County is home to a wealth of natural resources, but these natural environmental systems are under an increasing threat from unsustainable development and climate disruption. Humans already directly affect more than 70% of the global, ice-free land surface, and about a quarter of this land surface has been degraded.¹⁶³ Climate change is exacerbating land degradation, because land surface air temperature has risen nearly twice as much as the reported globally averaged temperatures. Increases in the frequency and intensity of extreme weather events have contributed to topsoil removal, food insecurity and in general, declining ecosystem health. If we do not act immediately, we may risk losing some of the things that make Whatcom County such a wonderful place.

Perhaps the natural resource most directly threatened by climate change is water and in particular, freshwater. Water is the fundamental resource that supports our fisheries, forests, agriculture, and other critical ecosystems that support life on earth. Freshwater resources represent only about 3% of the total water on earth of which about 1% is readily available for human use.¹⁶⁴

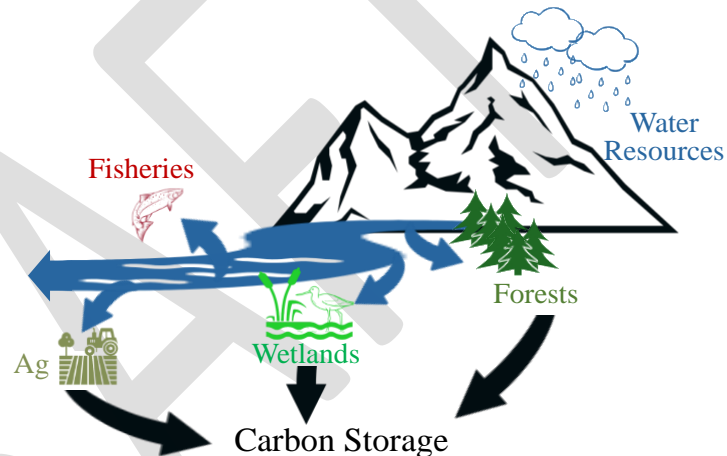


Figure 3.1: Water is the key resource for healthy ecosystems and carbon storage.

Rising stream temperatures are putting stress on our local salmon runs resulting in fewer fish for everyone. Climate change projections predict that 40 miles of the Nooksack River will exceed the thermal tolerance of salmon by 2040.¹⁶⁵

Ecosystems in the Salish Sea are also suffering from the cumulative impacts of 150 years of development and climate stressors.¹⁶⁶ The climate impacts of ocean acidification and sea level rise threaten our fisheries and shellfish industry and destroy important shoreline and estuary ecosystems that are a vital part of the marine food chain.

¹⁶³ Climate Change and Land, An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. A Summary for Policymakers. January 2020. https://www.ipcc.ch/site/assets/uploads/sites/4/2020/02/SPM_Updated-Jan20.pdf

¹⁶⁴ NASA Freshwater Availability, <https://earthdata.nasa.gov/learn/toolkits/freshwater-availability>

¹⁶⁵ Floodplains by Design and The Nature Conservancy, 2018. Climate Change in the Nooksack River: A quick reference guide for local decision-makers: <https://cig.uw.edu/our-work/decision-support/floodplains-by-design/>

¹⁶⁶ Sobocinski, K. L. (2021), The State of the Salish Sea, G. Broadhurst and N.J.K Baloy (Contributing Eds.), Salish Sea Institute, Western Washington University, <https://doi.org/10.25710/vfhh-3a69>

The natural environment in this plan includes those ecosystems that are threatened by climate disruption, but also can be part of the climate solution, especially in their role as natural sinks for large quantities of carbon (Fig. 3.1). Cropland, grasslands, forests, riparian corridors, wetlands, and estuaries serve many critical functions in addition to carbon storage, such as clean water, clean air, soil formation and food production to name a few. These are vital functions that must be resilient to climate change and play an important role in carbon uptake and storage.

As emphasized in Section 2 of this report, land use is a valuable tool that can reduce GHG emissions and enhance natural carbon sinks (Fig. 3.2). Sustainable management practices, incentives and education can increase the carbon storage potential of cropland, forests, and wetlands.

Wetlands are also a vital component of watersheds that support the overall hydrologic system.

Increases in forest cover not only increase carbon dioxide uptake but can also alleviate some of the negative impacts of climate change by

decreasing surface temperatures through evapotranspiration. Land use conversions to grassland, developments (settlement) or other lands results in a release of about 160 thousand MT CO₂e per year in Whatcom County.¹⁶⁷ This amount of land conversion is not sustainable and would add about 1.6 million tons of GHG emissions over the next decade.

The addition of the natural environment in this Climate Action Plan signifies both the importance of natural ecosystems in achieving climate resilience and the increasing threat to these systems and our quality of life in Whatcom County. As expressed often and eloquently by Native Americans, we are temporary occupants and passing custodians of these natural resources and they must be protected for future generations.

This section provides an assessment of the current knowledge available on the status of the natural environment in Whatcom County and how these resources can be strengthened to build climate resilience.

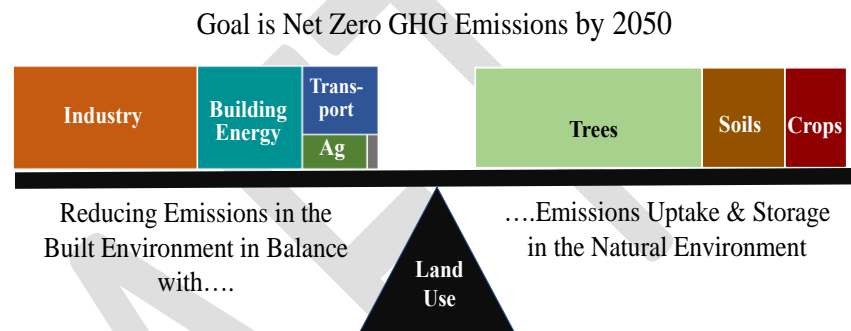


Figure 3.2: Using the natural environment along with emissions reduction in the built environment to help rebalance GHGs.

¹⁶⁷ ICLEI sponsored study on the GHG Inventory for Forests and Trees Outside Forests for Whatcom County. 163,000 MT CO₂e was the average per year emissions over a ten-year interval from 2000-2010 for Whatcom County.

Water Resources and Fisheries

The landscape of Whatcom County has changed greatly over the past 150 years. The lowland forests have been nearly eliminated, the lower Nooksack River has been leveed with a large percentage of wetlands ditched or filled, permeable ground surfaces have been replaced with impervious surfaces and developments, and upland forests have been harvested multiple times in most places and most recently with short-duration harvest rotations. Watershed¹⁶⁸ functions and the interrelated hydrologic systems have been adversely impacted by these changes and in many cases the habitats they support are degraded. Recent studies suggest that young Douglas fir plantations are inefficient when it comes to water use and may reduce late summer streamflows by up to 50% as compared to mature and old growth stands.¹⁶⁹ With the projected impacts of climate change, a healthy, intact watershed is critically important.

Water resources in Whatcom County include the rivers, streams, floodplains, wetlands, estuaries, glaciers, and aquifers. These resources supply water for multiple municipal, domestic, industrial, and agricultural uses; provide habitat for all life stages and migration corridors for salmon and other aquatic and non-aquatic species; store and convey floods; support recreation and resilient ecosystem processes; and contribute to the natural character and beauty of our county.

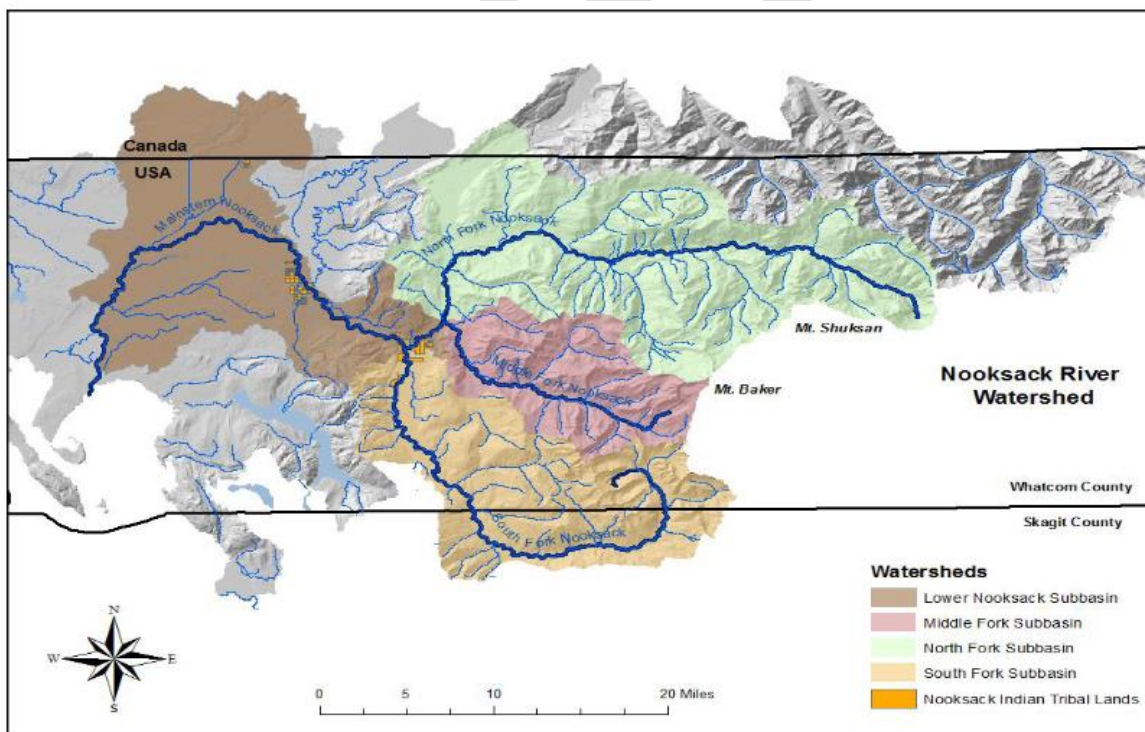


Figure 3.4. Nooksack River Watershed.

¹⁶⁸ <https://nplcc.blob.core.windows.net> 1 FINAL Glacier Summary Report_2015.pdf

¹⁶⁹ Perry, T.D., and J.A. Jones. 2016. Summer streamflow deficits from regenerating Douglas fir forest in the Pacific Northwest, USA. *Ecohydrology* 2016:1-13. DOI 10.1002/eco.1790.

Climate change is already having a profound impact on Whatcom’s water resources.¹⁷⁰ More intense, heavy rains,¹⁷¹ coupled with greater proportion of precipitation falling as rain during the winter instead of snow, will increase the frequency and magnitude of flooding and could overwhelm stormwater systems. Sea level rise¹⁷² and increased storm surge will increase coastal flooding and create a “coastal squeeze”¹⁷³ that may result in loss of intertidal wetlands as well as the potential for damage and loss of buildings, roads, and other infrastructure near the shoreline.

Most detrimental to salmon survival, and restoring sustainable fisheries are declining summer streamflows (Fig. 3.4)¹⁷⁴, higher water temperatures, reduced habitat quantity and quality, redd scour loss due to increased peak flows and flooding, and insufficient in-stream river flow. The contribution of glacial meltwater to summer base flows that reduce stream temperatures will, in a matter of decades, be drastically diminished and essentially may no longer be available. In August 2015, total flow in the North Fork of the Nooksack River was 60-95% glacier melt. Glacier melt contribution will be drastically reduced in the future with

continued climate change.¹⁷⁵ Annual winter snowpack will decline under a warming climate and changing precipitation types (e.g., snow vs. rain) and dynamics (location and amounts per time period). Further reductions to the already limited water supply threaten to intensify conflicts over water use.

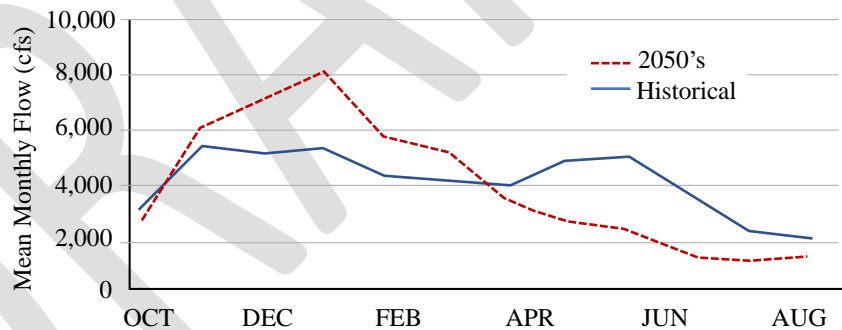


Figure 3.4: Projected Nooksack River flows at Ferndale in 2050's.

¹⁷⁰ Dickerson-Lange, S.E. and R. Mitchell. 2013. Modeling the Effects of Climate Change Projections on Streamflow in the Nooksack River Basin, Northwest Washington. Hydrological Processes, Published Online in Wiley Online Library

¹⁷¹ Office of the Washington State Climatologist, "PNW Temperature, Precipitation, and SWE Trend Analysis Tool," March 2019. [Online]. Available: <https://climate.washington.edu/climate-data/trendanalysisapp/>. [Accessed 25 October 2019].

¹⁷² NOAA, "Sea Level Rise Viewer," [Online]. Available: <https://coast.noaa.gov/slr/#/layer/flid/2/-13657290.7071441/6246546.839721947/11.015246303680001/satellite/94/0.8/2100/interHigh/midAccretion>, [Accessed 16 January 2020]

¹⁷³ Coastal squeeze is defined as intertidal habitat loss which arises due to the high-water mark being fixed by a defense and the low water mark migrating landwards in response to sea level rise.

¹⁷⁴ Floodplains by Design and The Nature Conservancy, 2018. Climate Change in the Nooksack River: A quick reference guide for local decision makers. <https://cig.uw.edu/our-work/decision-support/floodplains-by-design/>

¹⁷⁵ Ryan Murphy, 2016. Modeling the Effects of Forecasted Climate Change and Glacier Recession on Late Summer Streamflow in the Upper Nooksack River Basin. WWU Graduate School Collection. 461. <https://cedar.wwu.edu/wwuet/461>.

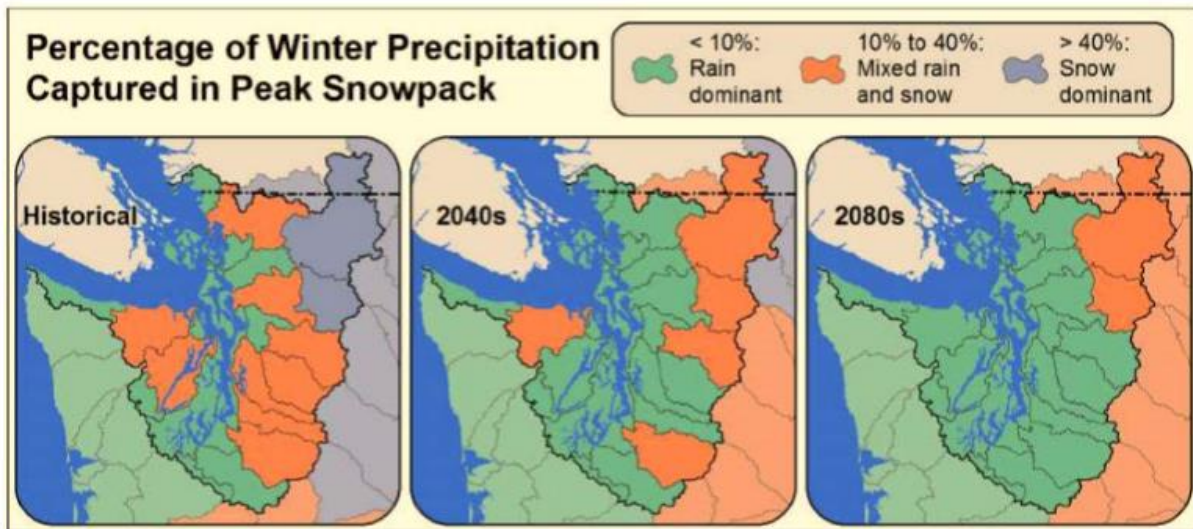


Figure 3.5: Model projections of Puget Sound watersheds suggest a transition to largely rain-dominant basins by the 2080s.

In addition to the impact of climate change on freshwater systems, Whatcom County’s saltwater fisheries (including shellfish) are threatened by climate change, particularly by the effects of ocean water warming, sea level rise, and ocean acidification. These threats come at a time when other pressures, environmental and economic, have caused decline in fishing activity: for example, the Lummi Nation has only about half the number of active fishers as it had in the early days of the Boldt decision in the mid-1970s,¹⁷⁶ and the non-tribal fishing fleet has likely seen similar declines.

Water Rights and Whatcom County’s Role

Waters of the state are a public resource, and a water right is required to beneficially use water. Western water law operates under the doctrine of prior appropriation, or “first-in-time, first-in-right,” based on the date the water is first put to a beneficial use. Beneficial use includes sufficient streamflow to sustain the habitat and life cycle needs necessary to provide a harvestable surplus of salmon that supports treaty-reserved fishing rights. Climate change is predicted to produce drier summers in Whatcom County which will increase water scarcity during critical periods for instream resources like salmon and out of stream water needs such as irrigation for farms.

Management and enforcement of water law is complicated by the number and complexity of water rights in the Nooksack Basin. It has been estimated that up to 40% of all water used in agriculture may lack a legal water right.¹⁷⁷ Both the Lummi Nation and Nooksack Indian Tribe have petitioned the state Department of Ecology to initiate stream adjudication, a court process that identifies, quantifies, and confirms legal water rights. The Washington state legislature secured funding (SB-5092 in 2021) to prepare and start the adjudication of state water rights for the Nooksack water resource inventory area.

¹⁷⁶ Kara Kuhlman, “Lummi Nation Climate Change Mitigation and Adaptation Plan, 2016-2026,” 2016.

¹⁷⁷ Community Research Project report, 2019. Document listed at: <https://whatcomcounty.us/3162/Meetings-Additional-Information>

In addition, funds were appropriated for Whatcom County to start a collaborative negotiation process to complement water rights adjudication.

Whatcom County's responsibility for water resources management is primarily assigned to the Public Works Department Natural Resources Division. The Planning and Development Services, and the Health Department also support specific water resource review and planning functions. The Public Works Department supports the following water resource management responsibilities:

- The River and Flood Division provides emergency flood response and floodplain management services. These services include integrated floodplain management planning, flood risk reduction through capital projects and acquisition of flood-prone areas, repair and maintenance of levees and other flood protection structures, floodplain permitting and administration of the National Flood Insurance Program. River and Flood staff, in partnership with Tribes and agricultural and other stakeholders, lead the Floodplain Integrated Planning (FLIP) process.
- The Natural Resources Division supports and engages in salmon recovery and water resources planning, monitoring, management, including staffing the WRIA (Water Resource Inventory Area) 1 Watershed Management Board (see below) and Planning Unit. Whatcom County serves as the lead administrative agency for watershed management planning efforts.
- Planning and Development staff review development applications, issue development permits, enforce zoning and other development-related codes, and perform long range land use planning for the County. Long range planning efforts include periodic updates of the Comprehensive Plan, Shoreline Management Program, critical areas regulations, and the Coordinated Water System Plan, in addition to serving a primary role of implementing the Streamflow Restoration Act in WRIA-1.
- The Health Department responsibilities related to water resources primarily relate to the review and approval of potable water sources and the review, approval, and inspection of on-site septic systems.

Whatcom County's role in fisheries. Whatcom County supports the 2005 WRIA 1 Salmonid Recovery Plan¹⁷⁸ goal of restoring healthy, self-sustaining runs of salmon to harvestable levels. The County has also formed shellfish protection districts improving water quality so that all shellfish harvesting areas are free of fecal contamination and can be opened for harvest. Achieving these goals is essential to maintaining the way of life for the Lummi Nation and Nooksack Indian Tribe and for the Whatcom County community at large.



Figure 3.6: WRIA 1 Salmonid Recovery Plan map. 2005

Whatcom County has both tribal ceremonial, subsistence, and commercial fisheries and non-tribal commercial and recreational fishing industries. The Lummi Nation and Nooksack Tribe rely on salmon and shellfish and other traditional foods as a major

¹⁷⁸ WRIA 1 Salmon Recovery Program, <https://salmonwria1.org/salmon-recovery>

part of their diet and are actively promoting consumption of traditional foods for their health and cultural value. Their rights to “take fish at usual and accustomed places” are guaranteed by the 1855 Treaty of Point Elliott and have been repeatedly confirmed by the courts. Tribal communities continue to fight for enforcement of their treaty rights and maintaining their legal sovereignty, as well as the chance to revitalize their communities economically and preserve their cultural autonomy. In addition to ceremonial and subsistence fisheries, the Lummi Nation and its individual members maintain the largest native commercial fishing fleet in the US, producing salmon, clams, and crabs for sale, and the Nation co-manages several treaty-reserved fisheries. The Nooksack Indian Tribe and its members are also heavily involved in commercial salmon fishing, both in the Nooksack River and in saltwater. Over one hundred commercial fishing boats (tribal and non-tribal) based here operate in the north Pacific, and there are several processing plants in Bellingham, Blaine, and Ferndale, as well as five commercial shellfish producers. Commercial fishing in the County brought in \$320 million in 2013.¹⁷⁹

Climate change is an urgent concern to tribal and commercial fishers and shellfish producers, threatening both the way of life and the economic viability of both tribal and non-tribal fishers and shellfish producers. The cultural, social, and economic vitality of tribal communities depends partly on other stakeholders’ maintaining and strengthening a relationship of mutual respect and cooperation, so that we can react to climate change and other environmental challenges in ways that preserve the Tribes’ legal and cultural rights to subsistence, income, and sovereignty.

Goal and Strategies in Water Resources and Fisheries

Goal: Ensure long-term equitable and climate-resilient water resources in Whatcom County that address the impacts of climate change on water quantity and quality, sea-level rise and storm surge, and the challenges associated with water resource management.

The strategies identified below also support the overarching natural resource goal of promoting adaptation and improving community and ecosystem resilience to climate change.

The nine water resources and fisheries climate strategies support two main areas: the seasonal impacts on water availability (strategies 1 through 5), and the increasing risk and damage from climate-related flooding and storm damage (strategies 6 through 9). There are many cross-cutting issues in water resources that intersect and overlap with agriculture, forestry, ecosystems, and other land uses, which are discussed throughout this larger Section 3 on Natural Environment. Ensuring long-term equitable and climate-resilient water resources will require significant effort. To be most effective, actions pursuant to these strategies should be designated, designed, and implemented as soon as practical to be effective at offsetting the adverse impacts of continued climate change into the future.

The water resources strategies support two main areas: the seasonal impacts on water availability and the increasing risk and damage from climate-related flooding and storm damage.

¹⁷⁹ Port of Bellingham, The Economic Impacts of the Commercial Fishing Fleet at the Port of Bellingham. <https://www.portofbellingham.com/DocumentCenter/View/5138/Commercial-Fishing-Impact-Study-2014-FINAL?bidId=>

Climate Strategies in Water Resource and Fisheries

1. Resolve uncertainty in current and future water resources
2. Restore and protect streamflow to a level and temperature that ensures year-round salmon migration and survival and other aquatic and non-aquatic species.
3. Maintain and enhance estuarine, marine shoreline and coastal wetland habitats for fish and shellfish.
4. Reduce water demand through conservation and efficiency
5. Protect existing and develop new or alternative water supplies.
6. Promote climate resilient floodplain management.
7. Manage riverine floodplains to reduce flood risk and allow for natural processes that increase the capacity to store floodwaters and attenuate flood peaks.
8. Reduce flood risk by moving people and infrastructure out of harm's way.
9. Manage stormwater infrastructure for increased frequency and magnitude of rainfall/flood events.

Strategy 1: Resolve Uncertainty in Current and Future Water Resources

Our local water supply is paramount to the livelihood and economy of the County through its role for salmon, ecosystem services, agriculture, industrial, domestic, and municipal consumption, and diverse cultural and recreational values. Surface and groundwater in the Nooksack River Watershed are the primary sources of fresh water for Whatcom County. Lake Whatcom is the source of water for about 50% of Whatcom County residents.

When averaged annually, Whatcom County has ample water for all requirements. This annual average results from combining an oversupply (in the winter and early spring) with a scarcity (low stream flows and increased irrigation needs) in the summer and early fall when demand for irrigation is high (Fig 3.7).¹⁸⁰ As stated in the 1997

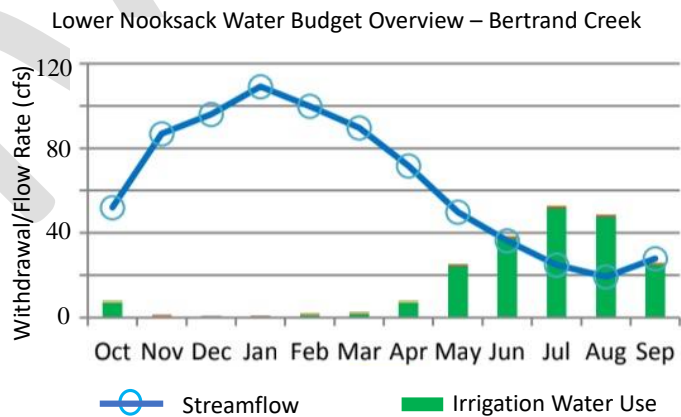


Figure 3.7: Simulated monthly streamflow 1999-2011 and estimated water use (Topnet-WM model as a function of evapo-transpiration irrigation efficiencies, crop type and acreage).

¹⁸⁰ Lower Nooksack Water Budget Overview, WIRA-1 Joint Board. Prepared by Silver Tip Solutions, Hydrologic Services Co., Dumas and Associates, and Associated Earth Sciences, Inc.

Reconnaissance Survey of Whatcom County Water Storage Options:¹⁸¹ “The Nooksack River streamflow is strongly seasonal, with almost 50% of the runoff occurring between November and March and another 20% occurring during the spring snowmelt season.”

Meeting our county’s diverse needs with the quantity of water available will only become more difficult with climate disruption.¹⁸² A projected shift in the amount and timing of precipitation with significantly less in spring and summer will continue to cause water shortages during the growing season. Glacial melt derived streamflow will increase slightly over the next 30 years in glacial creeks and in the North and Middle Forks and in the lower Nooksack River, but then decrease substantially in the latter half of the century as glaciers disappear.¹⁸³

Moving forward on solutions to our water supply has been stymied by several issues that start with accurate measurements of our water supply and use. Approximately 20% of irrigation water for agriculture is drawn from the Nooksack River system (all three forks) and the remaining 80% from groundwater – mostly the Abbotsford-Sumas aquifer that extends into Canada.¹⁸⁴ Considering only direct withdrawals from the Nooksack River is deceptive, because withdrawals from shallow aquifers, like the Abbotsford-Sumas aquifer, that feed the river system also have a direct impact on stream levels. Although an exact assessment is lacking, community leaders often estimate that up to 40% of water withdrawals are not legally permitted in the Nooksack basin.¹⁸⁵

While predictions of climate change impacts to specific water quantity concerns may contain uncertainty, there is sufficient confidence in the projected climate trajectories that indicate efforts to conserve, plan and adapt for less water availability will benefit regional resilience. The LENS Area Numerical Groundwater model¹⁸⁶ should be used to support implementation of the WRIA 1 Watershed Management Plan. This regional model will provide a better understanding of groundwater and surface water interactions to allow resource managers to make decisions on how to allocate water for existing and future uses and how to mitigate impacts while maintaining instream flow. Data supported water planning and implementation will improve the climate resilience in the Nooksack River Basin and ensure a stable economic future and healthy environment.

¹⁸¹ Nooksack Basin Water Users Steering Committee: Reconnaissance Survey of Whatcom County Water Storage Options, December 1, 1997

¹⁸² Climate change in the Nooksack River: A quick reference guide for local decision-makers. Issued by Floodplains by Design and The Nature Conservancy. Based on the UW Climate Impacts Group, State of Knowledge: Climate Change in the Puget Sound, 2015.

¹⁸³ Ryan Murphy, 2016. Modeling the Effects of Forecasted Climate Change and Glacier Recession on Late Summer Streamflow in the Upper Nooksack River Basin. WWU Graduate School Collection. 461. <https://cedar.wvu.edu/wwuet/461>

¹⁸⁴ Henry Bierlink interview, April 12, 2019, Community Research Project report, <https://whatcomcounty.us/3162/Meetings-Additional-Information>

¹⁸⁵ *Ibid.*

¹⁸⁶ Lynden, Everson, Nooksack, Sumas (LENS) area of Whatcom County. Chuck Lindsay (Associated Earth Sciences, Inc.), Gilbert Barth (S.S. Papadopoulos and Assoc., Inc.), and Christina Bandaragoda (University of Washington).

Key Priorities for Strategy 1:

- *Use climate change projections to estimate future water availability.*
- *Use the LENS model with climate projections to estimate the impact of different sectors on stream flow levels.*

2. Restore and Protect Streamflow to a Level and Temperature that Ensures Year-Round Salmon Migration and Survival

Instream flow levels in the Nooksack River, which help support salmon life cycle needs, frequently fall below state requirements in the summer and fall. Recent studies suggest that flow in the Nooksack River has been declining since the late 1800's and that minimum instream flows at Nugent's Corner currently are not met approximately 112 days of the year. By 2075, minimum instream flows may not be met for as many as 190 days.¹⁸⁷ As a result, water quantity in Whatcom County has been the subject of much debate, planning, and at times, legal action over the last several years.

A combination of hotter temperatures, lowered stream flows, and historic removal of shade from riparian forests has raised the temperature of our creeks and rivers, to the point that temperatures in some areas are sub-lethal to lethal to salmon and trout. High water temperatures can also promote bacterial infections that can kill ESA listed early Chinook salmon adults before they are able to spawn.

The South Fork Nooksack River in particular experiences dangerously high summer and fall water temperatures that threaten "early" or "spring" Chinook, that enter the Nooksack River in the spring and migrate upstream where they can stay for several months before spawning in August and September. Cool, deep pools with woody cover provide important resting areas where fish are safer from predators and disturbance and can conserve their energy for spawning. If the water table is lowered by increased irrigation or municipal use, these cool pools may no longer provide this needed refuge.

The North and Middle Forks of the Nooksack River receive a significant amount of their summer flow from snowfields and glaciers on Mount Baker, keeping water temperatures lower than on the South Fork. If glaciers shrink as less snow accumulates each winter, there will be less summer water and less cool water in the future.

To maintain a healthy aquatic ecosystem it will be necessary to increase stream flows when they drop below a critical level. In addition, the scientific basis for the current minimum instream flow standards is in question and may be low estimation of actual needs. There are numerous recommended approaches proposed to improve streamflow in upland and lowland streams. Efforts are underway to evaluate the role of forest hydrology in streamflow and significant projects are proposed in the South Fork Nooksack River basin to assess this approach. Restoration of forest hydrology also improves fish habitat, reduces sedimentation, and increases carbon storage across the landscape.

Projects are also proposed for stream augmentation which may be an effective way to increase streamflow from deep groundwater sources. These projects can generate the data needed to justify a change in state water regulations and laws that impact our ability to enhance stream flow under a changing climate.

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Multiyear demonstration projects should involve most areas of the Nooksack River basin that typically experience low instream flows during the summer and early fall. Volunteers from different organizations could collect data on the economic, social, and environmental impacts of this augmentation demonstration project. Ultimately, the information collected will be used to develop best practices and legislative fixes of state water laws and regulations as needed.

Salmon hatcheries, including two operated by the Lummi Nation and the Kendall hatchery operated by the Department of Fish and Wildlife, have partially mitigated the effects of habitat loss on salmon runs. However, even enhancement by hatcheries may not be able to keep pace with the effects of diminished flows and warmer water on salmon reproduction.

Increasing air temperatures, declines in the depth and area of winter snowpack, retreat of snowlines to higher elevations, shrinking glaciers, and decreasing summer precipitation are expected to continue to disrupt freshwater systems, habitats, and watershed functions in Whatcom County. It is important for communities and natural resource managers to monitor, maintain, and adapt water policy to prepare for the risks and impacts associated with climate change.

Key Priorities for Strategy 2:

- ***Develop demonstration projects to increase streamflow and lower stream temperatures.***
- ***Restore and protect wetlands and riparian zones.***

3. Maintain and Enhance Estuarine, Marine Shoreline and Coastal Wetland Habitats for Fish And Shellfish

Aquatic habitat loss is a prime factor in endangering our salmon runs, other fish resources, and shellfish production. We can halt and reverse habitat loss and degradation through removing hard shore protection, restoring wetlands to promote structural complexity and biological diversity, and promoting mechanisms for sediment transport and deposition.

With 3 feet of sea level rise by 2100 predicted by many climate models, much of the current intertidal shellfish habitat could become permanently under water, reducing the total area available for shellfish production. Sea level rise may result in erosion of the estuaries of the Nooksack and other streams, impacting habitat for juvenile salmon. Attempts to armor shorelines to protect coastline residences and infrastructure can exacerbate the effects of sea level rise by causing waves to bounce off the bulkheads and erode the beach, impacting intertidal habitats for shellfish and forage fish such as sand lance and surf smelt. It is possible that in a few areas the shoreline and associated shellfish beds could move inland to places two to three feet higher elevation, but this is not certain.

Declining pH of ocean water is perhaps the most serious threat to our fisheries, particularly shellfish. Oysters, clams, and mussels cannot “set” shells when the water becomes too acidic, and some growers are already having to add basic materials to the water where shellfish larvae begin to set shells, or to seed larvae elsewhere and bring the juveniles here for maturation. Other disruptions may happen in the marine food web. For example, Dungeness crabs, a key source of food and income for both Native and non-tribal fishers, probably will suffer declines in many of their prey species.

Warmer ocean water incidents in the Eastern Pacific in recent decades, including the famous “blob” that formed from 2015 to 2018 and repeated El Niño events, also bring warmer waters. This affects the

distribution of the marine organisms that salmon feed on, and thus the distribution, growth, and survival of salmon in the Pacific Northwest and Alaska. It can also affect the migration routes of salmon returning to spawn; these all have direct effects on the number of fish available to local tribal and commercial fishers for harvest and to return to the spawning grounds to sustain the populations.

Ocean waters also become more stratified during warm water events; this promotes red tides, which have recently lasted longer into the fall, affecting the safety of our shellfish harvests. Rising ocean temperatures also promote toxic algal blooms as well as *Vibrio* and other bacteria, which release toxins rendering oysters toxic to humans. In addition, competing invasive species, such as the European green crab, have moved northward recently because of rising ocean temperatures. Other important tribal subsistence resources, such as sea urchins and sea cucumbers, also have their reproductive cycles shifted in time with changes in ocean temperatures.

The Shoreline Management Program (SMP) requires the County to understand the current and potential ecological functions and processes provided by shorelines, understand how exempt development will impact these ecological functions, and include policies and regulations to address the cumulative impact on these ecological functions.

The Shoreline Management Program can be significantly strengthened by consideration of climate change and sea level rise. The permitting of new building developments and associated infrastructure that may be in place for decades must be evaluated using projected risks of sea level rise, storm surge and flooding over the projected lifetime of the building, road, or bridge. Coastal and riverine flooding will increase in magnitude and frequency.

Whatcom County is currently participating in development of a local Coastal Storm Modeling System (CoSMoS) which will further inform the extent of potential impacts of sea level rise combined with storm surge, wind currents, barometric pressure, and other environmental factors. This effort will support selection of an actual sea level rise elevation and/or shoreline impact zone. New County code language is needed that clearly identifies the projected impacts of sea level rise and increased impacts of riverine and coastal flooding. Code improvements must also require applicants pursuing development within the shoreline jurisdiction to perform a climate vulnerability assessment for the proposed action and highlight mitigation measures proposed to address projected climate impacts. This language will support applicants in mitigating climate risk to their private investment and will support local government in protecting public safety, private property, and environmental health.

Key Priorities for Strategy 3:

- ***Revise codes and regulations for shoreline management to create healthy ecosystems that are climate resilient.***
- ***Facilitate shoreline migration of wetlands.***

4. Reduce Water Demand through Conservation and Efficiency

Much can be done to conserve and improve the efficiency of water use in Whatcom County through educational outreach and modification of current practices. Whatcom County has contracted with the Whatcom Conservation District to implement the Enhanced Whatcom Water Alliance Program that

promotes water use efficiency and conservation for domestic and municipal user and is also partnering with the District to develop an Agricultural Water Use Efficiency and Conservation Program.

Key Priority for Strategy 4:

- *Incentivize efficiency upgrades to systems that consume large quantities of water.*

5. Protect Existing and Develop New or Alternative Water Supplies

The County should consider developing new sources of groundwater that could replace the use of water withdrawals that impact the streamflow levels in the Nooksack Basin. Both the Birch Bay Water and Sewer District and the City of Ferndale have drilled deep groundwater wells in the past few years that have yielded potable water. For example, Birch Bay drilled an exploration well¹⁸⁸ that intersected a confined aquifer at a depth of around 600 feet. The available data indicates that the recharge area for the aquifer extends a significant distance into southern British Columbia¹⁸⁹ and therefore would not impact water levels in the Nooksack Basin.

The science is just beginning to reveal the deep aquifer potential in Whatcom County and whether this source of groundwater will be able to provide sufficient water for irrigation or municipal and industrial uses. It may also be possible to utilize these deep aquifers in northwest Whatcom County without impairing established water rights or minimum instream flows.

Protection of existing wetlands, aquifer recharge areas, and upland forest hydrology also have significant impacts on streamflow and provide significant potential to enhance or increase streamflows in the future. Current efforts to identify, restore, and protect wetlands, aquifer recharge areas, and headwater areas must be significantly enhanced and expanded. This could be accomplished through increased rate of acquisition of conservation easements on these priority areas, development of a carbon credit program to acquire protections on forested watershed areas, and improved protections within development regulations to minimize impacts to watershed health and water supply.

Other approaches for new and alternative water supplies may be as simple as rainwater harvesting to provide water for buildings or yards, advanced wastewater treatment for water reuse, and technologies like reverse osmosis for desalination.

Key Priority for Strategy 5:

- *Develop a better understanding of deep groundwater resources that can augment freshwater needs.*

6. Promote Climate Resilient Floodplain Management

In contrast to water shortages in the summer and early fall, climate change is increasing the frequency and intensity of extreme rainfall events in the late fall and winter causing the potential for severe flooding. According to one study, this will result in a 27% increase in Nooksack River streamflows in late

¹⁸⁸ Dan Eisses, General Manager of the Birch Bay Water and Sewer District, presentation given at the Academy of Lifelong Learning, Whatcom Water Woes II, December 2018.

¹⁸⁹ Charles Lindsay, Senior Principal Hydrologist, Associated Earth Science, Inc., personal communication.

winter and early spring, and the 100-year flood event may become the 10-year flood event.¹⁹⁰ The County's Public Works department, in partnership with Tribal staff and representatives from the agricultural community, is updating the 1999 comprehensive flood hazard management plan through the Floodplain Integrated Planning (or FLIP) process. Whereas the 1999 plan focused on flood hazard management, the intent of FLIP is to develop an Integrated Floodplain Management Plan that addresses flood hazard management, agricultural protection, and salmon recovery needs.

The County, together with the City of Bellingham and Port of Bellingham, is also supporting a USGS project to develop a fine-scale flood risk model for the lower Nooksack River (Compound Flood Model) and coastal areas of Whatcom County that includes consideration of the combined impact of sea level, storm surge and stream flooding under climate change (Coastal Storm Model System - CoSMoS). By including climate change in the FLIP process and the flood risk modeling of the river and coastal areas, the County will have a better understanding of flood risk and economic consequence. In turn, this should lead to improvements in floodplain management, revised land use regulations, and the County's approach to designing and locating infrastructure.

Key Priority:

- **Lower flood risk and damage by implementing FLIP.**

7. Manage riverine floodplains to reduce flood risk and allow natural processes that increase the capacity to store floodwaters and attenuate flood peaks

The Nooksack River channel has changed dramatically over the last 150 years (Fig 3.8).¹⁹¹ The historical meandering stream helped manage the energy flow of water by increasing resistance and reducing the channel gradient. In essence the meandering stream created a wider floodplain that accommodated the peak flows. Log jams were removed in the early 1900s to facilitate boat travel and economic development. This removal reduced the natural braiding and oxbows in the river channel and contributed to a narrowing of the natural channel. Removal of snags, levee construction and removal of riparian zones for agriculture further straightened the channel and increased the gradient.

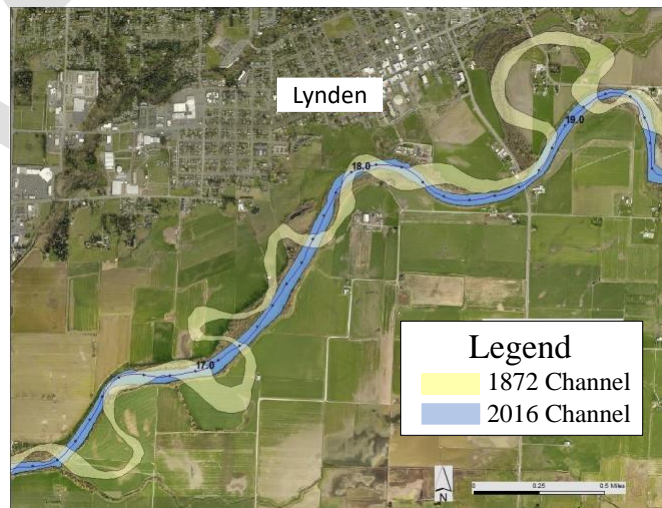


Figure 3.8: Changes in the Nooksack River channel between 1872 and 2016

¹⁹⁰ Dickerson-Lange, S.E. and R. Mitchell. 2013. Modeling the Effects of Climate Change Projections on Streamflow in the Nooksack River Basin, Northwest Washington. Hydrological Processes, Published Online in Wiley Online Library

¹⁹¹ Lower Nooksack River Geomorphic Assessment, Final Report, by Applied Geomorphology, Inc., Element Solutions, Northwest Hydraulic Consultants, and DMT Consulting. February 11, 2019.

This straight river channel and high flow gradient can no longer accommodate the increases in winter and early spring rainfalls that are occurring due to climate change. To reduce flood risk and economic damage, the County needs to establish channel migration zones, reconnect floodplains by lowering or setting back levees and restore habitat in riparian zones.

Connectivity of wetlands and riparian areas to streams provides sources for water-conveyed materials such as sediment, nutrients, and woody debris, while reducing streamflow energy, promoting channel complexity, and providing habitat. Human alterations such as dams, levees, roads, and water withdrawals have reduced stream-floodplain or stream-wetland connectivity among other impacts.

Farming is the preferred land use for historical floodplains. The County needs to increase funding and capacity for the Purchase and Development Rights (PDR) Program to discourage development in floodplains and re-evaluate land use designations and regulations in light of climate change.

Key priority for Strategy 7:

- **Restore connectivity of our fragmented hydrologic system to increase water storage and reduce flood damage.**

8. Reduce Riverine and Coastal Flood Risk by Moving People, Development, and Infrastructure

A recent analysis showed that most US homeowners do not carry sufficient flood insurance to cover flood damage and could face \$18.8 billion in flood damage annually.¹⁹² For Whatcom County the annual loss per property with substantial flood risk would amount to \$4,000 to \$8,000 per year. Only a few areas in the US have higher annual flood losses. This information is based on an analysis done by the First Street Foundation, which now provides a flood factor risk for homeowners by zip code.¹⁹³ For example, 43 percent of the properties in Lynden are at risk and annual damage could be as high as \$732 thousand this year.

FEMA has been updating its flood risk rating system using insurance industry approaches that will likely face backlash from homeowners who cannot afford the higher cost of flood insurance.¹⁹⁴ This new flood risk rating system is expected to be released sometime in 2021. Many communities are already requesting federal tax dollars to move whole neighborhoods out of high flood risk zones.¹⁹⁵ Moving structures out of harm's way is the only long-term solution to reduce financial risk and ensure public safety. Moving to higher ground was noted by the Lummi Nation as the logical adaptation solution to sea level rise.¹⁹⁶ The County should also evaluate the need to move critical emergency infrastructure and

¹⁹² Most Americans Don't Have Enough Flood Insurance for Climate Change by Leslie Kaufman and Mira Rojanasakul, Bloomberg Green, February 22, 2021. <https://www.bloomberg.com/graphics/2021-flood-risk-financial-cost/>

¹⁹³ Find your home's Flood Factor, <https://floodfactor.com/>

¹⁹⁴ FEMA's Upcoming Changes Could Cause Flood Insurance to Soar at the Shore, by Ed Leefeldt and Amy Danise, Forbes Advisor, March 18, 2021. <https://www.forbes.com/advisor/homeowners-insurance/new-fema-flood-insurance-rates/>

¹⁹⁵ US Flood Strategy Shifts to 'Unavoidable' Relocation of Entire Neighborhoods, by Christopher Flavelle. New York Times, August 26, 2020. <https://www.nytimes.com/2020/08/26/climate/flooding-relocation-managed-retreat.html?referringSource=articleShare>

¹⁹⁶ Lummi Nation Climate Change Mitigation and Adaptation Plan: 2016-2026 prepared by the Water Resources Division, Lummi Natural Resources Department. February 16, 2016.

develop a plan.

Key priority for Strategy 8:

- *Move people and emergency infrastructure based on updated FEMA maps on flood risk.*

9. Manage Stormwater Infrastructure for Increased Frequency and Magnitude of Rainfall/Flood Events

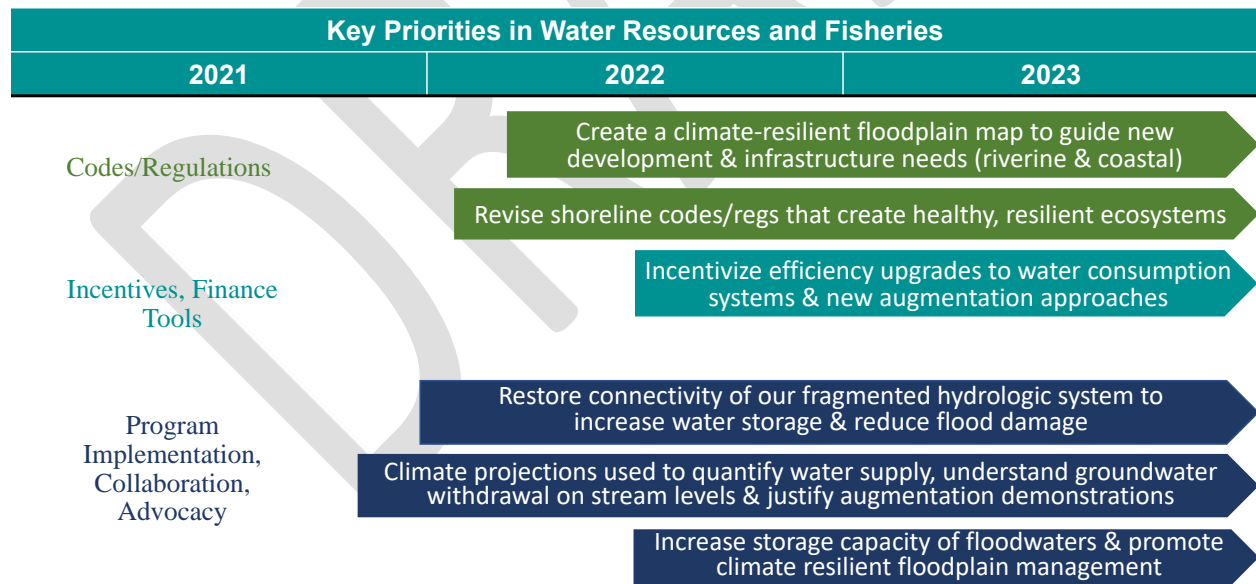
Stormwater impacts are projected to increase under future climate scenarios. To effectively protect stream channels, wetlands, and watershed function from increased erosion and water impacts, it is necessary to manage the higher frequency, magnitude, and duration of stormwater flows. Future climate scenarios need to be incorporated into stormwater project design. This includes replacing culverts with structures that can convey increased flow while ensuring fish passage.

Codes and regulations should be updated to minimize impervious surfaces in developments and consideration of green stormwater infrastructure to reduce erosion from large storm events (see [Land Use](#)). The County should also accelerate the construction and retrofit of stormwater flow control system, runoff treatment and infiltration facilities to increase capacity and accommodate future rainfall and flood events.

Key Priorities for Strategy 9:

- *Update stormwater infrastructure such as culverts to minimize ecological damage from increased magnitude and frequency of storm events.*

Timeline for Water Resources and Fisheries Priorities



Conclusion

Water, which has always been viewed as a plentiful resource in the Northwest, is increasingly causing damage from oversupply in the winter and scarcity in the summer. In hindsight, many of our current problems with flooding and drought have been caused by humans trying to control and change the natural hydrologic system. Climate change has highlighted and accelerated the problems associated with

these past water management approaches. We still have time to adapt our water management approaches to climate change to lessen detrimental impacts, but the sooner we act, the more we can avoid costs to life, property, our environment, and our economy in the future.

Agriculture

Agriculture plays a critical role in Whatcom County's economy, history, and culture. Like other sectors of our economy, agriculture must adapt to climate change to remain economically viable and produce the food we all depend upon. Agriculture can also be a large part of the climate solution through soil carbon sequestration. Nationally, the USDA is focusing on improving soil health and building agricultural resilience that will put farmers in a stronger position as the impacts of climate change begin to mount.

As a part of our human infrastructure and an emitter of GHGs (Fig. 2.2), agriculture could have easily fit into the Built Environment Section of this report. Instead, we chose to place agriculture into this section because 1) the tremendous potential of agricultural soils to sequester carbon, and 2) the need for immediate action in agriculture to adapt to the high temperatures and drought that is already a growing problem, as demonstrated by the losses farmers suffered during the June 2021 extreme heat wave, a type of that is forecast to become more common as global temperatures rise.¹⁹⁷

Agriculture is also central to our concern with climate equity and justice, as our field crops in particular depend on intensive farm labor during the hottest summer months, and farm workers are among those most exposed to the effects of heat waves.

Agriculture in Whatcom County

In 2017 Whatcom County had 1712 farms operating on 102,000 acres.¹⁹⁸ Preserving this acreage provides the foundation for addressing the other impacts to climate change. Over a twenty-year period (1997-2017) nearly three times as much farmland was lost in Whatcom County as compared to the overall losses in western Washington. In response, Whatcom County established a goal to maintain a minimum of 100,000 acres¹⁹⁹ of agricultural land to support an economically viable industry.

Approximately 75,000 acres of farmland is used to grow crops, both food and animal feed. With this fertile Pacific Northwest farmland, Whatcom County ranks in the top 3% of farm production in the US and is home to many favorite brands.²⁰⁰ These include large and small farms producing berries, milk products, seed potatoes, tree fruit, cattle, horses, vegetables, ornamental plants, and others.

Total value of agricultural products was \$372 million, \$218 million from animal agriculture and \$154 million from crops. In addition, agriculture creates economic benefits locally due to agricultural production and consumption.²⁰¹

¹⁹⁷ *Bellingham Herald* 5 July 2021: <https://www.bellinghamherald.com/news/local/article252532053.html/>

¹⁹⁸ <https://s3.wp.wsu.edu/uploads/sites/2091/2019/08/2017AgStatsSummary.pdf>

¹⁹⁹ <https://www.whatcomcounty.us/DocumentCenter/View/3989/Land-Cover-Analysis-PDF?bidId=>

²⁰⁰ <http://choosewhatcom.com/agriculture/>

²⁰¹ All figures are from the National Census of Agriculture, 2017.

https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/1/state/WA/county/073

Several special characteristics of Whatcom County agriculture may impact our ability to adapt to climate change.

- Agricultural land here is expensive, almost tripling in value from 2002 to 2017, and growing more expensive since—often \$20,000 to 25,000 per acre with water rights. Farmland rental rates and taxes are also high. This restricts the crops that can be grown profitably.
- The majority of our agricultural products come from family-owned and operated small and medium-sized farms. In 2017, only 42 farms were larger than 500 acres; the average size was 60 and the median only 12. Farms of 10 acres or less have also more than doubled since 2002.
- About half of all agricultural land is irrigated.
- We grow a small number of crops compared to other regions: Dairy products and berries combined accounted for \$292 million, or 78% of total agricultural sales.
- Although the total number of cows has increased since 1950, the number of small dairy operations has decreased dramatically over this timeframe.
- Almost all of our agricultural products are sold as commodities and consumed elsewhere; only an estimated 3-5% of locally grown agricultural products are consumed within the county.

Concern for Climate Change in the Agricultural Community

Whatcom County farmers have a strong, often multi-generational sense of stewardship of the land and of the environment and are concerned with the immediate and observable environmental trends and changes. Farmers are also concerned about the economic and regulatory environments in which they must run their businesses.

Washington crops and livestock are being affected by climate impacts such as increasing temperatures and water stress, declining availability of water during the growing season, rising atmospheric carbon dioxide, and changing pressures from pests, weeds, and pathogens. Some impacts on agriculture may be beneficial while others may lead to losses – the consequences will be different for different cropping systems and locations.²⁰²

“Farmers have experienced a lot of extreme weather since 2011, from droughts to extreme wet, and it’s likely that’s driving some of the changes in perspectives. Of course, farmers are closer to the weather than most folks, and that extreme weather can really make it difficult to plant, raise and harvest high-quality crops.” Professor J. Arbuckle and extension sociologist at Iowa State University.

Higher temperatures will impact crop types, quantity, and quality. Warmer winter temperatures and fewer freezing days have already brought northward movement of insect pests, such as the spotted-winged fruit fly (*Drosophila suzukii*) that attacks raspberries and blueberries. Since the fruit fly appeared, farmers have had to return to the intensive spraying practices of the early 2000s. In addition, two fungal pests, *Botrytus* or gray mold and *Monilinia* or mummy berry, affect raspberries, blueberries, strawberries, wine grapes, and other crops.

Like plant pests, animal diseases migrate with changes in climate. Pigeon fever has recently affected horses here, and it or similar diseases may come to affect cattle, especially since about 250,000 livestock come into the county every year, and about 150,000 go out.²⁰³

²⁰² <https://cig.uw.edu/wp-content/uploads/sites/2/2020/12/snoveretalsok2013sec11.pdf>

²⁰⁶ Interview with Michael Anderson, DVM.

Western Washington agriculture is likely less vulnerable than the interior. Water availability, access to urban markets, and the milder climate of coastal Washington will likely make it easier for agriculture to adapt in this region.²⁰⁴ Additionally, other parts of the country may experience more extreme climate impacts, encouraging more people to move to Whatcom County, thus increasing pressure to develop agricultural lands for residential purposes. Climate change is resulting in a shift in seasonal precipitation – more precipitation in the winter and spring and less in the summer will increase pressure on an already complex and competitive water-rights regime. Water supply is a huge agricultural concern where planting schedules can be delayed by spring flooding and growing seasons often coincide with the dry season. Agricultural irrigation is the largest user of water in the county (44%), and irrigation peaks in August when streamflows are low.²⁰⁵ With decreasing snowpack, more winter precipitation will flow into streams and rivers when fields are fallow or crops do not need to be irrigated, and less water will be available during the summer irrigation season.

Summer water shortages are likely to become much more common. In dry years, the County’s irrigation water use typically increases approximately 25%. As precipitation patterns change, demand for irrigation water will increase at the same time the supply decreases. Conditions like those during the 2015 and 2018 droughts or the 2021 heat wave — when crops failed and pastures went dry because of inadequate water — are likely to become more common.

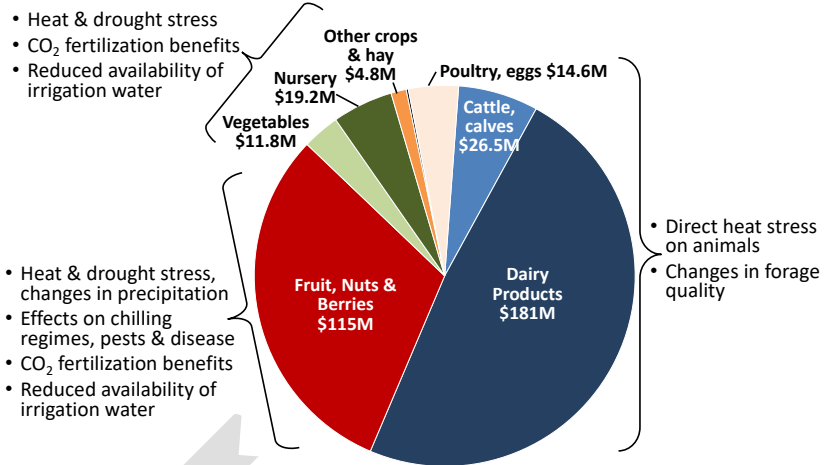


Figure 3.9: Impact of climate change on farm products in Whatcom County using values from the latest census data (2017). Total market value was \$373 million.

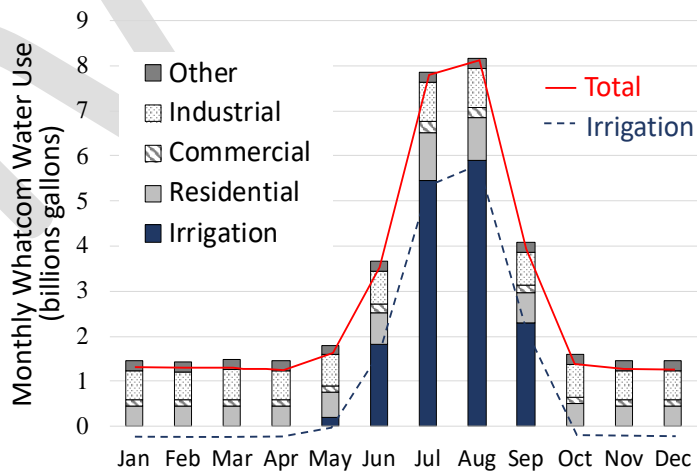


Figure 3.10: Example of monthly water use in Whatcom County (from Hirst, E. “Analysis of Whatcom County Water Use,” January 2017: https://nwcitizen.com/images/fileuploads/Analysis_of_Whatcom_County_Water_Use.pdf).

²⁰⁴ <https://cig.uw.edu/wp-content/uploads/sites/2/2020/12/snoveretalsok2013sec11.pdf>

²⁰⁵ See the UW Climate Impacts Group SWE [Trend Analysis Tool](#) for trends in the last 160 years. For projections, see the [Regional Climate Projections Tool](#) on the same website.

It's important to note that as winter precipitation increases and more of it falls as rain rather than snow, lagoons, and tanks where dairy manure is stored during the winter may reach their maximum capacity, forcing farmers to cut their herds or increase storage capacity.

Farmers will also face increased competition, particularly for water from the transnational Abbotsford-Sumas aquifer. Aquifer recharge is highly dependent on climate variables and this shallow, unconfined aquifer impacts river and stream flows and aquatic life as well. Currently, groundwater supplies about 80% of the agricultural irrigation needs in the summer. The Abbotsford-Sumas aquifer is highly productive and provides water supply for nearly 10,000 people in the US (towns of Sumas, Lynden, and farmlands) and 100,000 in Canada, mostly in the City of Abbotsford, but also in the township of Langley.²⁰⁶ With drier summers and increased use, this shallow aquifer may no longer be adequate to meet water demands sustainably.

Already, many streams in the Nooksack River watershed are over-appropriated, and many farms lack adequate water rights, meaning they may not be allowed to use surface or shallow ground water sources for irrigation when streamflows are low. Water rights, already a contentious issue, may become even more so, making a just and equitable solution to water allocation the single most vital imperative for climate change adaptation.

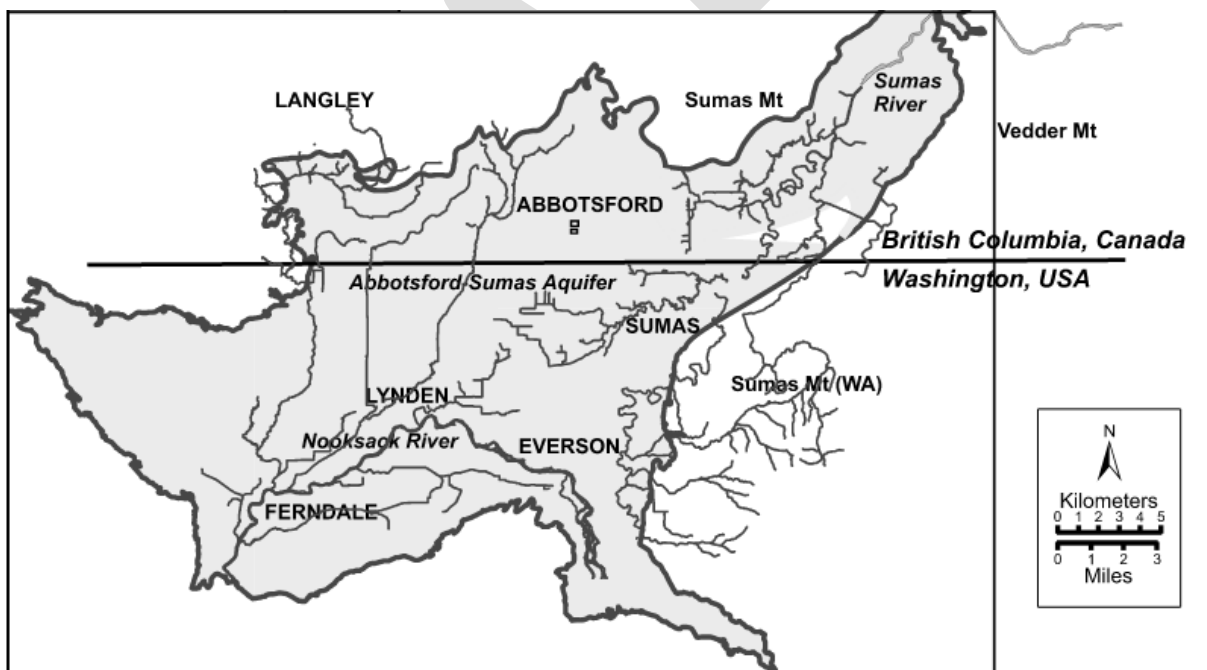


Figure 3.11: Aerial extent of the shallow, unconfined Abbotsford-Sumas aquifer in southwestern British Columbia and northwestern Washington State.

Finally, our local agricultural economy depends on farmworkers, particularly in the summer season. Because farm laborers are among our most vulnerable populations, mitigating climate change becomes an imperative of environmental justice. Although heat stress is now a problem only on the hottest days, if temperatures continue to rise there may be more days like those of late June 2021, when field

²⁰⁶https://www.researchgate.net/figure/Recharge-zones-for-the-Abbotsford-Sumas-Aquifer-The-recharge-model-was-run-for-each-of_fig6_253490522

workers are exposed to dangerously hot conditions. Additionally, smoke from more frequent wildfires²⁰⁷ in increasingly hot and dry summers also a more serious threat, exposing farm workers to dangerous levels of particulate matter, especially on the hottest days. Any actions we can take to mitigate temperature increase in the coming decades will redound to the benefit of these crucial participants in our agricultural community.

Climate Goal and Strategies for Agriculture

Farmers are more likely to support new farming approaches to increase climate resilience if they are economically feasible and address their more immediate concerns of water availability, loss of topsoil and soil productivity, and loss of crops from disease, pests, and extreme weather events.

It will require both mitigation and adaptation strategies to maintain a viable agriculture economy and livelihoods in the County under a changing climate. Several specific and feasible strategies for addressing the problems outlined above are discussed below and detailed in the strategies, actions, and benefits table in the Appendix.

Goal: Employ farm management practices that create climate resilience while at the same time reducing operational costs in agriculture and ensure a viable long-term food supply.

Climate Strategies for Agriculture

1. Adopt farm management practices that maximize soil carbon storage and increase water and nutrient availability.
2. Avoid the conversion of agricultural lands to maintain farm production at a level that sustains a vibrant and climate-resilient agricultural economy.
3. Enlist the agricultural community in preserving and enhancing water storage and stream-flow levels that enable salmon migration, healthy ecosystems, and agricultural irrigation.
4. Reduce agriculture-related emissions and increase renewable energy, while providing farmers with new income opportunities.
5. Strengthen agricultural diversity to expand the eat local market and increase farm incomes.
6. Encourage increases in research and development of drought- and heat-resistant agricultural crops at the state and federal levels and flexible infrastructure to support diversified crops.

Strategy 1: Adopt Farm Management Practices that Maximize Soil Carbon Storage and Increase Water and Nutrient Availability

Agriculture can play a very important role in reversing many of the detrimental impacts of climate change while at the same time reducing the high operational costs associated with modern industrial farming. Modern industrial farming has led to a tremendous increase in food production, but has also led to high operational costs, low profit margins for farmers, and in some cases, unintentional environmental damage. Climate change is further complicating farming practices, and in many areas of the country, rendering these practices unsustainable.

²⁰⁷ EPA, Change in Annual Burned Acreage by State, 1984-2001 and 2002-2020 <https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires>

NASA satellite imagery has shown that concentrations of CO₂ increase in April and peak in May across the US. This is attributed both to soils warming and the practice of agricultural tillage. The release of CO₂ to the atmosphere is reduced and carbon storage in soils is enhanced by no-till or low-till farming methods.

Farmers have long known that off-season cover crops can increase soil carbon storage and important soil nutrients like nitrogen, while at the same time prevent soil erosion. Farmlands across the US could absorb 276 million tons of atmospheric CO₂ every year or about 5% of annual emissions according to a National Academy of Sciences report.²⁰⁸

Managing for soil health is one of the best ways farmers can increase crop productivity while preparing for stresses on crop growth due to climate change. Extreme weather events, such as extended drought and heavy precipitation, are out of landowners' and growers' control; but through effective soil health management systems they can better manage how they prepare for and react to these circumstances.

Results are often realized immediately and last well into the future.

No-till and cover crops can help stabilize yields, improve agricultural productivity, and build resiliency through increased soil organic carbon content and soil water storage.²⁰⁹ Four basic principles improve the health of soil and can facilitate agricultural resilience: minimize disturbance, maximize soil cover, maximize biodiversity, and maximize presence of living roots.²¹⁰

- Healthy soil allows more water to infiltrate and retains more moisture, enabling it to effectively absorb extreme rainfall as well as support crops during droughts.
- Adopting soil health systems before extreme events hit can save farmers significant time and money in the long run and preserve the vitality of their soils for many years to come.
- Employing soil health systems by using practices such as no-till and cover crops, can help stabilize yields, improve agricultural productivity, and build resiliency through increased soil organic carbon content and soil water storage.
- These practices also benefit the environment, reducing nutrients lost through run-off, replenishing aquifers, and also acting as a natural filter for our waterways.

Additionally, the soil additive biochar acts as a sponge for water and nutrients making them available for plant growth and soil microorganisms. Biochar is essentially charcoal and is formed from a process called pyrolysis, where organic matter is burned under low oxygen conditions. The US Biochar Initiative supports increasing the rate of natural carbon sequestration and reducing emissions of greenhouse gases remains critical. Biochar technology can do both.

²⁰⁸ National Academies of Sciences, Engineering, and Medicine 2019. *Negative Emissions Technologies and Reliable Sequestration: A Research Agenda*. Washington, DC: The National Academies Press.
<https://doi.org/10.17226/25259>.

²⁰⁹ <https://soilhealthinstitute.org/how-does-soil-health-increase-resilience-to-droughts-and-extreme-rainfall/>

²¹⁰ https://www.nrcs.usda.gov/wps/PA_NRCSCconsumption/download?cid=nrcseprd1386665&ext=pdf

The conclusion of the recent documentary, *Kiss the Ground*²¹¹, proposes that by regenerating the world's soils, humans can rapidly stabilize Earth's climate, restore lost ecosystems, and create abundant food supplies by exploring the possibilities of regenerative farming. Climate adaptation can be rooted in taking better care of our soils and drawing down carbon from our atmosphere by rebuilding our soils, practicing integrated pest management, nutrient and fertilizer management, and conservation agriculture. The Whatcom Conservation District provides critical support for local farmers interested in increasing their soil health; however, demand for support and services exceeds the District's capacity.

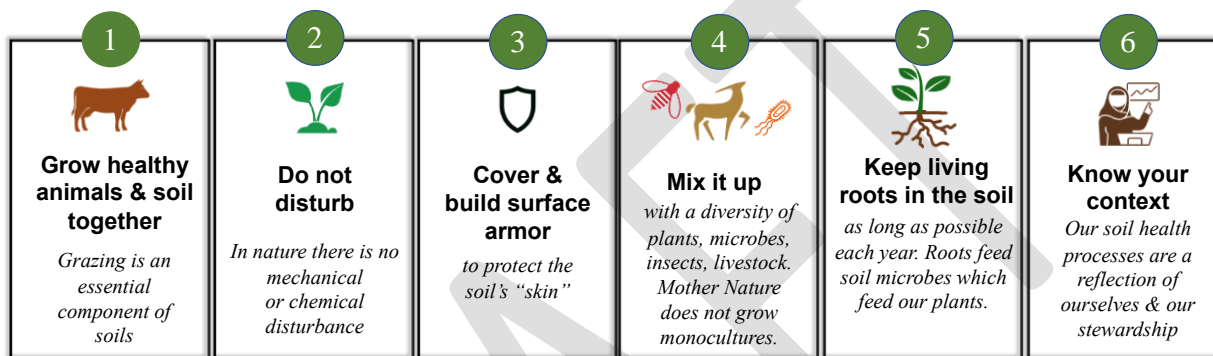


Figure 3.12: The six principles of soil health from the Soil Health Academy. <https://soilhealthacademy.org/fact-sheets/>

Increasing soil organic matter has the added benefit of absorbing large amounts of water, which creates more soil moisture retention and availability for crops. The 2018 farm bill included a Soil Health Demonstration Trial whose participants will follow certain soil health assessment protocols to enable further research and encourage widespread adoption of practices. In addition, the bill includes enhancements to the Conservation Stewardship Program for agricultural producers to improve soil health.²¹²

The USDA is ramping up the Conservation Reserve Program to have higher rental payments and expanding the number of incentivized environmental practices allowed with a more targeted focus on climate change.²¹³ Farmers enrolled in this program receive a yearly payment to preserve environmentally sensitive areas that are difficult to cultivate, such as wetlands, from agricultural production.

Changing farm practices to promote soil health is a long-term investment and an excellent first step in creating greater climate resilience in our agricultural economy. Whatcom County can help farmers initiate this transition by sponsoring local workshops on soil health developed by organizations like the

²¹¹ <https://kisstheground.com/>

²¹² <https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2019/08/23/soil-health-can-combat-climate-change-from-the-ground-up>

²¹³ Expansion and Renewal of Conservation Reserve Program, <https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index>

Soil Health Academy.²¹⁴ This series of workshops could be sponsored with the WSU Extension, Whatcom Conservation District, Sustainable Connections, and the local regenerative farm, Inspiration Farm.

A common solution that occurs throughout this section on the Natural Environment is the need for a carbon marketplace to reward farmers, foresters, and other landowners for their efforts to increase carbon storage. An example of a carbon marketplace could be as simple as establishing a monetary value on carbon sequestration that would allow landowners to sell carbon credits to companies that want to offset their carbon emissions. This in turn incentivizes landowners to increase the carbon storage potential of their lands. Carbon markets offer an opportunity to improve soil health and moisture and bolster rural economies.

"If you can get something green on the ground year-round, you're feeding the microbes in the soil and it's a lot healthier. And if somebody wants to pay you to do that, it looks to me like you're foolish not to do it." Ohio farmer, Rick Clifton, grows cover crops year-round & is paid ~\$35,000 per year to store soil carbon by Indigo Agriculture.

Key priorities for carbon sequestration and water protection

- **Promote regenerative farming practices to increase soil carbon storage**
- **Form a carbon marketplace to provide carbon offsets and reward landowners**

Strategy 2: Avoid the conversion of agricultural lands to maintain farm production at a level that sustains a vibrant and climate-resilient agricultural economy

If predictions of up to three feet of sea level rise by 2100²¹⁵ are accurate, Whatcom County faces the loss of up to 5,000 acres of farmland in coastal areas,²¹⁶ particularly around Ferndale. Another concern, as sea level rises, is saltwater intrusion into groundwater and/or soil salinization in low-lying areas. Flood risk associated with storm surge will further exacerbate the problem.

In addition to climate change, population growth will continue to exert pressure to convert agricultural lands to other purposes. Agricultural land here is expensive, almost tripling in value from 2002 to 2017, and growing more expensive since—often \$20,000 to 25,000 per acre with water rights. These high land costs discourage a new generation of farmers and often persuade older farmers to convert and sell portions of their land for development in order to fund their retirement. Loss of agricultural lands occurred over the last twenty years when the County allowed the proliferation of 5-acre *ranchette* developments. High agricultural land prices have also increased the potential transition of family farms into corporate farming.

Rapid residential development of former agricultural and forest lands threatens the viability of agriculture and continues to highlight the urgent need for greater protection of farmland at a time when climate change also threatens the viability of some forms of agriculture. We should strive to maintain the minimum of 100,000 acres of agricultural land as mandated by the County Council in 2009.

²¹⁴ <https://soilhealthacademy.org/>

²¹⁵ [According to IPCC](#), depending on the amount of global temperature change, sea level is projected to rise from 26 to 98mm (10 to 38 inches).

²¹⁶ Interview with Chris Elder, Sr. Planner: Watersheds, Whatcom County, 23 May 2019.

Whatcom County currently has slightly more than 87,000 acres zoned as agricultural, plus over 28,000 acres of rural-zoned (R5 and R10) lands that contain many working farms on prime agricultural soils. The Agriculture Advisory Committee recommends that these identified Rural Study Areas receive additional protection, from development and fragmentation, through 1) reducing development in R5 and R10 rural-zoned areas, 2) reducing conversion and fragmentation of farmland, 3) preserving agricultural neighborhoods. and 4) protecting open space from fragmentation.

The Purchase of Development Rights Program²¹⁷(PDR) and the Open Space Farm and Agriculture Current Use Assessment²¹⁸ program can be used. However, many farmers consider the compensation provided by the PDR program to be inadequate, as it comes nowhere near the value of the development rights on the open market. To be effective, the PDR program will need to be funded at a higher level, both to enable more land to be protected and to incentivize landowners to sell their development rights.

The updated 2019 Washington State Farmland Preservation Indicators Report²¹⁹ documents efforts to preserve agricultural land. Conservation Futures²²⁰ is a county tax levy program provided for in RCW 84.34.230 that protects, preserves, maintains, improves, restores, and limits the future use of threatened areas of open space, timberlands, wetlands, habitat areas, culturally significant sites, and agricultural farmlands. The funds for Conservation Futures are acquired through a property levy and are used to purchase rights or interests in real property for counties to preserve lands of public interest for future generations. In 2020, Whatcom County collected \$1,148,380 from this fund to support the PDR program.²²¹

Because of the high cost of farmland, it is very difficult for new farmers to acquire the land needed to get started. Incentives to sell and subsidization of new farm purchases through low-interest loans would contribute to preserving agricultural land.

Key priorities for land conversion

- ***Expand PDR program and re-evaluate compensation levels***
- ***Re-zone rural study areas to preserve and increase total farm acreage***
- ***Adopt innovative financial mechanisms that would facilitate entry for new farmers***

Strategy 3. Enlist the agricultural community in preserving and enhancing water storage and stream-flow levels that enable salmon migration, healthy ecosystems, and agricultural irrigation

For agriculture, we need to address both inadequate summer supplies and competition among different users. Since negotiated settlements have failed in the past, the joint processes of negotiation and

²¹⁷ <https://www.whatcomcounty.us/573/Purchase-of-Development-Rights-Oversight>

²¹⁸ <https://www.whatcomcounty.us/1160/Open-Space-Program>

²¹⁹ [2019 Washington State Farmland Preservation Indicators Report \(PDF\)](#)

²²⁰ <https://app.leg.wa.gov/rcw/default.aspx?cite=84.34.240>

²²¹ https://uploads-ssl.webflow.com/5faf8a950cdaa224e61edad9/6070c2b0676da848f07246c0_2020%20OFP%20Conservation%20Futures%20Report.pdf

adjudication of water rights will most likely resolve the issue of water equity among the various users. Clarification of water rights must also recognize the future challenges brought about by climate change.

Several specific reforms to the current state water law could address summertime shortages and maldistribution, making local agriculture more resilient to increasingly severe shortages in the future. For example, the current “use it or lose it” relinquishment provision²²² discourages water augmentation and water trading approaches. The County should also explore and possibly pilot water trading mechanisms including leasing, sales, banking and trading and innovative approaches to metering water.

None of these reforms would eliminate competition over water. However, greater flexibility in water allocation could improve the ability of competing interests to negotiate creatively and reach mutually acceptable solutions. Because it is inevitable that conflicts will arise, such conflicts must be addressed by a process that includes fair representation of all stakeholders.

Restoring salmon habitat also restores the health our watershed. The watersheds provide clean drinking water, flood protection, waste assimilation, aesthetic and recreational benefits and other ecosystem services. As these services are lost, benefits are reduced and costs to residents increase. As the watershed is restored to health, our quality of life rises and the costs of watershed degradation decline. Sufficient funding mechanisms for salmon habitat would enable operating capacity and enable capital projects as well as provide matching funds for grants to leverage the work. Money spent in the watershed provides jobs and economic development.²²³

Salmon-safe²²⁴ offers a peer-reviewed certification and accreditation program to implement farming practices that protect water quality, maintain watershed health, and restore habitat. As a leading U.S. ecolabel, Salmon-Safe offers peer-reviewed certification, linking site development and land management practices with the protection of agricultural and urban watersheds. Their mission is to transform land management practices so Pacific salmon can thrive in West Coast watersheds. Currently, 95,000 acres of farm and urban lands in Oregon, Washington, B.C. and California are certified through their program.

The Nooksack Basin Salmon Recovery Program²²⁵ does a tremendous job in educating the community and restoring healthy rivers and marine shorelines. The County should support and continue to collaborate with these non-profit organizations to engage actively with local landowners, businesses, and the larger community. Recent efforts to restore anadromous fish passage with culvert removals and diversion dam removal on the Middle Fork Nooksack and efforts by the Floodplain Integrated Planning (FLIP)²²⁶ are working to integrate actions with multiple stakeholders that address flooding, salmon needs, and land use.

²²² See WSU, Landowner’s Guide to Washington Water Rights, page 7:

https://s3.wp.wsu.edu/uploads/sites/2073/2014/09/landownerguide_waterrights.pdf

²²³ <https://www.govlink.org/watersheds/9/committees/archive/1005/WRIA9-FundingMechanism-PolicyBrief2-FundingNeed.pdf>

²²⁴ <https://salmonsafe.org/about/>

²²⁵ <https://salmonwria1.org/>

²²⁶ <https://whatcomcounty.us/2971/FLIP-Reports>

Where feasible, the agricultural community should employ drainage management, such as adjustable weirs, to increase storage early in the growing season and promote subirrigation of crops. Advanced wastewater treatment and manure treatment approaches can also be employed to allow water reuse. Finally, employing modern irrigation and efficiency technologies can greatly increase conservation of freshwater resources.

Key priorities for ensuring adequate water for agriculture and fish habitat

- ***Use collaborative demonstration projects to collect the information needed to seek greater flexibility in our current water law.***
- ***Implement irrigation modernization and efficiency technologies to reduce water use.***

Strategy 4: Reduce Agriculture-Related Emissions and Increase Renewable Energy, while Providing Farmers with New Income Opportunities

Agriculture is responsible for about 6% of the County’s GHG emissions - from machinery, transportation, agricultural chemical manufacturing, and energy use, along with methane emissions from animal agriculture.²²⁷ There are measures that can reduce agricultures emissions and environmental effects while also maintaining “critical mass” and enhancing farmers’ income.

Nutrient (i.e. manure) treatment systems can reduce agricultural greenhouse gas emissions as well as alleviate the problems of poor distribution of water. Manure gives off methane, a potent greenhouse gas. Anaerobic digesters draw off the methane, which can be burned on site to produce electric power and release carbon dioxide, a much less potent greenhouse gas. Liquid residues still contain bioactive nitrogen and can be used as fertilizer, and solid residues can be used as bedding for cows, for mulch, or other uses. Other agricultural residues such as food processing waste can also be used in the digester, increasing its power output and making the investment more attractive to the dairy farmer.²²⁸ Digesters can also lessen the problem of manure storage in the wintertime, which can contaminate waterways.

At present, however, anaerobic digesters are affordable only with cost-share for construction or subsidized prices for the electricity generated, because electricity prices are much lower in the Pacific Northwest with its large amounts of hydropower. Although farmers who installed digesters between 2010 and 2012 sell electricity at contract prices high enough to pay back construction costs, now new or renewed contracts offer prices so low that digesters are no longer economical for farmers. Hence there have been only five digesters built in the county, four of them now operating.

Rather than burning digester methane on site, it can be sold to natural gas suppliers and help make the digester technology affordable. These systems are in place in Oregon, California, and British Columbia, and could be tried here if the price structure were attractive to farmers. Methane from digesters is considered renewable methane similar to the methane derived from landfills. The new CETA law that will increase the amount of renewable energy used to generate electricity by utilities may very well increase the contract price of renewable methane. As discussed in [Electricity and Buildings](#), many

²²⁷ US Environmental Protection Agency, [Sources of Greenhouse Gas Emissions](#), 2018; IPCC, “Climate Change and Land,” 2019, p. 9.

utilities like PSE are purchasing renewable methane from large landfills to offset their current use of fossil fuels.

Other nutrient management technologies can potentially address both climate change and other environmental issues: one of these is an innovative, three-stage processing system recently installed at Coldstream Farms near Deming. The end product is clean water that can be returned to a stream. Such systems, however, are expensive to operate, suggesting that the County should incentivize installation and support research into lower-cost operation.

Petrochemical fertilizers and pesticides use fossil carbon both as feedstock and as fuel, so reducing their use can reduce carbon emissions of agricultural operations and increase farm incomes. In addition, farmers have long known that petrochemical fertilizers can harm soil quality, so reduced use of chemicals can contribute to the improvement of soil quality as discussed in strategy 1.

Farms also have land and roof tops that can be used for wind and/or solar power. When paired with battery storage, farms can meet their own electricity needs when averaged over a year and may be able to sell excess renewable electricity as they do with power generated by burning methane from digestion. Starting in the late 1800's, farmers used windmills to pump water or grind grain. This practice largely ended with the Rural Electrification Act of 1936. Throughout the country farmers are enhancing their income by leasing land for windmills. Ninety-five percent of the land around wind turbines can continue to be farmed. The added income farmers receive from developers or utility companies can offset periods of low commodity prices, tariffs, or crop damage from droughts, floods, and pests.

Key priorities for emissions reduction

- **Reduce emissions associated with fertilizer by incentivizing manure management systems**
- **Support renewable energy projects in agriculture to reduce emissions and generate farm income**

Strategy 5. Strengthen Agricultural Diversity to Expand the Eat Local Market and Increase Farm Incomes

The trend in eating local will not only reduce transportation emissions but is also another way to increase farm incomes. Our focus on a few monoculture crops increases Whatcom County agriculture's vulnerability to climate change and other environmental disturbances, but also to changes in markets. Almost all the food we produce goes to distant markets, and almost all the food we consume is produced elsewhere. This makes us dependent on markets as well as increasing fuel consumption.



Figure 3.13: Coldstream Dairy Farm has installed a three-stage processing system to manage dairy manure and produce water clean enough to be returned to nearby streams.

Reducing this dependence by developing a more diversified local food system would improve climate resilience and support local markets and new income streams for farmers.

Most local dairy farmers receive a nationally set price for their milk, which in recent years has been low enough to cause them hardship, or even induce them to sell out. Independent producer-handlers who sell specialty products locally, often at premium prices, should be encouraged, perhaps through tax breaks or assistance with marketing. Sustainable Connections²²⁹ has a strong collective marketing campaign that supports local food and the businesses that sell it.

Connections between local food producers and consumers, particularly through direct sales, already happen at farmers markets and dockside fish sales, but most large grocery stores sell very few local foods. In specialty markets, consumers will pay more for organic products, and local markets might accommodate most, or all of the *organic* berries grown in the county. Expanding the farm-to-school program²³⁰ in which local schools buy directly from farmers provides children with more healthy alternatives.

Promoting local food systems would facilitate the entry of small-scale farmers. The prosperity of farming depends in part on a trained workforce and access to land. Farm internship programs are gaining popularity.²³¹ As our farming workforce ages, the County should consider programs that provide access to small amounts of land for intensive, diversified vegetable, fruit, grain, and livestock farming. Additionally, farm transition planning is available for families who want to keep their farmland in production or in the family from generation to generation.²³² Washington FarmLink²³³, a program of Tilth Alliance, connects aspiring and experienced farmers to landowners, ensuring that land remains in agricultural production. Sustainable Connections has its Food and Farming initiative²³⁴ which advocates for and strengthens our local food economy and runs a farmer incubator program. Cloud Mountain Farm Center²³⁵ is a nonprofit working farm committed to agricultural education.

The County should adopt a funding mechanism that supports the Whatcom Conservation District's efforts to ensure a sustainable agricultural economy. Currently the Conservation District receives 100% of its funding from grants and contracts. Historically, funding has come from the State legislature through the State Conservation Commission, but this has been declining. Our local Conservation District could do much more to increase soil carbon storage and help local farmers adapt to climate change if they had a guaranteed base of support. [RCW 89.08.405](#) authorizes the County to approve revenues for the Conservation District to support Council priorities, such as those outlined in this CAP. The County

²²⁹ <https://eatlocalfirst.org/elf-for-biz/>

²³⁰ <https://www.whatcomfarmtoschool.org/>

²³¹ https://uploads-ssl.webflow.com/5ec2d4f7da309c68cdc0655a/5f3ffbb650595cedb5952a67_FINAL-Indicator-Fact-Sheet-EO.pdf

²³² <https://www.scc.wa.gov/ofp/transition-planning>

²³³ <http://wafarmlink.org/>

²³⁴ <https://sustainableconnections.org/programs/food-farming/>

²³⁵ <https://www.cloudmountainfarmcenter.org/education/>

Council can approve by resolution an additional annual property rate that may not exceed 10 cents per acre with the maximum annual per parcel rate not exceeding \$5.²³⁶

Key priority for expanding local markets:

- *Diversify our local agricultural crops to increase climate resilience in our food system, enable eat local options, and increase farm incomes.*

Strategy 6: Encourage Increases in Research and Development of Drought- and Heat-Resistant Agricultural Crops at the state and federal level and Flexible Infrastructure to Support these Crops

The small number of crops currently grown in Whatcom County²³⁷ renders our agricultural economy especially vulnerable to major changes in temperature and precipitation. Providing that water is available, warmer temperatures may facilitate growing new crops, but they may also challenge the viability of currently planted varieties. With decreasing water availability, however, it may be necessary to look for varieties that are more drought-tolerant or heat-tolerant, or even to switch to different crops. In addition, our major crops require specialized infrastructure to produce and process, making it more difficult for farmers to switch crops if this becomes necessary.

Currently, adequate infrastructure exists for berries, seed potatoes, and dairy products, but not for other potential crops. If agronomic and market research indicate that other crops would do well here, especially under anticipated future climate conditions, the County should consider facilitating infrastructure construction and equipment purchase, through loan guarantees, assisting farmers and businesses in obtaining grants and cost-share funding, and develop other ways to make purchase of necessary infrastructure more affordable for farmers. Food processors headquartered in British Columbia and Eastern Washington have recently shown interest in establishing operations here, something the County should encourage.

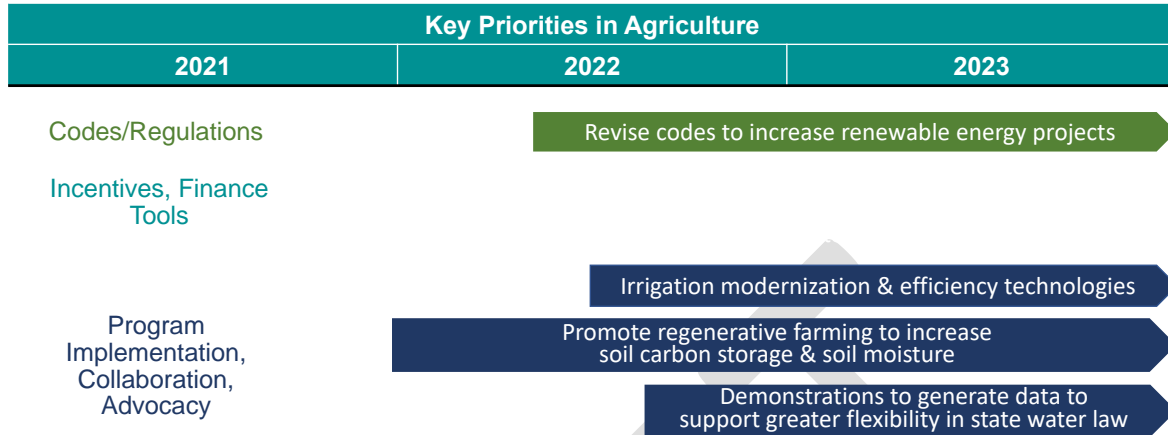
Key priority for local food system

- *Prioritize development of flexible food processing facilities*

²³⁶ <https://app.leg.wa.gov/rcw/default.aspx?cite=89.08.405>

²³⁷ See 2017 Census of Agriculture
https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/1/state/WA/county/057

Timeline for Agricultural Priorities



Conclusion

Farming and forestry practices can support the County’s efforts in removing greenhouse gases from the atmosphere. Agricultural soils are potentially a large carbon sink and through management of soil health, can be a large part of the climate solution. Climate adaptation strategies in this sector are significant for improving food security and agricultural resilience as well, because many of them contribute to a more robust and inclusive food system, better able to withstand climate impacts.²³⁸

To achieve the ambitious but imperative goals outlined here, we must promote continued collaboration among federal, tribal, state, and local government agencies, conservation and water districts, universities and research organizations, representatives of the farming industry, farm worker social justice organizations, and most importantly, farmers. This will require leadership from the County Council and agencies of the county government, which need to be proactive in promoting innovative, resilient, and adaptive agriculture.

²³⁸ <https://drawdown.org/sectors/food-agriculture-land-use>

Forestry

Forested land accounts for the majority of the natural land cover encompassing over 60% of the county. If managed well, these forests can substantially contribute to carbon mitigation and climate adaptation. Climate disruption is the most important threat to the survival of forests and their viability as a carbon sink. Increasing temperatures, prolonged drought, and extreme weather events – all associated with our changing climate - are leading to larger and more destructive wildfires, flooding, landslides, and pest outbreaks. Forests also play an important role in climate resilience contributing to biodiversity, natural water filtration and storage, and removal of pollutants from the air. It is clear that climate disruption poses not only a threat to forest resources and their environmental benefits, but also to human habitation.

Forest lands contribute to Whatcom's economy, supporting our forest industry, as well as providing extensive educational and recreational opportunities and the jobs that support these sectors. Climate disruption is complicating the future viability of these important economic sectors. Higher overall temperatures and lower soil moisture impacts tree survival during summer months and have already caused a decline in western red cedar and western hemlock.²³⁹ Tree survivability can especially be a problem when reforesting steep south- and west-facing slopes that tend to be hotter and drier.



Adopted from Whatcom Conservation District

Figure 3.14: Drier fuels and forests from changing climate conditions

Further, increased year-round temperatures allow for many invasive species to survive and damage the forest ecosystem. With warmer winters, invasive species whose population numbers and range were previously limited by extended cold temperatures are now able to survive and spread. A notable example of this is the western pine beetle, whose populations in the past were severely reduced each winter is now able to survive mild winter temperatures and cause more extensive damage in Northwest forests. Invasive species, both floral and faunal, may damage the local ecosystem by killing or outcompeting native tree species. In addition, some common invasive species such as Scotch broom and Himalayan blackberry are highly flammable and increase the risk of wildfire spread.

Forests in Whatcom County exist within a variety of jurisdictions and ownerships. Roughly two thirds of Whatcom County forests are located on federal lands including North Cascades National Park and Mount Baker-Snoqualmie National Forest. Non-Federal forestland within Whatcom County is managed or owned by the Washington Department of Natural Resources (DNR), large timber companies, and

²³⁹ Hot, dry weather killing Washington trees, <https://www.king5.com/article/tech/science/environment/hot-dry-weather-killing-washington-trees/281-586640386>. Numerous news organizations have reported on this topic over the last few years.

small acreage landowners. The Lummi Nation manages its forests under the auspices of the Bureau of Indian Affairs.

Goal and Strategies for Forestry

The goal and strategies identified below support the overarching natural resource goal of mitigating emissions, while promoting adaptation and improving forest ecosystem resilience to climate change. These strategies encompass changes that could be made to current forestry practices and additional practices that could improve the sustainability of Whatcom County's forest resources in the future. Many strategies in forestry are also applicable or relevant to other topics in the natural resources section, particularly land use, water resources and ecosystems.

Goal: Ensure a long-term equitable and resilient forest resource in the county by acknowledging, educating, and preserving the benefits from current forest management practices and addressing the impacts of climate change on forest health and adapting forest management practices to this new reality.

Forestry Strategies

1. Protect and enhance carbon storage and sequestration in forest ecosystems
2. Increase forest health, survival and climate resilience through forest management practices that reduce wildfire risk, increase soil moisture, and stream flows, and preserve wildlife habitat
3. Promote climate resilient planning and programs to maintain our forest economy for recreation and wood products through leadership, education, and successful programs.

Strategy 1: Protect and Enhance Carbon Storage and Sequestration in Forest Ecosystems

Whatcom County was part of a pilot study for the Local Governments for Sustainability to develop and test a protocol for estimating the amount of carbon that is removed from the atmosphere through photosynthesis and stored by forests. This protocol is now part of the ClearPath model for GHG assessments. Using data from early 2000 – 2010, the study established a baseline that indicated Whatcom forests are removing about four million metric tons of CO₂e every year, or about half of Whatcom's total emissions in 2017. In addition, Whatcom forests store about 400 million tons of carbon dioxide in total. The county cannot afford to lose this important carbon mitigation resource to wildfires, drought, or disease. Although this forest protocol was not evaluated in the 2017 GHG assessment, it should be included in future county-wide GHG assessments.

The trend in forest carbon storage and sequestration over time might indicate conversions in land use or disturbances such as logging and wildfires. This new ClearPath protocol for forests is definitely a step forward, providing information on the value of our forests; however, it is also important to understand the value of the carbon storage potential for different forest and non-forest ecosystems. For example, wetlands that exist within and outside forests are known to store large quantities of carbon. Carbon storage can vary with soil and vegetation type, so identifying and protecting those lands with a high potential for carbon storage should be a priority.

Another approach that should be considered is the value of setting up a county carbon market or carbon trading to offset GHG emissions. A carbon market establishes a monetary value on carbon sequestration

that would allow landowners to sell carbon credits to companies that want to offset their emissions. For example, under the Climate Commitment Act, carbon offsets can be used for compliance up to limits specified in the legislation. This new source of revenue would incentivize landowners to increase the carbon storage potential through forest management processes like thinning to increase growth rates or extending the rotation age of a forest stand before harvesting. In short, carbon markets offer an opportunity to protect county forests from conversion, encourage more sustainable forest practices and bolster rural economies.²⁴⁰

Key Priorities for Carbon Sequestration and Storage:

- *Identify and preserve the most important forest resource lands based on carbon storage and sequestration potential through i) expanded purchase of forestry conservation easements through Purchase of Development Rights program to rapidly retire development rights where pressure of conversion is greatest, and ii) rezone Rural Forestry to Commercial Forestry to remove development potential.*
- *Establish values and trends in forest carbon sequestration and storage over time using the ClearPath GHG assessment protocol.*
- *Fund a study to evaluate the potential of setting up a carbon market in the county to encourage and reward forest landowners for enhancing carbon storage and sequestration.*

Strategy 2: Increase Forest Health, Survival and Climate Resilience Through Forest Management Practices that Reduce Wildfire Risk, Increase Soil Moisture, and Stream Flows, and Preserve Wildlife Habitat.

Healthy forests are stable, sustainable, and resilient to stress, but most importantly, vital to our future.²⁴¹ Forests provide large quantities of clean water, prevent soil erosion, and provide habitat for a diversity of plants and animals. Defining forest health however is difficult since it is so dependent on location. An ecologist may define the health of forests as those ecosystems that are able to maintain their organization such as species diversity and autonomy over time.²⁴² A utilitarian may define forest health as to the average diameter and height of the trees based on age and species. The US Forest Service's program on Forest Health Monitoring uses a combination of both definitions.

There are 212 permanent forest inventory plots in Whatcom County for monitoring forest health, but only about half of these sample plots have been measured twice since 2002.²⁴³ The county should

²⁴⁰ Whatcom Forests Provide Resilience Amidst Changing Climate, by Elyn Murphy and Chris Elder. Whatcom Watch, March 2020. <https://whatcomwatch.org/?s=Whatcom+Forests>

²⁴¹ Forest Health Monitoring: National Status, Trends, and Analysis 2020, draft report by Kevin Potter and Barbara Conkling. USDA US Forest Service Forest Health Monitoring Program. https://www.fs.fed.us/foresthealth/publications/FHM_2020_SRS_draft_national_technical_report.pdf.

²⁴² Toward an operational definition of ecosystem health. In: Costanza, R.; Norton, B.G.; Haskell, B.D., eds. Ecosystem health: new goals for environmental management. Washington, DC: Island Press: 239–256.

²⁴³ Community Research Project, Chapter 7 by Elyn Murphy, 2019. <https://whatcomcounty.us/3162/Meetings-Additional-Information>.

partner with the various conservation organizations to provide more frequent evaluation of sample plots as they relate to forest health. Wetland areas within forest tracts are especially important to wildlife, as well as the overall health of the ecosystem and have large carbon storage potential. Maintaining mature forest cover for these areas is important and may also involve increasing no harvest buffers along perennial and non-perennial streams.

Reforestation and afforestation are challenging under a changing climate. The challenge is to plant a tree today that can withstand the higher temperatures, lower soil moisture, and more frequent wildfires over the next sixty-plus years. Several agencies such as the Washington DNR, Native American tribes and the USFS have initiated progressive programs to confront the risk of climate disruption. These programs are an excellent start but have not always resulted in actual changes in forest management practices, especially for commercial and rural forest landowners.

Wildland fires are a serious and growing hazard threatening life, property, while releasing large quantities of GHGs. Severe wildfires also reduce soil moisture retention by removing organic matter and in some cases volatilizing compounds that can form a water-repellent layer on the soil.²⁴⁴ Milder winter temperatures and more rainfall in the winter and early spring creates a buildup of ground vegetation. During summer droughts this vegetation dries out, becoming fuel for wildfires, and creating conditions more conducive to wildfire spread. Low intensity fires are now widely recognized as a natural process that reduces understory vegetation and facilitated reforestation; the County should explore the judicious use of prescribed burns to counteract the buildup of fuel and excessive density of trees.

With population growth in Whatcom County a significant number of homes and businesses have been built in wildland-urban interfaces (WUIs) – the area where structures and other human development meets or intermingles with undeveloped wildland or vegetative fuels – often increasing the risk of fires and the destruction of property. These interface areas are particularly vulnerable because seventy to ninety percent of wildfires are human caused. Some of these areas, such as Glacier, also lack road access options beyond one way in and out, further raising the risk to property and life.²⁴⁵ The Washington DNR was instructed by the State Legislature in 2018 to map WUIs in each county to mitigate wildfire hazard. This WUI mapping tool is now available for use by counties as a component of understanding and assessing wildfire risk. The intent is to apply stricter international building fire codes in WUI areas to reduce damage.

Resilience in the county's next generation of forests from wildfires, drought and disease will require forest owners to consider different harvesting strategies, specifically timing, size, and shape of harvests to reduce the spread of wildfires, damage from insects and disease, flooding and increasing sediment load in creeks and landslides. Even thinning young forest stands can enhance survival, growth, and carbon sequestration by reducing competition for soil moisture and sunlight as well as provide an opportunity to remove invasive plants. Survival of forests may also depend on a more diversified

²⁴⁴ The Effect of Fire on Soil Properties by Leonard DeBano. Rocky Mountain Research Institute. https://forest.moscowfsl.wsu.edu/smp/solo/documents/GTRs/INT_280/DeBano_INT-280.php.

²⁴⁵ Dye, A.W., J.B. Kim, A. McEvoy, F. Fang and K.L. Riley. 2021. [Evaluating rural Pacific Northwest towns for wildfire evacuation vulnerability](https://usfs.maps.arcgis.com/apps/View/index.html?appid=8630fdb3e88f475fb5304415ce9e03c0&extent=-136.2333,39.1055,-102.4834,50.3252). Natural Hazards, 2021. USFS Wildfire evacuation risk for PNW communities: <https://usfs.maps.arcgis.com/apps/View/index.html?appid=8630fdb3e88f475fb5304415ce9e03c0&extent=-136.2333,39.1055,-102.4834,50.3252>.

portfolio of tree species, an increase in tree spacing where soil moisture is a problem, or even assisted migration-planting stock from seed zones that are adapted to drier conditions. "...a land manager may need to consider appropriate seed lots or seed sources within populations. There may be populations within a species that are more suited to expected climate conditions and acquiring seed sources from those populations may help the species perform well into the future." There are tools to help foresters make decisions about assisted migration including the Climate Change Tree Atlas, and ForeCASTS for species-level considerations and the Seedlot Selection Tool for seed lot and seed source considerations.²⁴⁶

Douglas fir is one of the most predominant trees in western Washington that responds well to different environments. Recent studies have shown that Douglas fir from areas with the coldest winters and driest summers had the greatest drought resistance, not seedlings from the warmest, driest climate.²⁴⁷ This makes sense because the physiological processes that help the tree tolerate dry winter winds and frozen soils also help the tree tolerate summer drought stress. Reforestation projects must consider future site conditions and should use tree stock from seed zones that can survive these conditions.

The Nooksack Salmon Enhancement Association (NSEA) recommended that forests should incorporate mixed landscape for greater diversity that allows shifts in species distribution.²⁴⁸ This can be accomplished by creating a mosaic of patch sizes and age classes for timber harvest and avoiding monocultures. Species diversity has created more resilience in northeast deciduous forests but is rarely considered in the northwest conifer forests where monocultures are the norm.

The county can demonstrate and educate forest landowners by partnering with the Million Tree Project²⁴⁹ to test climate-resilient practices in selected areas where a grassland may be converted to forest land. Large land disturbances may also present an opportunity to establish new genotypes and forest heterogeneity and diversity. Although Douglas fir is one of the most drought-tolerant commercial species in the Pacific Northwest, small rural landowners in the county and county parks might be more willing to experiment with a wider selection of species.

Key Priorities to Enhance Forest Health and Survival:

- ***Increase monitoring of forest inventory plots and use information to revise forest management practices to reflect climate risk.***²⁵⁰
- ***Demonstrate climate resilient species as part of the Million Tree Project.***

Strategy 3: Promote Climate Resilient Planning and Programs to Maintain our Forest Economy for Recreation and Wood Products Through Leadership and Education.

²⁴⁶ <https://www.fs.usda.gov/ccrc/topics/assisted-migration>.

²⁴⁷ Predicting Douglas-Fir's Response to a Warming Climate by Andrea Watts. Science Findings, Pacific Northwest Research Station, US Department of Agriculture Forest Service. Nov. 2015. <https://www.fs.fed.us/pnw/science/scifi179.pdf>.

²⁴⁸ Taylor, Lindsay and Henson, Kayla, Model Forest Policy Program, the Cumberland River Compact, and the Nooksack Salmon Enhancement Association "Forest and Water Climate Adaptation: A Plan for Whatcom County, WA," December 2010.

²⁴⁹ Whatcom Million Trees Program, www.whatcommilliontrees.org.

²⁵⁰ The Forest Health Watch website <https://foresthealth.org/>.

Whatcom County has a large financial stake in promoting a strong and vibrant forest industry as well as healthy forests on protected lands. According to the State Department of Commerce,²⁵¹ forestry contributed 1,889 direct jobs and over 3,000 indirect or induced jobs²⁵² in Whatcom County in 2017. These jobs translated into \$220 million in wages and \$5.8 million in taxes and fees.

The county can play an important leadership role by incorporating climate change risk into all aspects of the Comprehensive Plan. Forest zoning and new roads and developments all have an impact on forest health and survival under a changing climate. Many of the issues are complex and cross cutting such as the competing interests between the timber industry, watershed management, recreation, and preservation of important ecosystem functions.

Support and partnerships with local organizations that educate the public about the important role of natural resource management in promoting climate resilience and producing food and fiber can sustain our local economy, environment, and wellbeing. The County can also use its purchasing power to buy locally sourced lumber for all county building projects and promote this concept to local builders. County efforts in economic development should encourage the research and development of new forest products such as cross-laminated timber that can reduce the carbon footprint of new buildings.

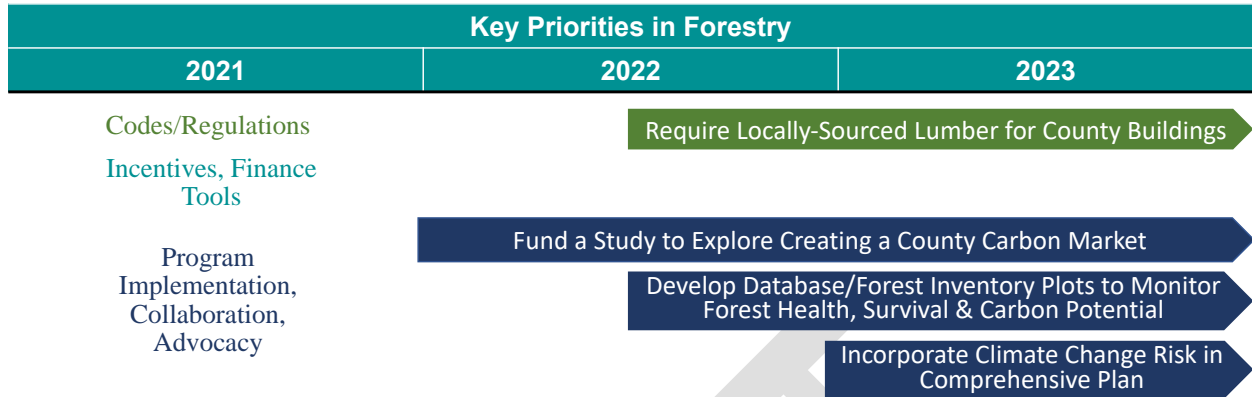
Key Priorities in Forest Climate Resilience Planning and Programs:

- ***Incorporate climate change risk in all aspects of the Comprehensive Plan on forests and land use.***
- ***Support local organizations that educate the public about the important role of natural resource management in promoting climate resilience.***
- ***Use county economic drivers and influence to promote locally sourced lumber and development of new wood products such as Cross Laminated Timber.***

²⁵¹ Washington State Department of Commerce, <http://data.workingforests.org/#Whatcom>.

²⁵² Economists define indirect as those jobs created as a result of the direct jobs, while induced are jobs within the supply chain.

Timeline for Forestry Priorities



Conclusion

Climate change dictates that we must anticipate and be prepared for rapid changes in forest management practices in commercial, rural, and recreational forests. Rapid change in a sector that is accustomed to fifty to sixty years between planting and harvesting is challenging. What works today might not work in a decade or half century. Although we cannot say with absolute certainty how forests will respond to a changing climate, we can incorporate and test new ideas that may preserve a forest industry for future generations.

Forestry research on climate change has been going on for at least twenty years but has intensified over the last decade. Incorporating climate change vulnerabilities into reforestation plans should become routine, rather than an exception. The county should support and partner with organizations that hire stewardship foresters such as the Whatcom Conservation District, Washington State University Extension Forestry, Tribes, and others. We can adapt and build resilience into our forest resources and maintain this vital resource for future generations. As with all change, communication and education are critical.

Ecosystems

Whatcom County ranges from the Cascade Mountains to the lowlands to the Salish Sea creating a wide range of diverse ecosystems. Despite the alterations of the landscape and impacts on wildlife over time, Whatcom County remains an area of significant biodiversity. The County is characterized by 36 general habitat types and presently has 433 non-fish vertebrate species, including 15 amphibians, 8 reptiles, 320 birds, and 86 mammals.²⁵³ Adding fish species to this list, there are well over 500 vertebrate species known to occur. Whatcom County is also home to over 1,100 species of plants as well as an unknown number of fungi, invertebrates, and other organisms on which the higher forms, including humans, depend.

Our ecosystems maintain many environmental processes that benefit humans, sustaining life as we know it. There are countless ecosystem services that humans and animals alike depend on for our health and wellbeing, but they generally fall into four broad categories: 1) *provisioning*, such as food products or water resources; 2) *regulating*, such as stabilizing climate and limiting disease; 3) *supporting*, such as nutrient cycling, carbon storage and oxygen production to maintain life; and 4) *offering cultural services*, such as spiritual benefits and recreational opportunities.²⁵⁴ All of these ecosystem functions require healthy ecosystems.

Impacts from climate change are already affecting the health of ecosystems in Whatcom County.²⁵⁵ Shorelines and stream banks are being degraded by storm surge and flooding, salmon runs are threatened, western red cedar trees are dying, and native plants are migrating to more favorable growing zones. Climate impacts are likely to worsen without intervention. Ecosystem services that help us stabilize the climate and adapt to a changing climate are essential to human well-being and require immediate attention.

Ultimately, planning for climate change may be viewed as a form of risk management with the goal of building resilience to climate change impacts. By implementing the strategies and actions in this document we may avert, lessen, or adapt to some of the expected consequences of climate change. For example, adaptation strategies such as landscape-level planning can play an important role in controlling outbreaks of pests and diseases, and improving risk sharing and transfer mechanisms. Land use decisions the County makes today will either reduce the effects of climate change in the future or worsen the economic and environmental toll. Consideration of climate change in all of the County's land use policies and regulations can significantly reduce this damage to our economy and quality of life.²⁵⁶

²⁵³ Whatcom County 2017 Ecosystem Report, prepared by the Wildlife Advisory Committee.
<https://www.whatcomcounty.us/DocumentCenter/View/30221/2017-Whatcom-County-Ecosystem-Report-Final?bidId=>

²⁵⁴ Kershner, D. 2019, Chapter 8, Land Use, Recreation, and Wildlife and Habitat. 2019 Community Research Project, prepared for the Whatcom Climate Impact Advisory Committee.
<https://whatcomcounty.us/3162/Meetings-Additional-Information>

²⁵⁵ Mauger, G.S., et. al. 2015. State of Knowledge: Climate Change in Puget Sound. Report prepared for the Puget Sound Partnership and the National Oceanic and Atmospheric Administration. Climate Impacts Group, University of Washington, Seattle. doi:10.7915/CIG93777D

²⁵⁶ Kershner (n 40)

Providing information on climate-related risk can improve the capacity of land managers and enable timely decision making. A risk management approach may also save resources, amplify social resilience, support ecological restoration, and foster engagement and collaboration between multiple stakeholders. Due to the complexity of challenges and the diversity of actors involved in addressing land use challenges, a mix of policies, rather than single policy approaches, can deliver improved results in addressing the complex challenges of sustainable ecosystem management and climate change. An example of a risk-based adaptive policy mix is combining universal access to early warning systems with effective contingency planning.

Goal and Strategies for Ecosystems

Ecosystems and their component elements, including biodiversity and associated processes, are vulnerable to ongoing, gradual changes in climate, and extreme perturbations from storms, floods, droughts, or wildfires. Resilience is defined as “the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.” The following overarching goal is designed to maintain the health of local ecosystems in the face of a changing climate:

Goal: *Develop climate resilient ecosystems by protecting and restoring ecosystems and the carbon they store and maximizing ecosystem health to enhance carbon sequestration.*

The strategies that support this goal fall into three main categories: i) Protecting existing ecosystems and the carbon they store (strategies 1 and 2; ii) Restoring natural ecosystems (strategy 3); and iii) Ensuring healthy ecosystems to maximize carbon sequestration (strategies 4 and 5).

Strategies for Ecosystems

1. Increase community awareness about the importance of healthy, climate-resilient ecosystems to our economy and quality of life.
2. Incorporate projected climate change impacts into revised land use and development codes to reduce damage to healthy ecosystems and increase the climate resilience of vulnerable ecosystems.
3. Provide technical, logistical, and financial support for community efforts to restore and enhance ecosystems.
4. Implement long-term monitoring to assess the impact of climate on ecosystem health.
5. Preserve and enhance ecosystem health to build climate resilience in our hydrologic processes, air and water quality, carbon storage, and ecological connectivity.

Strategy 1: Increase Community Awareness about the Importance of Healthy, Climate-Resilient Ecosystems to our Economy and Quality of Life

Ecosystem services such as carbon sequestration and storage should play a central role in our climate change response, both toward achieving net carbon neutral or net negative targets and as a by-product of the other goals described below. Community awareness of the importance of ecosystems is, in general, low. Wetland, estuary, and forest ecosystems are capable of storing much more carbon than

they release. This stored carbon accumulates in soil and sediments, live plant and animal tissues, and wood products, and in some instances (e.g., in peatlands and conifer forests of the Pacific Northwest) can serve as a carbon sink for centuries. Enlisting community support for protecting these critical ecosystems is essential.

Community awareness starts at the County level. The protection of ecosystems from climate and human impacts must be reflected throughout the Comprehensive Plan and the codes and regulations associated with land use (strategy 2). The County should also support our local non-profit organizations that enlist public volunteers in environmental projects and promote climate change education in our local school systems.

Strategy 2: Incorporate Projected Climate Change Impacts into Revised Land Use and Development Codes to Reduce Destruction and Increase the Climate Resilience of Vulnerable Ecosystems

Protecting land for recreation and wildlife habitat generally provides ecosystem services that are essential to the resilience of society in the face of climate change. These ecological benefits, which are freely provided when ecosystems are properly functioning, include such services as wood products, fish, clean drinking water, flood control and natural pollination of crops.²⁵⁷

A meaningful response to climate change will require changes in the land use code. It will require increasing the pace of protection of working lands, recreation lands, habitat, and ecosystem restoration activities, as well as the scale of investment in these efforts. If there is going to be growth in Whatcom County that doesn't make us even more vulnerable to climate change, the County government needs to do a better job of focusing development in existing urban areas, while devoting more resources to protecting farmland and forest lands, shorelines, and riparian corridors and to restoring habitat. Low density development is one of the key contributors to carbon emissions.²⁵⁸

Currently, the County allows wetland mitigation projects in new developments, which simply means that a wetland can be removed if a comparable-size wetland is created elsewhere. Studies have shown that wetland mitigation projects are not providing the ecosystem services equal to what is being lost to permanent development.²⁵⁹ At the very least, the mitigation project should be required to catalogue the ecosystem functions and demonstrate how they would recreate these key functions. Climate vulnerability assessments should also be considered for significant land use changes.

Strategy 3: Provide Technical, Logistical and Financial Support for Community Efforts to Restore and Enhance Ecosystems

Retaining, restoring, and expanding critical habitats can have outsized positive benefits. Planting trees in non-forested areas such as grasslands is an excellent example of increasing carbon sequestration and provides a host of ancillary ecological services. Enhancing carbon storage also requires protecting accumulated carbon in vegetation and soils from future catastrophic loss (or "sink reversal") triggered by disturbances such as flood, drought, fire, or pest outbreaks, or future poor management.

²⁵⁷ Kershner (n 40)

²⁵⁸ Kershner (n 40)

²⁵⁹ Chandrasekhar, A., How effective is restoration at recreating wetlands? The Economics of Ecosystems and Biodiversity blog, published December 24, 2013. <http://www.teebweb.org/how-effective-is-restoration-at-recreating-wetlands/>

Many local non-profit organizations are involved in restoring and enhancing natural ecosystems by expanding riparian zones and purchasing wildlands for preservation. These organizations are well-equipped to do this work and should be supported by the County.

Strategy 4: Implement Long-Term Monitoring to Assess the Impact of Climate on Ecosystem Health

Maintaining and enhancing ecosystem health ties together both strategies 4 and 5. Ecosystem health is the indicator or measure of the well-being and natural condition of ecosystems and their functions. The most important aspect of measuring ecosystem health is that it provides a baseline for assessing changes over time, especially the changes that are occurring as a result of climate change. Both the Critical Areas Ordinance and the Shoreline Management Program have no standards for net loss of ecological function, nor does the County directly monitor ecological function over time. Baseline information on the health status of ecosystems in the County is sorely lacking.

Much of the needed information on ecosystem health can be accomplished by expanding County-sponsored citizen science programs, modeled after programs sponsored by the Marine Resources Committee. The County can also enlist and help fund local conservation organizations to help create a system for measuring ecosystem health and periodic monitoring of designated ecosystems in the County. This information on ecosystem health, along with considering cross-cutting strategies and actions in the other areas covered in this section on the Natural Environment, will assist prioritization of the projects presented in strategy 5.

Strategy 5: Preserve and Enhance Ecosystem Health to Build Climate Resilience in Our Hydrologic Processes, Air and Water Quality, Carbon Storage, and Ecological Connectivity

Enhancing ecosystem health is important because climate-induced stressors are projected to increase, including more intense rainfall events, floods, periods of extreme heat, drought, and wildfire, higher sea levels and damaging waves. In Whatcom County, ongoing coastal erosion will only intensify as sea levels rise, adding to land use pressure. A pro-active strategy is needed to restore, revegetate, and strengthen coastlines and estuaries to withstand changing conditions. Great attention needs to be focused on preserving and enhancing ecosystem resilience to compensate for projected extreme impacts if climate policy falls short.

Ecosystems most at risk are those that are already degraded or near the limits of tolerance. Low resilience may be exacerbated by loss of key species, introduction of invasive species or diseases, and reduction and fragmentation of habitats, factors that may or may not be related to climate change. As such, reversing or mitigating these factors can increase ecosystem health and climate resilience. For example, reintroducing American beaver can help adapt to declines in glaciers and snowpack, which impact summer streamflow, because they help store more water in wetland and riparian areas.

Restoring saltwater wetlands is an effective strategy for sequestering carbon, while improving habitat for salmon and migratory birds. Western Washington University researchers John Rybczyk and Katrina Poppe have studied sediments in at the Nature Conservancy's Port Susan Preserve, where dike removal and lowering of another dike have begun the process of restoring a 150-acre portion of the

Stillaguamish Estuary. These researchers have found that restoring the marsh has resulted in twice the carbon sequestration of other marsh properties outside the restoration zone.²⁶⁰

Additionally, enhancing the connectivity of natural areas will facilitate the movement of plant and animal communities to more suitable climate zones in more northerly latitudes and higher elevations.²⁶¹ Consultants to the County recommended in 2005 that the impact of development projects on wildlife connectivity be considered in development permitting. The County Council didn't approve the change²⁶² but this issue should be revisited.

Sustainable ecosystem management can also contribute to resiliency in various ways, through reducing extraction of natural resources, expanding protected areas, combatting invasive species, and managing for species at risk. Ensuring that all components that make up an ecosystem function effectively is essential for the overall health of our natural resources.

The County has tools to address strategy 5, including the PDR program and potentially creating a county-wide carbon offset program that would value carbon storage and compensate property owners who voluntarily protect and enhance their carbon stores. This cross-cutting carbon offset market would apply to forests and agricultural lands in addition to ecosystems.

Key Priorities for Ecosystems:

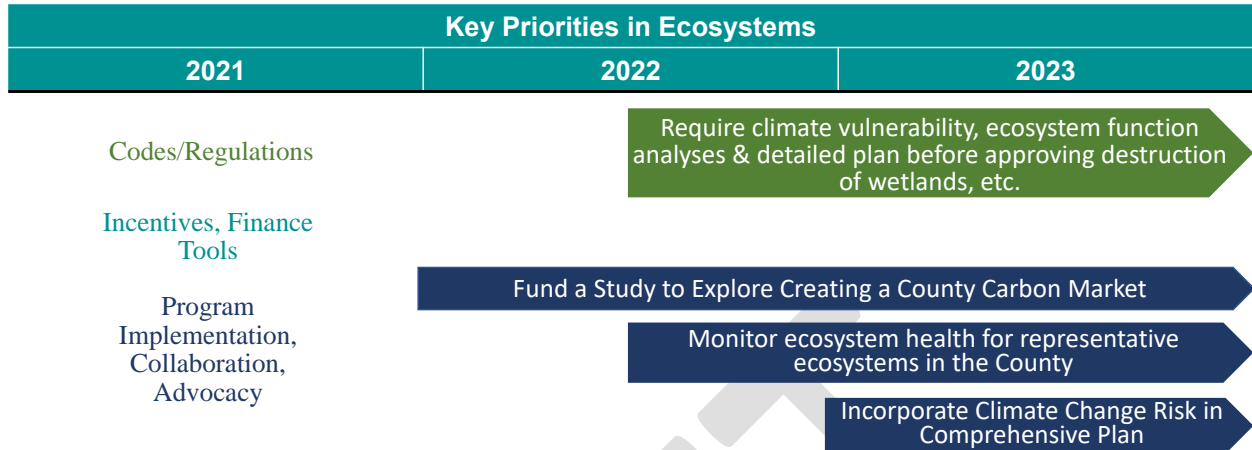
- ***Increase funding and community awareness of ecosystem restoration projects.***
- ***Create a system for monitoring ecosystem health over time and apply to representative ecosystems in the County.***
- ***Require climate vulnerability analysis, ecosystem function assessments, and a detailed plan to recreate these functions before approving any destruction of wetlands or other critical ecosystems.***
- ***Broaden the County PDR program and develop a carbon offset market.***

²⁶⁰ Grace-Sanders, J, "A saltwater marsh in recover is gobbling carbon, gaining ground," *Seattle Weekly*, August 29, 2019

²⁶¹ Krosby, M., et.al. 2016. The Washington-British Columbia Transboundary Climate-Connectivity Project: Identifying climate impacts and adaptation actions for wildlife habitat connectivity in the transboundary region of Washington and British Columbia. Climate Impacts Group, University of Washington.

²⁶² Parametrix et al., Critical Areas Ordinance Best Available Science Review and Recommendations for Code Update, Prepared for Whatcom County, May 2005.

Timeline for Ecosystem Priorities



Conclusion

Healthy ecosystems will provide greater climate resilience for Whatcom County. Healthy ecosystems and the essential services they provide are not only necessary for sustaining our economy, but also contribute to the high quality of life in this County. Protecting sensitive ecosystems and habitat should be a top priority for the County, with restoration as a second priority, because it is cheaper to prevent damage than to try to fix it. Creating climate resilient ecosystems now will help us avoid potential irreversible damage over the next decade.

SECTION 4 - IMPLEMENTING THE CLIMATE ACTION PLAN

Office of Climate Action

The message of this Plan is clear. Section 1 explains why we must act quickly and decisively. We must mitigate the effects of our activities on the local and global climate, and we must adapt to those effects of changing climate that are beyond our ability to mitigate. Sections 2 and 3 outline specific, detailed, scientifically backed actions that we need to take in order to accomplish our mitigation and adaptation goals.

The County needs to place high priority on reducing greenhouse gas emissions and building climate resilience in our communities, while ensuring an equitable transition for those whose jobs and livelihoods may be affected by climate change and climate action. This final section proposes an organizational structure for effectively implementing climate action.

To be effective, the County must act according to the guiding principles laid out in Section 1 with emphasis on urgency, environmental and social equity and justice, transparency, and accountability. The County must also exercise leadership, promote systems-level solutions, and employ best available science and management practices. The inevitable transition to net zero emissions will have an enormous impact on Whatcom County's economy, which is home to two refineries that represent almost 2,400²⁶³ highly skilled jobs. Whatcom County must be a leader in facilitating this economic transition to be competitive in the rapidly evolving clean energy future.

We propose that the first step toward climate resilience is to establish an Office of Climate Action within the County Government, headed by a senior Climate Advisor and located in the County Executive's Office. This Office needs to exercise leadership in addressing the three areas of concern that emerged in the 2019 Community Research Project coordination, information, and community engagement.

Coordination

The sheer number of strategies and actions presented in this plan's Appendix illustrates both the challenge and urgency needed to address climate disruption. We believe that to realize the full potential for climate action, the County needs a single office responsible for coordination, data collection and communication. As the County works toward more effective climate action, many departments will continue the important work they are doing now and much of their expertise will be needed to address the strategies and actions outlined in this plan. The job of the Office of Climate Action should be to coordinate programs that draw on this expertise, seek and secure funding for climate related activities, and ensure that County departments are aware of each other's plans and activities work in concert to achieve climate action goals, and act according to the principles of urgency, equity, transparency, and accountability. In particular, the Office of Climate Action can help the County take full advantage of increasing opportunities for funding of climate-related projects such as the Washington Clean Energy Fund, various funds established under the 2021 Climate Commitment Act, and any new federal grant opportunities that address climate change.

²⁶³ Hodges, H., A. Rucker, J. McCafferty, March 2019. Employment at Cherry Point, Exploring the economic impacts of Cherry Point on Whatcom County. Prepared by the Center for Economic and Business Research, Western Washington University. The number of jobs includes *bp*, Phillips 66 and Western Refinery Services.

To ensure coordination in addressing all aspects of the Climate Action Plan, the Office of Climate Action should be housed in the office of the County Executive, rather than in any particular department. In some cases, continuing the work of the existing Climate Leadership Committee, to be chaired by the Senior Climate Advisor, may be the most expedient way to ensure this coordination. In addition, it is vital that all County agencies consider climate effects when deciding and implementing policy; the Office of Climate Action can help agencies see their own particular responsibilities through a "climate lens."

In addition to coordinating key climate priorities and programs, the Climate Advisor should actively coordinate and cooperate with those organizations and communities in Whatcom County and beyond who will be affected by climate change and who can be partners in the effort to mitigate and adapt to it. Within the County, these include tribes, city governments, school districts, water and conservation district, ports, utilities, labor organizations, agricultural organizations, businesses, media, and community advocacy groups. Partners outside the county include neighboring counties, state and federal agencies, local and provincial governments in British Columbia, and state and national climate advocacy organizations.

In order to carry out these tasks of leadership, the Senior Climate Advisor should have wide experience in government and corporate relations, as well as technical and policy knowledge of the nature of the climate crisis, basic climate science, and energy policy. In addition, an important part of leadership is problem-solving and identifying opportunities. It is inevitable that, in the next few years as we move toward carbon-neutrality and climate resilience, unexpected problems and opportunities will arise. The current world-wide transition to net zero emissions is promoting rapid advances in technologies, so flexibility and willingness to change strategies are critical. The Senior Climate Advisor should have the ability to think creatively and adaptively, where necessary recommending that the County adjust and update climate policies and actions as our knowledge and experience grow, and local conditions change.

The Office should also consider engaging interns from local colleges and universities to undertake specific, time-limited tasks.

Information

Accurate and current data and information resources are essential for effective climate action and for compliance with our principles of transparency and equity. The Office of Climate Action should exercise leadership through collecting and disseminating vital information about climate change and about the County's progress in addressing it. In order to carry out the informational aspects of the Office's mission, the Advisor should be assisted by a technical information specialist who can compile and disseminate information regarding climate change and the County's progress in climate action.

The information specialist should have experience in climate-related data and information science. Data compilation services will include tracking and modeling emissions with the ClearPath model, updating information on energy savings from facility upgrades or other investments made to enhance climate resilience, monitoring information on climate programs at the state and federal levels and in neighboring counties and maintaining an online dashboard for the County on climate progress.

In addition to *collecting* information, the office should be a readily available *source* of reliable information. The public will be most interested in the impacts on workforce transition, jobs, equity, and

the environment over time. The Office should regularly inform the public about our climate goals and our progress toward achieving them. Thus a transparent, public-facing dashboard of county climate-related data and information will be essential. The Office should also provide testimony when required to relevant state and federal bodies on climate legislation and rules that facilitate our County climate goals.

The Office can also serve as a source of information about the County's ongoing and future programs of climate action. For example, the County has upgraded facilities to increase energy efficiency, reducing operational costs and saving taxpayers money. However, actual reporting on these savings is hard to find. Another example is the County-instituted a purchase of development rights program that can increase climate resilience by preserving and enhancing open space, high value working lands, and ecosystem services. This program is important and deserves much greater visibility.

In addition to compiling relevant data and making them available to county staff and the public, the Office should consult where appropriate with academic, government, and foundation experts on the biophysical, economic, and social aspects of climate change.

Community Engagement

Coordinating climate action and collecting and disseminating climate information will only be effective if the public understands the urgency of climate action and knows that this Plan is being carried out in a just, equitable, and transparent manner. For this reason, the Office of Climate Action needs to take a broad range of actions to inform, influence, and secure support from the general public in our County.

As soon as it is established, the Office should mount a campaign through print, electronic, and social media to explain the Climate Action Plan. It should enlist members of CIAC, academic and scientific experts, and advanced university and college students to give presentations to variety of interested organizations and community stakeholders.

The Office should also request that to kick off the implementation of this Plan, the County Executive and the Climate Advisor hold a public, town-hall type meeting to announce and promote the Climate Action Plan and hold yearly town-hall meetings thereafter to report on progress and discuss issues regarding the implementation of the Plan.

The Office should develop an outreach plan with local organizations involved in conservation, sustainability, and environmental education to inform the community on climate change. The main focus of this educational outreach would be school districts, but it is also important to reach out to community organizations that can help spread the message of the importance of climate action.

Role of the Climate Impact Advisory Committee

The County Council established the Climate Impacts Advisory Committee in 2017. Its mandate includes both providing expert advice to the County Council and Executive and serving as “a conduit to the public for information exchange, education, and engagement.” We recommend that the Office of Climate Action take advantage of the expertise and experience of CIAC members to carry out aspects of its mission.

The Committee should continue the active role it began with the Community Research Project in 2019 and has continued with the compilation of this Plan. In accordance with its enabling legislation, it should be prepared to advise the County Council on cross-cutting projects that will enhance climate resilience, changes to the Comprehensive Plan and existing codes, budgetary priorities, and possible sources of funding for climate action. CIAC members can provide their own expert advice, consult with scientific and policy experts, and help with community outreach as directed by the Office of Climate Action. An important function of the CIAC is advising the Office of Climate Action of new, emerging technologies and opportunities to provide a systems-level approach to achieve climate resilience.

To take full advantage of CIAC's role, the Climate Advisor needs to serve as the County liaison to the committee. We recommend that in the future, when citizens apply for CIAC vacancies, the Climate Advisor should recommend to the County Council those applicants that might best meet the needs for specific expertise and community representation. The Committee can thus serve as volunteer advisers to the Office on general policy directions as well as on specific projects and their implementation.

Funding

To be effective, the Office of Climate Action needs adequate funding. We fully realize that funds are scarce in a time of economic uncertainty, but we also believe that action is urgent and imperative to simultaneously help combat climate change and recover the economy. Strategic investments made now can save the County both money and effort in the future. We therefore recommend that the County Council allocate funds for the Office of Climate Action immediately, including supporting the Senior Climate Advisor and the information specialist as permanent positions beginning in fiscal year 2022. Staffing the Office of Climate Action, in turn, will enable the County to seek and secure outside funding for specific actions recommended in this Plan. Without such staffing, it may be difficult to take full advantage of the increasing opportunities to secure funding for climate mitigation and resilience.

Whatcom County is competing with other communities to be a leader in Washington state for the clean energy transition, as the state rapidly replaces fossil fuels in its economy. This transition will create the jobs needed to compete worldwide over the next several decades. A successful transition will also provide Whatcom County with the skilled workforce needed to effectively compete in the 21st Century and a stable, growing economy.

Once the Office of Climate Action is established, it can coordinate proposals for grants requests that are already available and should become increasingly so over the next two years. The State Department of Commerce is sending out requests for proposals for the Clean Energy Fund, including for example energy retrofits for public buildings. Other state sources, such as the funds appropriated in the various transportation-related bills detailed in Transportation, should also come online soon. The infrastructure bill currently being negotiated, in whatever form it passes Congress, will almost certainly include many programs that can enable many of the recommendations made in Section 2 on the Built Environment.

Other possible sources include the Amazon Climate Pledge Fund ²⁶⁴and the Gates Foundation’s Breakthrough Energy Ventures. In addition, the Office can collaborate with universities to seek funding for research, including for example agricultural programs through WSU and marine ecology programs through WWU and UW. A combination of all these sources could provide funds for GHG emission reductions, ecosystem adaptations, equitable job transitions, and climate resilience. But it takes time to pursue grants, loans, and collaborative projects, and we believe that quickly establishing and funding the Office of Climate Action is a timely investment that will bring immense returns in the form of money for desperately needed climate action measures.

Key Priorities for Implementation

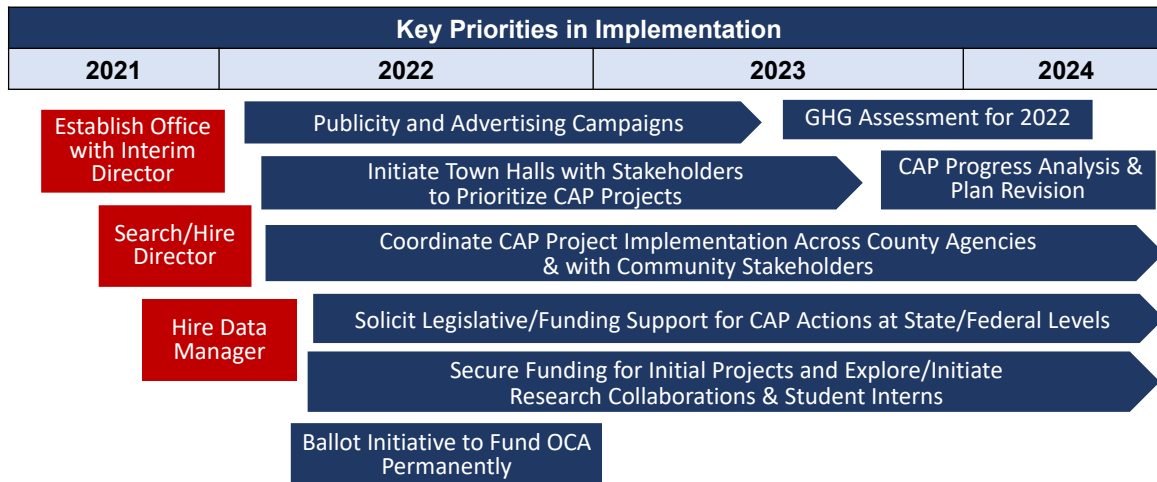
- ***Establish and staff the Office of Climate Action, with a full-time Director and a data analyst.***
- ***Seek outside funding for specific programs and projects including mitigation, adaptation and transitioning the skilled workforce for the future low-carbon economy.***
- ***Mount a publicity and education campaign to increase public awareness of and commitment to climate mitigation and adaptation.***

Timeline for Implementation

Signs of climate change are increasingly apparent, and its effects have potential to devastate our communities. Now is the right time to take concerted action. We thus recommend that the Council direct County leadership to further refine the functions and duties of this Office of Climate Action within the current County government organizational structure. County leadership should appoint an interim Climate Advisor (probably from current County staff) to begin setting up the Office while the search for a permanent Advisor is proceeding, with the goal of having the permanent Advisor working at the start of 2022.

As soon as the interim Advisor is in place, the Office can begin to prioritize specific projects in climate mitigation and adaptation, as recommended in Sections II and III of this Plan. High-quality, timely, well-targeted projects will be more successful in securing authorization and funding. The Office should begin by consulting with relevant experts (County staff, members of CIAC, or others) to develop concrete project plans for County approval and proceed as rapidly as possible to pursue funding and begin these projects. When the permanent Climate Advisor is in place, they can continue with the projects already started and begin working on others.

²⁶⁴ <https://sustainability.aboutamazon.com/about/climate-pledge-fund>



Concluding Thoughts

It is an oft-repeated cliché that reports are written in order to gather dust on shelves in government offices. With the present state of the global and local climate crisis, we do not have the luxury of dust-gathering. This report is written in the spirit of both urgency and optimism—we are in a crisis and all of us we must act now, involving government, stakeholders, and citizenry. At the same time, we have the knowledge, commitment, and planning to make a difference *for our communities and our environment* before it is too late. Organizing for effective climate action, as outlined in this Section, can give us both the hope and the tools to implement the concrete recommendations contained in Sections 2 and 3 of this report.

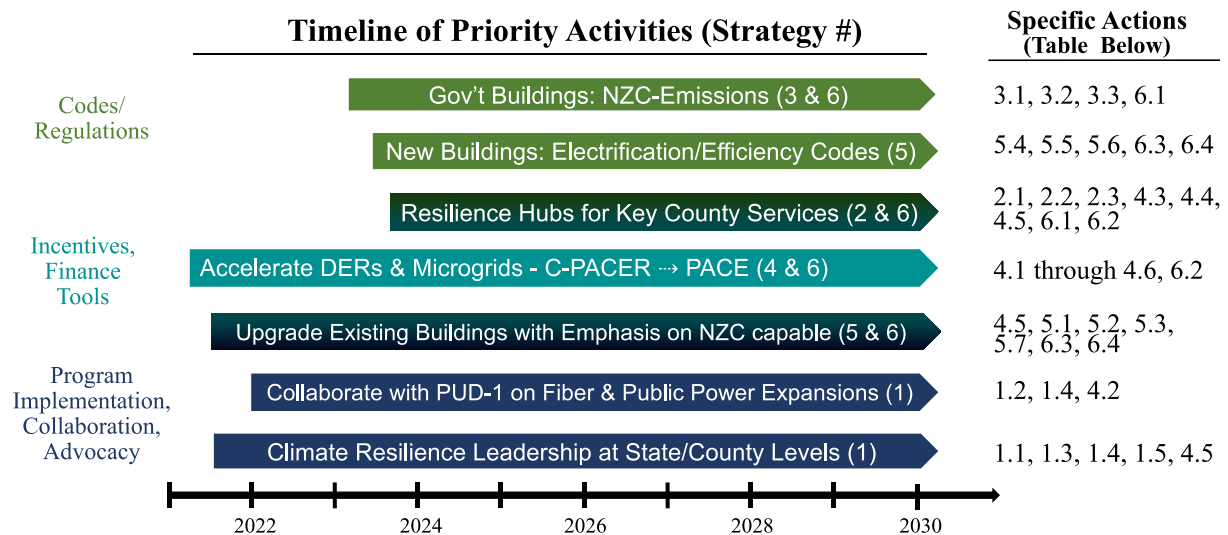
SECTION 5 - APPENDICES

Electricity and Buildings Appendix

We would like to acknowledge the following individuals who responded to our request for technical review and provided valuable insight for this chapter:

Reviewer	Organization or Technical Area
Hunter Hassig	former CIAC member, PSE Energy Advisor
Imran Sheikh	CIAC member, WWU Asst. Prof. Institute for Energy Studies
Eddy Ury	CIAC member, energy policy
Phil Thompson	CIAC member, retired WWU economics & energy professor
Emily Kubiak	Sustainable Connections & Community Energy Challenge
Rose Lathrop	Sustainable Connections, Buildings
Erin McDade	Architecture 2030
Atul Deshmane	PUD1 Commissioner
Markus Virta	President, WA Solar Energy Industries Assn.
Mark Schofield	Mgr-Community Energy Challenge
Ted Clifton Sr	Clifton View Homes, net zero energy home design and construction
Christine Grant	WWU Adjunct Instructor Energy Policy; PUD1 commissioner
Sarah Vorpahl	Dept of Commerce, State Energy Strategy
Austin Scharff	Dept of Commerce, State Energy Strategy
Rob Ney	Whatcom County Facilities Manager
Ray Kamada	Kamada Science and Design
Deepa Sivarajan	Climate Solutions – WA Policy Mgr

Timeline of Actions



Electricity and Buildings Actions and Benefits

1. Assert County leadership in state legislation, regulatory matters (WUTC and Commerce), and electric utilities operations that enables implementation of Whatcom climate strategies and facilitates a 45% reduction in GHGs by 2030.	
Actions	Benefits
<p>1.1 Climate advisor participation in WUTC rule making and legal proceedings examining utilities compliance with CETA.</p> <p>1.2 Pass a resolution to co-fund a municipalization study with Whatcom PUD-1 that would accelerate the use and development of renewable energy and give residents options.</p> <p>1.3 Identify areas where large scale solar or wind could be located and facilitate county regulations for deployment.</p> <p>1.4 Partner with PSE and/or public utilities and residents with cost-competitive utility scale options for renewable energy.</p> <p>1.5 Support state-wide legislation through testimony/letters that will help achieve GHG goals for 2030 (e.g., VNM,²⁶⁵ PACE).</p>	<ul style="list-style-type: none"> • Provides competition to lower consumer electricity costs while at the same time expanding renewable electricity. (1.1, 1.2, 1.5) • Virtual Net Metering/community solar allows renters and low-income households to access renewable energy. (1.3, 1.4) • Actions directly address equity issues and accelerate use of renewables. (1.4,1.5) • Creates new local jobs. (1.4,1.5)
2. Create resilience hubs for key community services throughout the county. Collaborate with utilities to identify needed Transmission and Distribution investments.	
Actions	Benefits
<p>2.1 Work with communities in the County to identify public buildings, such as schools, fire departments, etc., for community solar/battery projects and resilience hubs.</p> <p>2.2 Fund a study to evaluate and prioritize resilience hubs and microgrids (identified in 2.1) to fortify key emergency and public services and provide clean energy power in the event of a disaster and community benefits during normal times.</p> <p>2.3 Promote underground utility lines in areas of the county where frequent outages occur due to downed distribution lines (or target emergency battery backup where needed).</p>	<ul style="list-style-type: none"> • Better address customer electricity needs across the county and provide climate resilience. (2.1, 2.2, 2.3) • Allows the county to focus efforts on areas that are currently underserved and create more equity. (2.2) • Creates local jobs (2.1, 2.3)

²⁶⁵ VNM is Virtual Net Metering is required in many states, but not Washington. VNM is an accounting/billing process that is offered by some utilities, such as the Snohomish PUD and OPALCO, to compensate customers who have partial ownership in community solar or wind projects. This mechanism can provide equity to customers who rent or cannot afford rooftop solar.

3. Leading by example: electrify end uses in County government buildings, install renewable energy and energy storage where feasible to reduce energy operational costs and GHG emissions.

Actions	Benefits
<p>3.1 Develop a multiyear master plan for up-grading/consolidating county government facilities while meeting GHG targets.</p> <p>3.2 Work with the utility to install behind the meter battery storage systems, rooftop solar on county government buildings and EV charging infrastructure.</p> <p>3.3 Commit to NZC emissions for new county government buildings and facilities.</p>	<ul style="list-style-type: none"> • Take advantage of the window of funding over the next few years from state, federal, and private foundations. (3.1, 3.2, 3.3) • Batteries and rooftop solar show a commitment to saving operating costs and leadership in promoting a local clean energy economy. (3.2) • Transparency and urgency needed to address climate change. (3.3)

4. Create a community wide focus on *buildings as grid assets* to accelerate the use of clean Distributed Energy Resources (DERs) and microgrids to reduce peak electricity demand, optimize the grid, and provide electricity to buildings when the utility grid is down.

Actions	Benefits
<p>4.1 Advocate the use and demonstration of demand response with local utilities to reduce daily peak electricity and modernize control of the grid.</p> <p>4.2 Pass a resolution to support PUD-1 broadband deployment to facilitate DERs.</p> <p>4.3 Identify electricity distribution limitations where DERs and microgrids should be added to promote climate resilience.</p> <p>4.4 Deploy energy storage in targeted locations where batteries can provide more than one function (i.e., peak demand reduction and outage backup).</p> <p>4.5 Pilot C-PACER program in 2021, PACE in 2023.</p> <p>4.6 Maintain a publicly available dashboard of up to date, DERs and grid-connected renewable energy resources over time against target GHG emissions to show progress.</p>	<ul style="list-style-type: none"> • Optimize grid to accommodate EVs and gas appliance conversion to electricity. (4.1, 4.2) • DERs can postpone investments in distribution lines and reduce peak electricity demand, while providing clean power (and backup power) to underserved areas. (4.3, 4.4, 4.5) • Provide intraday storage of energy from intermittent renewable resources. (4.1, 4.4) • Creates new jobs in <i>clean</i> energy. (4.4, 4.6) • Allows building owner, regardless of income status, to defer the upfront cost of efficient electric space and water heating <i>accelerating adoption</i>. (4.6, 4.1) • Transparency and accountability (4.1 through 4.6)

5. Moving to net zero: upgrade existing buildings by collaborating with local NGOs to accelerate energy efficiency upgrades. Require new buildings to be net zero carbon emissions capable no later than 2027.

Actions	Benefits
<p>5.1 Fund a local NGO to develop a plan to pre-qualify heat pump products, installers, and suggest financial incentives/policies for County review and approval.</p>	<ul style="list-style-type: none"> • Ensures that buildings and homes are energy efficient, lowers operating costs for owners, decreases impact on the electrical

<p>5.2 Require/subsidize the installation of high efficiency electric heat pump water heater or furnace in existing buildings when replacement is needed.</p> <p>5.3 Develop a robust financing plan based on financial need that 1) supports major electric appliance upgrades, and 2) transition to NZC operations.</p> <p>5.4 Increase support of non-profit organizations that provide energy efficiency upgrades to residential and commercial buildings.</p> <p>5.5 Implement the latest WA state building codes into county building codes, with NZC and all-electric furnace and water heater by the 2027 code where possible.</p> <p>5.6 Educate the public and builders on the value of NZC homes and buildings and available financing.</p> <p>5.7 Explore options that reduce embodied carbon in building construction.</p> <p>5.8 Transition from kilowatt-hours and therms saved to carbon emissions reduced as the measure of success for energy efficiency programs.</p> <p>5.9 Develop policies and standard building plans for fast-tracking NZC building permits.</p>	<p>grid and reduced GHG emissions. (5.1 thru 5.9)</p> <ul style="list-style-type: none"> • Electrification reduces indoor air pollution and health risks. (5.2) • Focus funding and efforts to create equity in underserved and low-income communities. (5.2, 5.3, 5.4) • Transparency and urgency needed to address climate change. (5.9)
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6. Pilot key concepts through demonstration projects that can scale up rapidly to full-scale implementation to reduce electricity and buildings GHG emissions.

Actions	Benefits
<p>6.1 Convene a workshop to identify and prioritize a list of possible projects, including partners (i.e., utilities, NGOs, etc.) and with special attention to funding sources. Also use this workshop to identify initial candidate resilience hub sites (strategy 2).</p> <p>6.2 Identify an ad hoc task force of local experts to produce a comprehensive plan for reducing carbon emissions from existing and new buildings.</p> <p>a) Evaluate solar + battery microgrids for daily peak shaving and grid services, and backup during disruptions.</p> <p>b) Evaluate the benefit of a full-featured home energy management system consisting of “smart” appliances under local control, utility control, or a combination.</p>	<ul style="list-style-type: none"> • Opportunity to educate officials, businesses, and the general public on energy efficiency and new building techniques that lead to NZC. It is also an opportunity to identify partners and sources of state and federal funding. (6.1, 6.2) • Demonstrate cost-benefits and leverage early adopters in private sector (and their investments), thus accelerating market changes. (6.2) • Projects can be used to evaluate and justify new policies/incentives at the county level. (6.1, 6.2) • Project plans are developed rapidly in conjunction with an ad hoc group of local experts and stakeholders and could be

	<p>planned in multiple phases with review against milestones. (6.1, 6.2)</p> <ul style="list-style-type: none"> • These early demonstration projects leverage expected trends in price-performance of key technologies and standards that can then be more broadly implemented more quickly as marketplaces mature. (6.1, 6.2)
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Example Demonstration Projects

In the race to reduce GHG emissions in half by 2030, new innovations will be required that can be deployed later this decade. They continue to build on current best practices and also on the latest science and engineering breakthroughs. But because they are new, many of them have not been proven at large scale. Rather than wait for large-scale demonstrations that we can follow, we need to take the lead and implement the most important examples in these strategies as small demonstration projects that will provide local experience, public acceptance, and make it easier to scale-up rapidly in the future to meet our GHG targets. To wait for others to lead on all things will make it unlikely to meet our targets.

Whatcom County leadership will need to continuously evaluate the potential value of an evolving list of example projects against the CAP’s recommended strategies. The list below is just a starting point. All projects start as a business value proposition or concept that is evaluated against available resources (e.g., time, funding, staffing, collaborators). The most important and promising projects then develop a detailed project plan for formal review. If the plan is approved, then it is executed. If the value proposition is not sufficient, then business conditions can be monitored for new future developments.

Grid flexibility is the core to resilience and to the deep decarbonization needed to meet our targets.²⁶⁶ Buildings become grid assets by upgrading to energy saving appliances that can be managed individually or together in groups for much greater impact.

We identified three projects that were key to getting started: 1) an electrification prequalification project, 2) a solar/battery microgrid project, and 3) a resilience hub project. These example projects are designed to understand and demonstrate the potential for reducing GHG emissions. These projects also kick start strategies 3 and 5 to electrify existing homes, farms, and buildings, strategy 4 to add DERs throughout the community in an equitable manner, and strategy 2 to create resilience hubs that are self-sustaining during emergencies, but also provide low- and middle-income residents with low-cost renewable energy on a daily basis.

Additional examples to consider are:

Community Solar – The purpose is to enable customers without solar panels to buy whole or a portion of a solar panel available elsewhere on the grid and to credit their generation of electricity on their

²⁶⁶ Grid Modernization Implications for WA State Energy Strategy, Carl Imhoff, PNNL, October 9, 2020.

utility bill. Community solar is critical to equity-centered climate resilience by allowing those without access to clean energy (e.g., renters or owners without good solar exposure), and subsidizing lower income customers. There are many solar-exposed roofs throughout the local community capable of hosting community solar panels that would provide local resilience, better equity, and local investments and jobs – instead of funding utility-scale renewables elsewhere. The existing financial structure for community solar projects in Washington State makes participation an uneconomical investment, but that could be changed by state legislation and/or rulemaking to create a viable community solar program with Virtual Net Metering (VNM). With VNM, ratepayers that participate in community solar would be credited a fair price per kWh for their share of power production which is deducted from their home or apartment utility bill, just as net metering currently works for rooftop solar PV installations on owner-occupied residences. With the intent to make community solar programs functional, fair and rewarding for participants in Washington State, the County should support legislation that promotes community solar and VNM.

Water Heater Demand Response (DR) – The purpose is to shift water heating away from peak times by heating water earlier for use when needed. All new electric water heaters in Washington are required to have built-in demand response capability. Thus, a utility only needs to define policies for recruiting customers into a demand response program, and begin a demonstration project, that can scale up over time. This should receive high priority, especially as part of the electrification incentive process. With sufficient customer participation, new natural gas peaking plants can be avoided.

HVAC DR – The purpose is to shift building heating and cooling away from peak times by adjusting thermostats in anticipation of customer needs. For example, Consumers Energy in the state of Michigan is giving away 100,000 free smart thermostats in exchange for customer participation in their demand response program. Smart thermostats connect to the internet and allows the customer/owner or utility to remotely adjust space heating or cooling during extreme events. The results of this demonstration will be used to guide similar efforts to decarbonize the state’s energy supply.²⁶⁷ This should receive high priority, especially as part of the electrification incentive process. With sufficient customer participation, new natural gas peaking plants can be avoided.

Solar + Battery + EV – The purpose is to manage for 1) maximum energy storage for backup during outages (e.g. a battery), 2) peak shifting (e.g. storing solar energy for evening), or 3) responding to utility signals (e.g., time of use pricing) according to the **customer-configured** preferences. To emphasize, the customer decides and can change, the operating configuration at any time. This is made possible by new “microgrid” products available from Tesla, EnPhase Energy, and others in response to customer needs in California and elsewhere. Microgrids are a sort of building block for incremental grid modernization. In a simple sense, any electrical system that can “island” off the main grid is a microgrid or a semi-independent grid of its own. With the right equipment and software, a microgrid can coordinate DERs within its group, maximizing local resources while ensuring that enough power is drawn from the larger grid to keep supply and demand matched. Small residential microgrids typically “island” only when the

²⁶⁷ Free Google Nest thermostats available for Consumers Energy customer, posted May 19, 2020 on Michigan Live; <https://www.mlive.com/news/2020/05/free-google-nest-thermostats-available-for-consumers-energy-customers.html>

main grid loses power and reconnect when power returns.²⁶⁸ Wildfires in Australia and California have driven demand for these products, but the multifunction capability will improve, and costs will decline—*making them broadly available for modernizing the grid and providing resilience.*

County Services Hub – Similar to Snohomish PUD’s Arlington Microgrid, provide a solar PV array, battery storage, and electric vehicle charging for the new Northwest County Services buildings to add renewable energy, resilience, and community solar services. This a simple resilience hub focused on these county buildings (Public Works and Planning Departments).

Battery Storage DR – The purpose is three-fold in the case of Green Mountain Power in Vermont, whose demonstration project is being watched closely. The demonstration manages battery charging in homes to shave peaks, to provide emergency back up in outages, and to test the value of “transactive energy” enabled by the energy management module. This program will show what distributed energy resources are worth in customer-to-customer transactions (as opposed to utility-to-customer transactions)²⁶⁹ A recent Federal Energy Regulatory Commission (FERC) Order 2222 removes obstacles to wide scale deployment of DERs on the grid, which could facilitate customer to customer interactions according to Richard Brooks of Energy Central.²⁷⁰ In the future when high-performance EV batteries are updated, the old batteries will be repurposed at low cost for less demanding applications like home backup, and rooftop solar. *All of this potential from a simple battery in a building, which can then be leveraged together in groups for even greater impact (see Virtual Power Plant).*

Virtual Power Plant – Large aggregations of DERs called Virtual Power Plants or VPPs are growing rapidly. Modern VPPs are a decentralized network of DERs, that can be combined and controlled at a central control point, often a cloud-based software platform operated for the utility by a third party. These DERs often remain independent in their ownership, but their operation can be managed under certain conditions in exchange for a subsidy or rebate to the owner. Tesla has been a leader in large-scale VPPs with its Hornsdale Australia battery installation that replaced a fossil-based peaking plant. Portland General Electric (PGE) in Oregon is assembling a 4-megawatt VPP by placing battery storage in over 500 homes.²⁷¹ PGE offers households a rebate on the battery purchase or are paid \$20 or \$40 per month for use of households that have existing batteries. This PGE project will demonstrate the value of

²⁶⁸ Wildfires and blackouts mean Californians need solar panels and microgrids, by David Roberts, Oct 28, 2019, *Vox.com*.

²⁶⁹ Green Mountain Power’s pioneering steps in transactive energy raise big questions about DER’s value; The Vermont utility’s program will show what distributed energy resources are worth in customer-to-customer transactions; Utility Dive, Herman Trabish, March 4, 2020.

²⁷⁰ My review of FERC Order 2222, Energy Central, Sep 20, 2020; <https://energycentral.com/c/ec/my-review-ferc-order-2222>

²⁷¹ “PGE program will transform hundreds of homes into a virtual power plant” 4 MW pilot to launch this fall. Each home 12-16 kWh of batteries. <https://www.portlandgeneral.com/our-company/news-room/news-releases/2020/07-01-2020-pge-program-will-transform-hundreds-of-homes-into-a-virtual-power-pl>

managing peak load, provide emergency backup, and address social equity, while modernizing their smart grid.²⁷²

Campuses – The purposes of campus microgrids go beyond residential microgrids described earlier. Campus microgrids remain “separate but connected” to the main grid all the time. Campuses of various public and private organizations increasingly do this to modernize their operations and achieve organizational goals. The private utility Avista is currently developing a transactive energy microgrid in Spokane that will optimize energy use in “a hub building and five buildings of about 160,000 square feet each that will have net zero energy impact,” Avista’s Curtis Kirkeby said.²⁷³ The Department of Energy’s Pacific Northwest National Laboratory (PNNL) campus in Richland launched its Clean Energy and Transactive Campus in 2015, leading the way for innovations in distributed devices and control systems that more efficiently and cost-effectively manage DER and building energy usage.²⁷⁴ The PNNL campus is similar in size to a small university campus. Both Avista and PNNL microgrids were supported by the Washington state Clean Energy Fund, in order to lead the way on grid modernization in the state.

Potential Funding Opportunities for Electricity and Building Projects

Throughout [Electricity and Buildings](#), CIAC recommends that the County facilitate demonstration projects that focus on key approaches to modernizing the electric grid and integrating buildings as grid assets with the ultimate goal of creating resilience. With a new federal emphasis on modernizing our infrastructure and increasing resilience, funding and grant opportunities over the next few years promises to be significant. Therefore, it is important for County staff to develop a list of priority projects to begin implementation of the Climate Action Plan. These projects should be mapped against possible funding sources, starting with the Washington Clean Energy Fund (administered by the Department of Commerce) and the anticipated American Jobs Act. If passed, the American Jobs Act will most likely be administered over several federal departments, including Energy, Transportation, Commerce, Agriculture, to name a few.

This Washington State Department of Commerce: is the place to start as Washington’s Energy Strategy is implemented through information, resources and funding provided through this website. Expect these pages to update with the most recent strategy and legislative mandates soon. Covers the Clean Energy Fund (CEF); Energy Efficiency and Solar Grants; Forest Products financial Assistance Program; Home Rehabilitation Loan Program; and a map of locations for [Energy Grants and Loans Programs](#).

²⁷² PGE Energy storage program - <https://www.portlandgeneral.com/our-company/energy-strategy/resource-planning/energy-storage-very> good resource. See 5-part battery testing strategy: microgrid, substation, large solar + battery, residential VPP, and large-scale transmission-connected storage device.

²⁷³ Microgrid of the future emerges in Washington as Avista preps transactive DER project, by Robert Walton, UtilityDive, July 15, 2020. <https://www.utilitydive.com/news/microgrid-of-the-future-emerges-in-washington-as-avista-preps-transactive-d/581644/>

²⁷⁴ Clean Energy and Transactive Campus – Demand-side transactive controls at scale. <https://www.pnnl.gov/projects/clean-energy-and-transactive-campus>

[The Clean Energy Fund](#) description and reports of past awards also describes the status and updates of the following Commerce grant programs:

Grid Modernization Program

Commerce Grant Program	Description
Grid Modernization Program	This program is for public and private electrical utilities serving Washington customers. Utilities can partner with other public and private sector research organizations and businesses to apply for funding.
Electrification of Transportation Systems	This program provides grants to Washington State local governments and retail electric utilities for charging infrastructure.
Research, Development and Demonstration	This program provides a match for federal and non-state funds for strategic research and development projects on new and emerging technologies.
Wood Energy for Public Facilities	This program emphasizes projects that replace fossil energy sources with wood energy products (e.g., pellets, chips, cordwood, and other forms of forestry management debris) to meet the thermal and/or electrical needs of public facilities.
Grants to Nonprofit Lenders	Revolving Loan Fund grants show that a modest public investment can promote private investment. This drives economic activity and jobs for Washingtonians and helps our state lead the nation in energy efficiency.
Solar Deployment	The Solar Deployment program supports the development of projects that deliver environmental and economic benefit to Washington communities.
Dairy Digester Enhancement	The 2019 capital budget provides grants that enhance the viability of dairy digester projects, including bioenergy, improved energy efficiency and advanced nutrient recovery systems. Grants will include one project east and one west of the Cascades.

Commerce Clean Technology Sector

The Washington State clean technology sector is working with a variety of industries to provide technology and related production processes. These will improve their environmental and business performance. Our top priority is to create an economic understanding across the state, where innovation and entrepreneurship can thrive and create well-paying jobs. Website:

<https://www.commerce.wa.gov/growing-the-economy/key-sectors/clean-technology/>

American Jobs Plan (Federal Funding plan will be voted on sometime in the summer 2021; versions of this plan have significant funding for building climate resilience in communities)

Amazon Climate Fund

The Climate Pledge Fund ²⁷⁵is a corporate venture capital fund that invests in companies that can accelerate Amazon’s path to meeting The Climate Pledge. The scope is global and will consider

²⁷⁵ <https://www.theclimatepledge.com/us/en/about/the-climate-pledge-fund.html>

investments in companies developing products or services that reduce carbon emissions and help preserve the natural world.

Sector focus areas include:

- Transportation and Logistics
- Energy use, storage, and management
- Manufacturing and materials
- Circular economy
- Food and agriculture
- Renewable energy technology

Gates Related Funds

Breakthrough Energy Ventures²⁷⁶ – This fund basically follows the outlines of Bill Gates recent book and describes the problems and possible solutions under evaluation now.

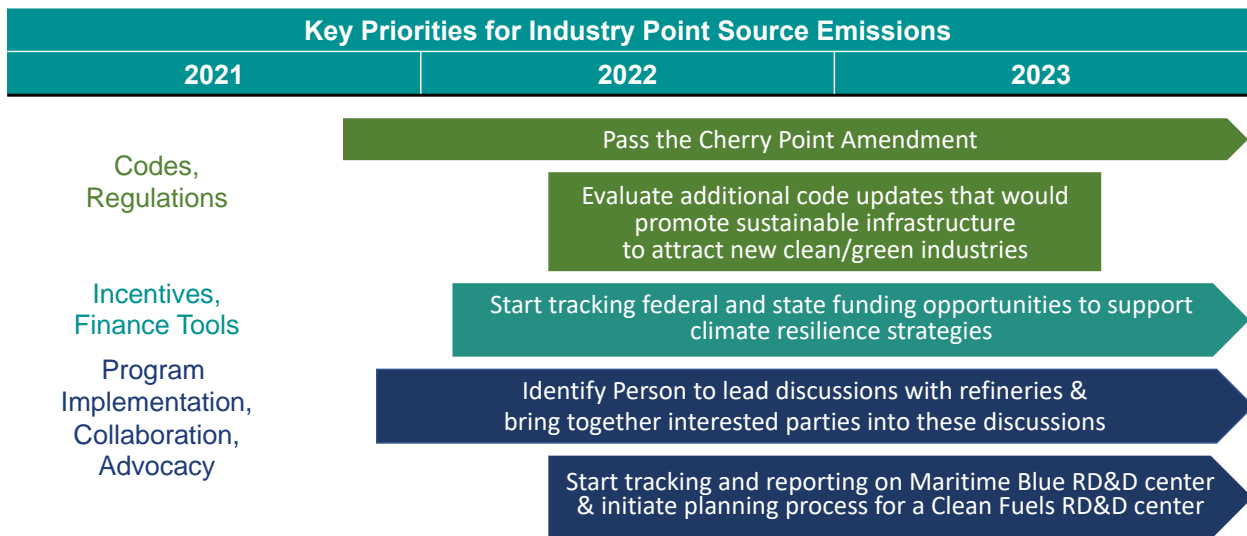
²⁷⁶ <https://www.breakthroughenergy.org/>

Industry Point Source Emissions Appendix

We would like to acknowledge the following individuals who provided valuable technical guidance and reviews of the industry point source emissions chapter:

Reviewer	Organization or Technical Area
Joel Swisher, PhD	Director, Institute of Energy Studies, WWU
Don Goldberg	Director of Economic Development, Port of Bellingham
Christine Grant	WWU, PUD1 Commissioner
Atul Deshmane	PUD1 Commissioner
Glenn Blackmon, PhD	Manager of Energy Office, WA Dept of Commerce
Michelle Jordon	Institute of Energy Studies, WWU
Ken Dragoon	Director of Hydrogen Division, Obsidian Renewables
Eugene Akiaten	Retired Petroleum Refinery Systems Director
Ray Kamada, PhD	Physicist, Kamada Science and Design
Robert Ruiz, PhD, MBA	President, Ruiz Energy Corporation
Pam Brady	Government Affairs Manager, <i>bp</i>
Elizabeth Davis	Commercial Optimization Superintendent, <i>bp</i>
Courtney Lancaster	Operations Superintendent, <i>bp</i>
James Berburg	Senior Environmental Engineer, <i>bp</i>
Sharon Shewmake, PhD	State Representative, WA 42 nd & WWU Energy Economics
David Hostetler	Engineer, research information & State Energy Strategy
Ellyn Murphy, PhD	CIAC - reviewing

Timeline:



Strategies, Actions and Benefits for Industry

1. Facilitate a solutions-focused collaboration with bp’s Cherry Point plant manager, energy experts in academia, and state and federal governments to achieve a 50% reduction in their point source emissions by 2030.	
Actions	Benefits of Actions
<p>1.1 Promote enhanced energy efficiency at bp’s Cherry Point refinery through recommendations outlined in US EPA’s EnergyStar program.</p> <p>1.2 Replace the current production and use of grey hydrogen at bp’s refinery with green hydrogen.</p> <p>1.3 Reduce GHG emissions at bp’s Cherry Point refinery and at any new or expanded facility at Cherry Point by promoting and facilitating the supply (i.e., transmission) and use of fossil-fuel free electricity.</p> <p>1.4 Develop recommendations for potential inclusion in the State’s Climate Commitment Act’s rulemaking process.</p> <p>1.5 Evaluate & promote possible incentives & tax subsidies at the federal level to accelerate the greening of refinery processes.</p>	<ul style="list-style-type: none"> • Reduce GHG emissions from industrial point source (1.1, 1.2). • Action 1.3 will reduce emissions from industrial buildings electricity use (insert hyperlink later) but will not impact industrial point-source emissions, which only apply to manufacturing processes. • Represent the County’s interests at the state (1.4) and federal (1.5) levels, especially development of the workforce.
2. Promote the research, development, and collaboration needed to build a hydrogen electrolysis facility to create green hydrogen in Whatcom County.	
Actions	Benefits of Actions
<p>2.1 Encourage PUD1 to evaluate the access to and availability of clean electricity from BPA to develop a 100 MW green hydrogen plant in Whatcom County.</p> <p>2.2 Create a task force with PUD1, Port of Bellingham, tribal & public representation with the goal of developing a solar and/or wind energy facility.</p> <p>2.3 Collaborate with PUD1 and the Port of Bellingham to reach out to known green hydrogen supporters and producers to build a new green hydrogen facility at Cherry Point.</p> <p>2.4 Working with State, federal, PUD1 and Port, understand the necessary legislative & fiscal support needed to construct a green hydrogen plant and supporting workforce.</p>	<ul style="list-style-type: none"> • Enabling increased T&D capacity to Cherry Point leverages access to regional electricity resources for all current and future users. (2.1) • A green H₂ facility will provide a large flexible load on the regional BPA grid that can negotiate lower prices for power. (2.1, 2.3) • Produce green hydrogen for multiple new markets by leveraging existing infrastructure (shipping, transport) and skilled workforce. • Attract additional clean energy manufacturers to Whatcom County. (all actions)

3. Establish a regional center for research, development and demonstration (RD&D center) to accelerate the development of low carbon fuels and building materials modeled after Washington’s Maritime Blue Strategy.

Actions	Benefits of Actions
<p>3.1 Ensure that the County or Port has representation in Maritime Blue given Whatcom’s strong maritime industry.</p> <p>3.2 Identify the technical areas and people needed to develop a concept document for the RD&D center on low carbon fuels and building materials. Solicit advice and help from the State Dept of Commerce Energy Office, Maritime Blue, and the US Dept of Energy for the concept document.</p> <p>3.3 Use the concept document to solicit funding for a detailed planning report to guide establishment of the RD&D center that includes potential industrial partnerships, funding opportunities, workforce training needs, and initial innovative demonstration projects that could be used to launch the center.</p>	<ul style="list-style-type: none"> • Sets the course and action to ensure Whatcom industries are relevant over the next several decades. • Provides the basis for workforce development needs in the County. • Ensures a vibrant future economy for the County by proactively competing in a rapid clean energy transition.

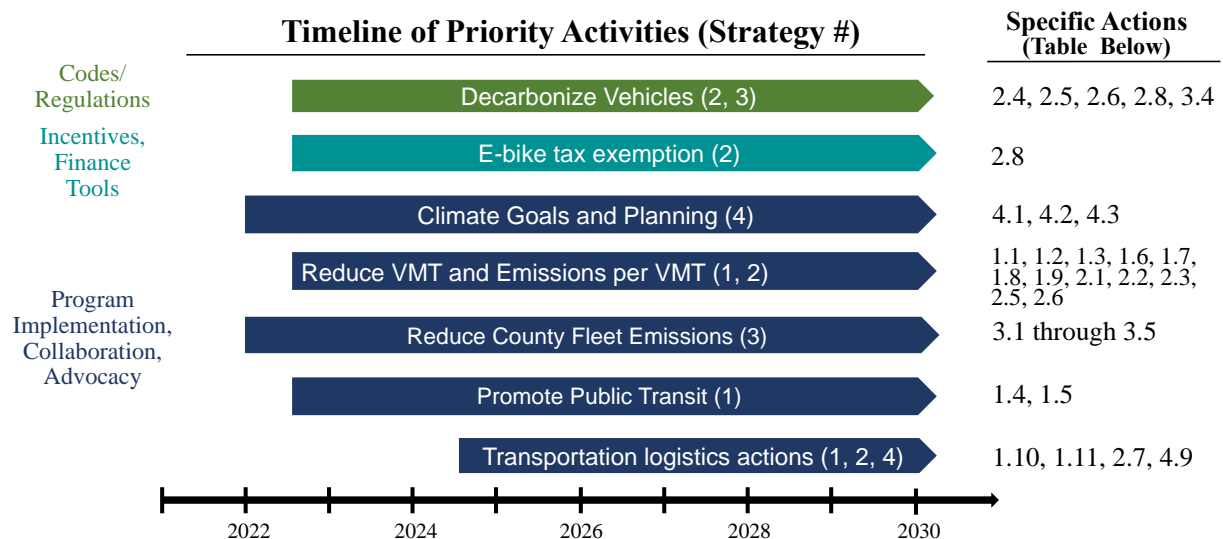
Transportation Appendix

This appendix provides a complete listing of all recommended actions under transportation strategies, along with description of each, as well as an identification of the actions that have a higher priority. Included in the descriptions that follow are suggestions about how to proceed and the identification of co-benefits and potential drawbacks.

While stressing that we believe all of the recommended actions should be completed, we can offer some suggestions regarding which of the proposed actions should receive a higher priority and have a higher sense of urgency attached. Some have been chosen because of their potentially large emission reductions or because they involve purchases of long-lasting vehicles or equipment. Others should be undertaken as soon as possible because they can be undertaken unilaterally and relatively quickly by County government units without requiring much in the way of additional expenditures and which in most cases can be easily incorporated into processes already taking place; these can also demonstrate the County’s resolve to address climate change issues. Some require legislative actions or changes to County regulations, while others can be accomplished through departmental policy changes that put more emphasis on the County’s climate goals.

We would like to thank the following reviewers who provided valuable comments and suggestions:

Reviewer	Organization or Technical Expertise
John Shambaugh	Washington Department of Transportation
Adrienne Hegedus	Port of Bellingham
Carryn Vade Griend	Puget Sound Energy
Daniel Tepper	Whatcom Parks and Recreation Foundation
Tim Wilder	Whatcom Transit Authority
Kirsten Wert	Whatcom Council of Governments
Lethal Coe & Transportation Technical Advisory Group	Whatcom Council of Governments



Transportation Strategies and Actions

1. Reduce vehicle miles traveled (VMT) by promoting alternatives to SOV transportation
Actions
<p>1.1 Update and Implement the Regional Trails Plan as identified in the 2011 Bicycle Pedestrian Plan and 2004 Chain of Trails plan and any subsequent revisions thereto to expand the regional trail network for commuting and recreation.</p> <p>1.2 Create safe active transportation routes to schools where they don't already exist, enhance existing active transportation routes to schools, and explore the electrification of school bus fleets.</p> <p>1.3 Create a countywide non-motorized plan, especially in UGAs of cities to Enhance bicycle and pedestrian commuting infrastructure, including storage/parking and dedicated off-road non-motorized trails.</p> <p>1.4 Work with WTA to improve transit service through network expansion, changes in transit schedules, and improved connections between transit routes and with other transport modes.</p> <p>1.5 Adopt any available state programs and fund local efforts to provide means-tested transit subsidies, such as low or no cost passes, to increase accessibility to transit.</p> <p>1.6 Support existing and develop new education and outreach programs to promote alternative transportation options.</p> <p>1.7 Work with employers to find programs and incentives to support multimodal commuting.</p> <p>1.8 Expand telecommuting and flextime scheduling for county employees and encourage other employers to do the same.</p> <p>1.9 Expand broadband internet countywide.</p> <p>1.10 Explore the feasibility of building multi-modal transfer stations to move freight from trucks to rail in coordination with the Port of Bellingham.</p> <p>1.11 Foster increased rail transportation for the public and industries.</p>
2. Promote increased utilization of electric, hybrid, and alternative fuel vehicles
Actions
<p>2.1 Implement a countywide EV promotions program through education and outreach.</p> <p>2.2 Offer pooled purchasing of EVs to reduce the upfront cost of such vehicles for Whatcom County residents.</p> <p>2.3 Work with local trade and technical schools, unions, and businesses to create an EV workforce pipeline.</p> <p>2.4 Install electric charging stations in strategic locations, prioritizing underserved locations.</p> <p>2.5 Require or provide financial incentives for major employers to provide onsite charging stations for employee EVs.</p> <p>2.6 Work with WTA and municipalities in the county to create infrastructure for electric buses.</p> <p>2.7 Develop an infrastructure plan for H₂ fuel distribution and other fuel mix options in coordination with state efforts.</p> <p>2.8 Exempt e-bikes and other e-ride devices from local sales taxes.</p>

3.Improve county vehicle fleet utilization while transitioning to non-fossil alternatives and reducing GHG emissions associated with county projects

Actions

- 3.1 The County should undertake an evaluation of its on-road vehicle fleet in order to achieve maximum GHG reductions. Considerations should include moving away from fossil fuels to electricity (EVs) and other clean fuels, the matching of vehicle numbers and types to their uses, and the potential for vehicle sharing among county departments. Ideally this would be accomplished by funding a study by an outside expert consultant.
- 3.2 Invest in a hybrid or electric technology to replace the Whatcom Chief ferry to Lummi Island.
- 3.3 Require end-of-life replacement of County-owned construction equipment using fossil fuels with alternative-fuel or electric equipment and encourage such replacements by private operators.
- 3.4 Incorporate contractor fuel emission reduction standards into bids and contracts and require reporting of fuel types and quantities used on specific contracted jobs.
- 3.5 Perform diesel exhaust retrofits for county-owned equipment, including filter technology with passive or active cleaning systems.

4. Use County resources to participate in and advocate for inter-governmental efforts to reduce GHG emissions associated with transportation.

Actions

- 4.1 Prioritize recommended actions within this Plan for funding and implementation within the County's 6-year Transportation Improvement Program
- 4.2 Continue to advocate for the advancement of climate goals in the Whatcom Council of Governments Regional Transportation Planning efforts.
- 4.3 Prioritize transportation climate goals when updating the Whatcom County Comprehensive Plan.
- 4.4 To the greatest extent possible adopt state Vehicle Miles Traveled (VMT) reduction targets and land use planning approaches designed to reduce VMT and SOV use. A separate strategy should be to adopt lower vehicular LOS standards in the County Comp Plan as a disincentive to auto-centric transportation planning.
- 4.5 While both are reliant on higher density development, participate in State-led efforts to provide resources and promote interjurisdictional coordination for VMT reduction programs, including Transit Oriented Development (TOD) and Transportation Demand Management (TDM).
- 4.6 Obtain available state funding to improve connections between transportation system elements.
- 4.7 Participate in any available state programs that would facilitate the transition to hybrid or electric vehicles by ride-share programs like Uber and Lyft.
- 4.8 Obtain available state-level funding for local jurisdictions to study freight travel reduction opportunities and plan for infrastructure improvements.
- 4.9 Evaluate and adopt methods for data collection to understand the impacts of commuting behavior.

Detailed Description of Actions

- **Recommended actions for Transportation Strategy 1: Create behavior change by promoting alternatives to SOV transportation**

Action 1.1: Implement the Regional Trails Plan as identified in the 2011 Bicycle Pedestrian Plan and 2004 Chain of Trails plan and any subsequent revisions thereto to expand the regional trail network for commuting and recreation.

A connected network of trails creates more walking, biking, horseback riding, and other active transportation opportunities to reduce the number of trips of single occupancy vehicles and provide more recreation options. Such a network can also assist school districts in creating safe routes to schools (see Action 1.2 below), and planning should incorporate that consideration. Efforts to create a well-integrated system of trails in Whatcom County have existed since the 1970s, and while good progress has been made, there still remains much work to do. The 2011 Bicycle Pedestrian Plan, created by the Bicycle Pedestrian Advisory Committee, contains planning considerations, implementation recommendations, and policy recommendations that are intended to provide guidance for expanding the active transportation trail network. The Bicycle Pedestrian Advisory Committee maintains a current list of priority projects. Expanding a trail network will require the County to acquire easements, purchase property, and work with the existing landholders and developers.

Action 1.2 Create safe active transportation routes to schools where they don't already exist, enhance existing active transportation routes to schools, and explore the electrification of school bus fleets.

Work with school districts to ensure that school property renovations support walking, biking, carpooling, and bussing to schools and that all school districts in Whatcom County maintain their Walk Route Plans, to be updated every two years. The Washington State Department of Transportation maintains Walk Route Plans and other resources, such as the Safe Routes to School Grant program, which provides funding to communities for project development. Work with school districts to ensure new schools are constructed in areas already well served by the multimodal transportation network. Consider implementing school crossing guard programs. Creating safe active transportation options for youth can also promote positive behavior and health outcomes. Messaging to students and their parents about available alternatives and their benefits will also play an important role.

We recognize that rural settings create challenges to active student transportation that aren't present in urban areas, but those challenges can be lessened if student transportation is included in County trail planning efforts (see action 1.1 above). We also recognize that school transportation systems are the responsibility of school districts, not county government, and that high costs

present a formidable barrier to school bus fleet electrification, but we note that new ownership models (e.g., leasing rather than purchase) are being tested in an effort to reduce those barriers.²⁷⁷

Action 1.3: Enhance bicycle and pedestrian commuting infrastructure, including storage/parking and dedicated off-road non-motorized trails.

Improvements to active transportation infrastructure can make such transportation modes safer, faster, more reliable, and more accessible. There are many potential infrastructure upgrades that would encourage increased use of active transportation. Some potential improvements can be found in the 2011 Bicycle Pedestrian Plan, including increasing safe and secure bicycle parking infrastructure at transportation nodes and residential, commercial, and public facilities; creating protective physical barriers for active mobility infrastructure; and installing adequate lighting, on-road paint, signage, and rain protection.

It is important to note that there is a distinction between Actions 1.1 and 1.3. Specifically, on-road active mobility infrastructure improvements, such as bicycle lanes, are less accessible and safe than trails and paths that are segregated from roads. Past efforts to grow the County trail system referred to in item 1.1 above included both off-road and on-road components, which should also account for a significant part of all relevant County transportation and parkland planning.

Action 1.4: Work with WTA to improve transit service through network expansion, changes in transit schedules, and improved connections between transit routes and with other transport modes.

Important factors that affect the willingness to use public transit are convenience and efficiency, its proximity to riders and any additional time required to use public transit as compared to SOV travel. WTA's goal is to increase public transit's share of work commuting from 5% to 9%²⁷⁸. The County should work with WTA to support and expedite these efforts, including the construction of park and ride lots and the extension of trails to public transit access points. Employers would also have an interest in such improvements, as many businesses and their employees are not located conveniently near current WTA routes.

Action 1.5: Adopt any available state programs and fund local efforts to provide means-tested transit subsidies, such as low or no cost passes, to increase accessibility to transit.

Reducing or eliminating the financial costs of riding transit can increase ridership. The outcomes can be improved when targeting specific communities, such as low-income, disabled, youth, seniors, or underserved communities. Cost reduction programs, such as Regional Reduced Fare Permits for

²⁷⁷ See, for example, Mufon, S., and S. Kaplan, "A lesson in electric school buses," Washington Post, Feb. 24, 2021. <https://www.washingtonpost.com/climate-solutions/2021/02/24/climate-solutions-electric-schoolbuses/>

²⁷⁸ WTA 2040 Long-Range Transit Plan, <https://www.wta2040.org/>

seniors and riders with disabilities, exist and could be expanded to include more people. State assistance in this area is recommended in the State Energy Strategy²⁷⁹.

Action 1.6: Support existing and develop new education and outreach programs to promote alternative transportation options.

Support and expand existing education and outreach programs that promote community mobility or active transportation. Work with other community partners who have shared interests like Whatcom County Public Health to promote active transportation and improve community health outcomes through transportation choices. Use targeting marketing in concurrence with new projects to increase community awareness of new projects and routes. The County could also partner with ridesharing apps as pandemic concerns about social distancing subside; this would be useful for not only trips to school and work, but also for shopping and leisure.

Action 1.7: Work with employers to find programs and incentives to support multimodal commuting.

Continue to offer transportation advising to employers, with an emphasis on large employers. Large employers in particular can change employee commute behavior by offering rebates for transit expenses, bike or walk to work incentives, secure bike parking, e-bike charging, flexible daily charging for parking, or employee showers within each building. For example, The Community Food Co-op currently offers employees a rebate on transit and bicycle costs.

Action 1.8: Expand telecommuting and flextime scheduling for county employees and encourage other employers to do the same.

Whenever possible, employers should develop telecommuting and flextime abilities for their employees. Telecommuting refers to the ability of employees to perform regular job duties remotely, or away from their primary business location. Flextime refers to a work schedule that permits employees to work hours that are alternative to the 8am to 5pm standard work schedule. In addition to reducing transportation demand, allowing employees the flexibility to choose their schedule and work remotely can assist individual needs, such as family needs, and increase employee morale and productivity while reducing tardiness and absence. County adoption of these approaches can serve as an example for other employers in the county and can inform them of the possible benefits. The community has gained very helpful insights into opportunities for and the workability of telecommuting during the COVID-19 pandemic. The County Human Resources Department would have the primary responsibility for leading this effort for County employees and the proposed Office of Climate Action recommended in Section 4 of this report would carry out communications with other employers.

Action 1.9: Expand broadband internet countywide.

²⁷⁹ Washington State Department of Commerce, 2021, 2021 State Energy Strategy, p. 58.
<https://www.commerce.wa.gov/growing-the-economy/energy/2021-state-energy-strategy/>

Expanding broadband internet countywide should be done prior to or in conjunction with action 1.7. In addition to reducing commuting needs, providing broadband internet countywide can also increase quality of life to underserved or more distant, rural areas by allowing access to online services. There is an existing community interest in expanding broadband internet countywide, and the pandemic has strengthened that interest.

Private internet service companies typically provide adequate service in denser urban settings but find less dense rural areas less lucrative, resulting in unserved or underserved areas where publicly owned providers should step in. Funding such public efforts is an important barrier to rural broadband extension. While state funding is available for counties classified as rural, Whatcom County is not in that category. Some federal infrastructure money that could be used for broadband projects has been made available to states through the recently enacted American Rescue Plan, and there is also some pending federal legislation to help fund the expansion of broadband access.

In its latest strategic plan²⁸⁰ Whatcom PUD No. 1 identifies, as one of its 2019 New Initiatives, “Working with the Port of Bellingham to advance analysis of need for development of broadband services in the county to determine future role of the PUD in infrastructure (fiber) development.” The County should support any such community efforts to provide publicly owned broadband access, both financially and by taking any regulatory actions necessary to assist broadband expansion. It should also seek any available federal or state funding available to counties.

Action 1.10: Explore with the Port of Bellingham the feasibility of building multi-modal transfer stations to move freight from trucks to rail.

The County currently relies on medium- and heavy-duty freight trucks for transporting goods. Because the technology for zero and low emission freight trucks is undeveloped or still being developed, the County should consider a shift to rail to offset freight emissions. Increasing the use of rail for transportations of goods will require a broader, more regional effort that includes potential coordination with the State, British Columbia, or the entire West Coast, in addition to the private freight rail carriers. Because of the regional nature of this option, it is likely that the most likely role for the County (through the proposed Office of Climate Action)

Action 1.11: Foster increased rail transportation for the public and industries.

Increasing the use of rail for transportations of goods or people will require a regional effort. The County should work with community partners and stakeholders to explore the benefits and opportunities of increased rail transportation in Whatcom County and explore/consider opportunities to develop passenger rail service transportation within Whatcom County. For example, efforts are underway to add an Amtrak station in Blaine, thus improving rail connectivity along the I-5 corridor.

- **Recommended actions for Transportation Strategy 2: Promote increased utilization of electric, hybrid, and alternative fuel vehicles.**

²⁸⁰ Public Utility District No. 1 of Whatcom County, “Strategic Plan 2025,” p. 8 https://www.pudwhatcom.org/wp-content/uploads/2019/04/Whatcom-County-PUD-No.-1-Strategic-Plan_2025.pdf

Action 2.1: Implement a countywide EV promotions program through education and outreach.

One important barrier to more rapid adoption of EVs, which can be minimized through education and outreach efforts, is a basic lack of understanding on the part of consumers. These efforts should be overseen in Whatcom County by the Office of Climate Action recommended in Section 4 of this report. For example, Puget Sound Energy (PSE) has shown a willingness (in official filings with the Washington Utilities and Transportation Commission in 2018) to assist in those efforts, and County EV education and outreach should take advantage of that. In addition, the recently issued State Energy Strategy recommends that the Legislature provide resources for these efforts. Whatcom County Code Chapter 2.126, which established the Climate Impact Action Committee, states (2.126.030H) that one of CIAC's functions is to "Serve as a conduit for public education, information exchange, and engagement in support of Whatcom County's climate change mitigation and impact prevention, adaptation, and preparation goals. This action recommendation would therefore be carried out by CIAC in conjunction with the proposed Office for Climate Action and any other relevant county departments.

Action 2.2: Offer pooled purchasing of EVs to reduce the upfront cost of such vehicles for Whatcom County residents.

Pooled purchases reduce the upfront cost of EVs to consumers. While there is already a federal tax credit of up to \$7,500 for EV purchases, pooled purchasing can provide an additional incentive. This would be even more important for buyers in lower income brackets whose income tax liability would not be high enough to allow for the full \$7,500 credit. Whatcom County government may be able to use its buying power to initiate and maintain such a program, which would be established and coordinated through the Office of Climate Action recommended in Section 4 of this report.

Action 2.3: Work with local trade and technical schools, unions, and businesses to create an EV workforce pipeline.

More widespread adoption of EVs will require a larger skilled workforce to sell and service EVs as well as maintaining the publicly or privately owned charging infrastructure. For example, the Whatcom Transit Authority's 2017 Six-year Strategic Plan identifies the need for a maintenance personnel training program as WTA adds electric buses to its fleet. In Skagit County the Northwest Washington Electrical Industry Joint Apprenticeship training center in Mount Vernon has a program for installing EV charging stations. Bellingham Technical College or Whatcom Community College could develop a similar training program. The proposed Office of Climate Action can help coordinate these efforts.

Action 2.4: Install electric charging stations in strategic locations, prioritizing underserved locations.

What has been termed "range anxiety" is the concern of existing and potential EV owners regarding when and where to charge their vehicles. Initial adopters typically are single-family homeowners who for the most part charge their vehicles at home, but there will be an increased need for public charging stations, especially in underserved areas. The 2020 State Energy Strategy recommends state funding of a charging infrastructure needs assessment.

PSE has four pilot programs in place to help increase charging capabilities: single family, multi-family, public charging, and for employers. There are also privately owned public stations in Whatcom County. See [PlugIn America](#) for a locator map of these stations.

Level 1 charging is the simplest, but also the slowest (2-5 miles of range per hour of charge time), requiring only a standard 120V grounded outlet at 8 or 12 amps, and is most commonly used in single family homes. Level 2 charging requires 240V service but is at least twice as fast as Level 1 (10-25 miles of range per hour of charge time); these can be installed in single family homes but are more common at workplaces, apartment buildings, and public areas. Finally, Level 3 or DC fast charging will provide a full charge in approximately one hour. This requires more specialized equipment and is commonly found in public areas and along heavy traffic corridors such as interstate highways. Note that “public” does not necessarily mean “free”; various pricing structures are used, including subscription and pay-by-the-hour.

Although private charging companies are becoming more common, they typically do not place chargers in low use areas, sometimes called “nonattainment” areas. Such areas will have to be served in other ways, such as through publicly funded chargers. Recently enacted Washington State legislation (HB 1091) regarding a Low Carbon Fuel Standard provides for funding by electric utilities of chargers in these underserved areas. In addition, PSE is running a “Multifamily Charging” pilot at four multifamily housing sites in Whatcom County.

Coordinated efforts to provide charging capabilities could be overseen by the proposed Office of Climate Action, which could also assess the extent to which the County should be involved in the provision of charging facilities. One concrete action that county government could take is an adjustment of building codes to require new (and perhaps older) buildings to have electrical systems capable of handling the increased electrical demands resulting from EV charging activities. If necessary, zoning regulations should be changed to allow easier placement of charging stations. Building codes should be revised to require or strongly encourage the inclusion of or, at the very least, the electrical system capability for charging stations in multifamily residential buildings

Action 2.5: Require or provide financial incentives for major employers to provide onsite charging stations for employee EVs.

While some employers are already doing this, possible county government actions in this area include requiring by law employers of a certain size to provide charging facilities or offering tax advantages to employers who do so. PSE has a Workplace Charging pilot underway with Western Washington University and the Whatcom County Civic Center.

Action 2.6: Work with WTA and municipalities in the county to create infrastructure for electric buses.

Whatcom Transit Authority's 2017 Six-year Strategic Plan, Appendix C, presents an analysis of the possibilities and challenges associated with public transit electrification, including the need for charging stations in appropriate locations. WTA expects delivery of its first two electric buses in early 2021. A major impediment to rapid electrification is the high initial cost of the buses (\$400,000 higher than conventional diesel), but new ownership models being used for school bus fleets might

also be applied to public transit fleets (see the discussion of Action 1.2 above). Whatcom County's role could include assistance in finding such locations and in helping WTA fund the installation of the chargers, which could be done through the proposed Office of Climate Action.

Action 2.7: Develop, in coordination with state efforts, an infrastructure plan for H2 fuel distribution and other fuel mix options.

While EVs are clearly the immediate future of non-fossil fueled vehicles, technologies for fuel cell vehicles (FCVs) that use hydrogen as a fuel are showing considerable promise. An important issue confronting this technology (similar to charging stations for EVs) is providing an adequate fueling station network. This would eventually require a new hydrogen pipe system connecting fueling stations. Whatcom County's immediate role in this process would be to cooperate with state efforts outlined in the 2020 State Energy Strategy to undertake a comprehensive FCV fueling infrastructure needs assessment, and such County efforts would be overseen by the proposed Office of Climate Action.

Action 2.8: Exempt e-bikes and other e-ride devices from local sales taxes.

While the portion of an e-bike's final sales price accounted for by local sales taxes is small, so is the proportion of county tax revenues. Exempting such sales from these taxes would be a low-cost way to signal the County's support for these vehicles and accommodates a proposed action in the State Energy Strategy (p. 58) for local governments to "explore options for providing incentives for e-bikes and other electric transportation devices." This exemption could be modelled after [HB 1330](#).

➤ **Recommended actions for Transportation Strategy 3: Improve county vehicle fleet utilization while transitioning to non-fossil fueled alternatives and reducing GHG emissions associated with county projects.**

Action 3.1: The County should undertake an evaluation of its on-road vehicle fleet in order to achieve maximum GHG reductions. Considerations should include moving away from fossil fuels to electricity (EVs) and other clean fuels, the matching of vehicle numbers and types to their uses, and the potential for vehicle sharing among county departments. This would be best accomplished by funding a study by an outside expert consultant.

Although total emissions from all County government operations amount to just over 0.001% of the overall total for Whatcom County, it is important for county government to demonstrate its commitment to GHG emission reductions and model ways in which other organizations and the general public can achieve such reductions. While the County vehicle fleet accounts for only a third or so of county government operations emissions, and those fleet emissions fell by roughly 20% between 2000 and 2017, the county fleet can serve as a very visible example of ways in which emissions can be reduced by the broader Whatcom community. (Emissions data are taken from the recently completed Whatcom County Greenhouse Gas Inventory Report.)

The most obvious way to reduce fleet emissions is to convert the fleet to EVs and other clean vehicles. The optimal approach to doing so involves first understanding how the fleet is used, and then determining and following the best path to conversion without reducing the benefits of the

vehicle fleet. It is likely that the County will have to engage an outside consulting firm with experience in performing such analyses. That analysis would also help to ensure that the fleet composition is optimal. While vehicle sharing may not result in significant emissions reductions, it would reduce the required size of the fleet, thereby decreasing required expenditures.

Action 3.2: Invest in a hybrid or electric technology to replace the Whatcom Chief ferry to Lummi Island.

The ferry only accounts for .05% of Whatcom County transportation GHG emissions, but it is a significant single source. Although the Washington State Energy Strategy ²⁸¹(p. 61) discusses efforts of Washington State Ferries to decarbonize its fleet using hybrid and electric technologies, it makes no specific recommendation regarding funding those activities, nor does it address ferries operated by other units of government. It is especially important to consider a cleaner technology now because the ferry will likely have a long life—the Whatcom Chief is 60 years old—and locking in an old GHG emitting technology for such a long time should be avoided. Adopting a carbon neutral ferry would not only result in lower GHG emissions, but it would also have the additional significant benefit of reducing the local air and water pollution impacts from burning and handling diesel fuel.

Fortunately, the County is already taking steps in this direction. The Whatcom County 2019-2032 Fourteen Year Ferry Capital Program²⁸² quotes from Whatcom County Resolution 2018-026, stating “To approach the goal of a carbon neutral vessel and provide flexibility for future electric conversion and reliability, the design of the vessel shall be a hybrid diesel-electric.” The capital budget shown in the Ferry Capital Program indicates an anticipated \$14.35 million for boat construction; part of this cost would be covered by the recently approved increase in Lummi Island Ferry fares. The Lummi Island Ferry Advisory Committee has stated in a February 2020 resolution that “once funding is in hand and the project can begin, LIFAC recommends that PWD allocate planning resources and create a timeline with milestones for upgrading the vessel to a carbon neutral propulsion system.” This Committee strongly urges the County to follow the LIFAC recommendation.

One challenge to the full electrification of the ferry is increasing electricity transmission and distribution capacity on the Lummi Peninsula or Lummi Island to accommodate higher loads caused by charging the ferry, and, since these technologies are relatively new and still evolving, there is also a potential of reduced reliability and increased maintenance costs.

Action 3.3: Require end-of-life replacement of County-owned construction equipment using fossil fuels with alternative-fuel or electric equipment and encourage such replacements by private operators.

Most construction equipment currently utilizes diesel fuel. First, the County should explore such replacements for its own equipment inventory and make those replacements when equipment reaches the end of its useful life. Second, the County should engage in outreach to construction

²⁸¹ <https://www.commerce.wa.gov/growing-the-economy/energy/2021-state-energy-strategy/>

²⁸² Available at <https://www.whatcomcounty.us/DocumentCenter/View/40743/Exhibit-B-2019-2032-Ferry-Capital-Plan-v21-RR-Final>

companies or other businesses that use fossil-fuel burning equipment to ensure awareness of the options and benefits of alternatives and encourage their adoption. Encouragement could take the form of requiring that all equipment used on work under contract with the County be fueled by electricity or other clean alternative fuels by some future date certain (e.g., 2030).

Action 3.4: Incorporate contractor fuel emission reduction standards into bids and contracts and require reporting of fuel types and quantities used on specific contracted jobs.

Work with the Planning and Development Services Department to modify existing contracts and other documents and implement data collection programs. County Requests for Proposals should require estimates of the amount of fossil fuels that will be used on a project as well as maintaining an actual record of the amount of these fuels used after the project has concluded; such information will improve the accuracy of future GHG inventories. This action will have no direct impact on current emissions, but it has nevertheless been designated a high priority item because it has a relatively low cost, and it sends a signal about potential future requirements.

Action 3.5: Perform diesel exhaust retrofits for county-owned equipment, including filter technology with passive or active cleaning systems.

Cleaning up the exhaust from off-road mechanical equipment would not appreciably reduce CO₂ emissions, but it can reduce other GHG emissions (e.g., NO_x) as well as other types of pollution that cause negative health impacts (e.g., particulates).

Recommended actions for transportation strategy 4: Use County resources to participate in and advocate for inter-governmental efforts to reduce GHG emissions associated with transportation.

Action 4.1: Prioritize recommended actions within this Plan for funding and implementation within the County's 6-year Transportation Improvement Program.

Whatcom County's Transportation Improvement Program (TIP) is a federally mandated plan that lists upcoming transportation and associated funding sources and informs regional long-range transportation planning efforts. The plan reflects the transportation priorities of the County as identified in the Comprehensive Plan. In coordination with an update to the Comprehensive Plan, as recommended in Action 4.3, the Capital Construction projects identified in the TIP should align with the County's climate goals. The next update for the plan is scheduled for 2025.

Action 4.2: Continue to advocate for the advancement of transportation climate goals in the Whatcom Council of Governments Transportation Improvement Programs.

WCOG currently considers climate impacts and prioritizes emissions reductions in its decision-making process. See, for example, the 2016 Comprehensive Plan and Whatcom Mobility 2040. The County should continue to use its position in WCOG to advocate for the prioritization of emissions reductions and climate resilient transportation infrastructure in WCOG's TIP projects. While there are several items in the current TIP that align with other recommended actions in this report, climate change issues (both emission reductions and improved climate resilience) should be emphasized equally with safety issues in formulating future plans.

Action 4.3: Prioritize transportation climate goals when updating the Whatcom County Comprehensive Plan.

Whatcom County's Comprehensive Plan is a guiding document for growth in unincorporated areas in coordination with the new plans of its cities that establishes a framework of goals, policies, and action items for growth planning. The Comprehensive Plan is a tool to be used in decision-making and can also be used to apply for grant funding. In the County's 2016 Comprehensive Plan, Goal 10-D calls for the "Strengthen[ing of] the sustainability of Whatcom County's economy, natural environment, and built communities by responding and adapting to the impacts of climate change." At the same time, the Plan's Goal 6B in [Transportation](#) does not include climate or other environmental goals as clear priorities, while other goals (e.g., 6D, 6E, and 6K) clearly support other recommendations in this report. The 2025 Comprehensive Plan should include an emphasis on the most current emissions reduction goals.

Action 4.4: To the greatest extent possible adopt state Vehicle Miles Traveled (VMT) reduction targets and land use planning approaches designed to reduce VMT and SOV use.

The recently released Washington 2021 State Energy Strategy ²⁸³(pp. 53-54 and Appendix C) recommends the establishment of clear VMT reduction targets that can be used to gauge the joint progress of multiple activities targeted at reductions in transportation activities. That document states (Appendix C, p. 1): "VMT is a function of the distances between destinations, the availability of transportation options and the availability of technologies and services that could replace travel. Land use patterns are a key factor in demand for transportation. Reducing VMT requires transportation planning and land use planning to be coordinated." Targets are to be achieved through direct means such as increased use of alternatives to SOV travel as well as through land use decisions such as the adoption of transportation-oriented development (TOD) principles; see Action 4.5 also. One simple example of the intersection of transportation and land use policy is the difficulty of using public transit in rural areas because buses lack safe "turn-around" options and passengers lack safe pedestrian access to the network. The Strategy recognizes that transportation needs are different in urban, suburban, small city, and rural environments and recommends that the state adopt regional VMT targets, perhaps linking state transportation funding to achieving targets for VMT along with other efficiency and equity metrics. Whatcom County should monitor and, if possible, participate in the development of these targets, and once the targets are established, they should be incorporated into all relevant County planning processes.

Action 4.5: Participate in State-led efforts to provide resources and promote interjurisdictional coordination for VMT reduction programs, including Transportation Oriented Development (TOD) and Transportation Demand Management (TDM).

This recommendation is related to Action 4.4 in that it also flows from the Washington 2021 State Energy Strategy (see pp. 54-55). Whatcom County should monitor and participate in these coordination efforts through the Office of Climate Action recommended in Section 4 of this report.

²⁸³ <https://www.commerce.wa.gov/growing-the-economy/energy/2021-state-energy-strategy/>

Action 4.6: Obtain available state funding to improve connections between transportation system elements.

Regularly explore and seek funding options for local jurisdictions to improve connections between transportation system elements. The Washington 2021 State Energy Strategy recommends (p. 57) the establishment of a state-level fund to support these efforts. Whatcom County would carry out this recommendation through the Office of Climate Action recommended in Section 4 of this report.

Action 4.7: Participate in any available state programs that would facilitate the transition to hybrid or electric vehicles by ride-share programs like Uber and Lyft.

Regularly explore and participate in any available state programs that would facilitate the transition to hybrid or electric vehicles by ride-share programs like Uber and Lyft. The City of Seattle’s “Clean Transportation Electrification Blueprint” calls for the electrification of ride-sharing vehicles by 2030. Such services are less prominent in Whatcom County than in Seattle, so that electrifying them would not yield significant emissions reductions, but doing so would nevertheless serve as a reinforcement of the push for electric vehicles in the county. Whatcom County would carry out this recommendation through the Office of Climate Action recommended in Section 4 of this report.

Action 4.8: Obtain available state-level funding for local jurisdictions to study freight travel reduction opportunities and plan for infrastructure improvements.

Heavy duty trucks account for only 5% of the vehicles on the road nationally but are responsible for 25% of US transportation emissions²⁸⁴. Such vehicles therefore represent important emissions reductions opportunities. The County should explore and seek funding options for local jurisdictions to study freight travel reduction opportunities and plan for infrastructure improvements. The Washington 2021 State Energy Strategy states (p. 60): “State and local governments should have access to sufficient resources, including data, to conduct planning and implement strategies for reducing VMT and greenhouse gas emissions in freight operations.” The Office of Climate Action recommended in Section 4 of this report would be tasked with monitoring and participating in freight VMT and emissions reductions programs established at the state level.

Action 4.9: Evaluate and adopt methods for data collection to understand the impacts of commuting behavior.

Explore data collection tools and methods best practices and regularly collect transportation data that can help inform continued transportation-related decisions. Consider expanding on existing data collection efforts, such as the City of Bellingham’s Bicycle/Pedestrian Survey. Involve other local public/private jurisdictions in data-collection efforts. After establishing a preferred method of data collection, regularly measure and publish relevant data. This recommendation parallels one made in the 2019 Community Research Report produced by the Climate Action Advisory Committee (see

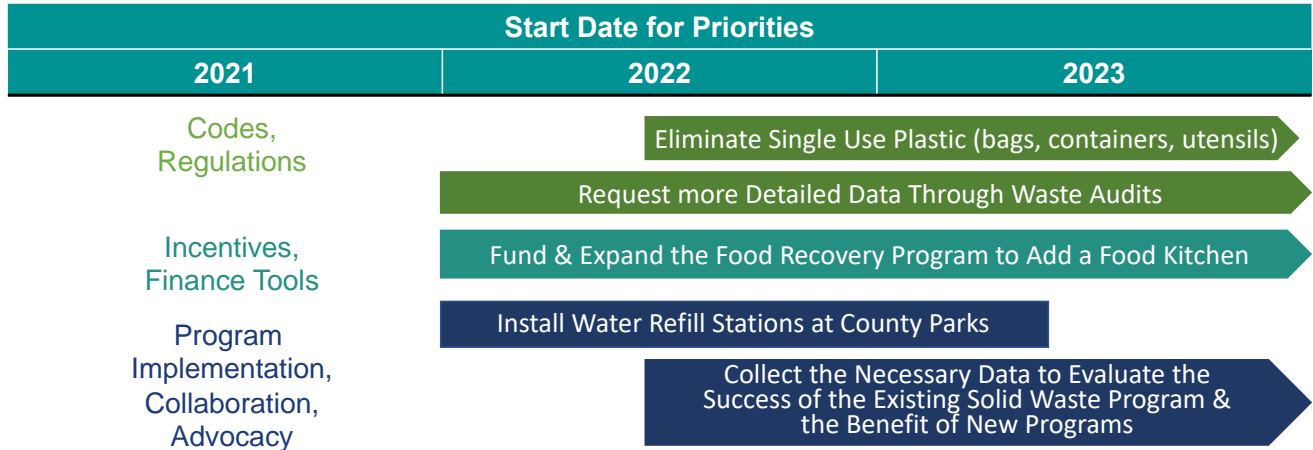
²⁸⁴ Walton, Robert, 2021. “As EV economics improve, medium- and heavy-duty trucking may be ‘next big frontier’ for clean transportation,” *Utility Dive*, March 25, 2021.

Table 2.1, p. 54). This task could be performed by the proposed Climate Action Office or by a contracted outside organization.

Waste Appendix

We would like to thank the following people in the Whatcom County Health Department who provided valuable insights for this chapter on waste emissions: Ali Jensen, Jennifer Hayden, and John Wolpers. A very special thank you to Vicki Thomas (LWV) who conducted interviews and wrote the chapter on Waste for the 2019 Community Research Project. Much of the information in this Climate Action Plan originate directly from her work.

Timeline of Priority Actions



Waste Strategies and Actions

1. Reduce the volume of non-recyclable single-use items and product packaging materials by increasing restrictions on disposal and communitywide education.
Actions
1.1 Eliminate single use plastic bags, containers and utensils used by restaurants and retailers via County ordinances. Require compostable, single-serving containers at commercial locations including stadiums.
1.2 Educate County residents and retailers on identifying product packaging that cannot be recycled and incentivize product manufacturers to provide better packaging options.
1.3 Request more detailed data through waste audits, as needed, from material handlers to better understand the effectiveness of County programming.
1.4 Identify large volume contributors to the solid waste stream and develop a community-wide campaign that either discourages product consumption or promotes changes in the packaging by the manufacturer.
1.5 Require higher percentages of recycled materials in products and packaging purchased by the County government.
1.6 Install water refill stations at County parks to avoid the need for people to buy water in plastic bottles.

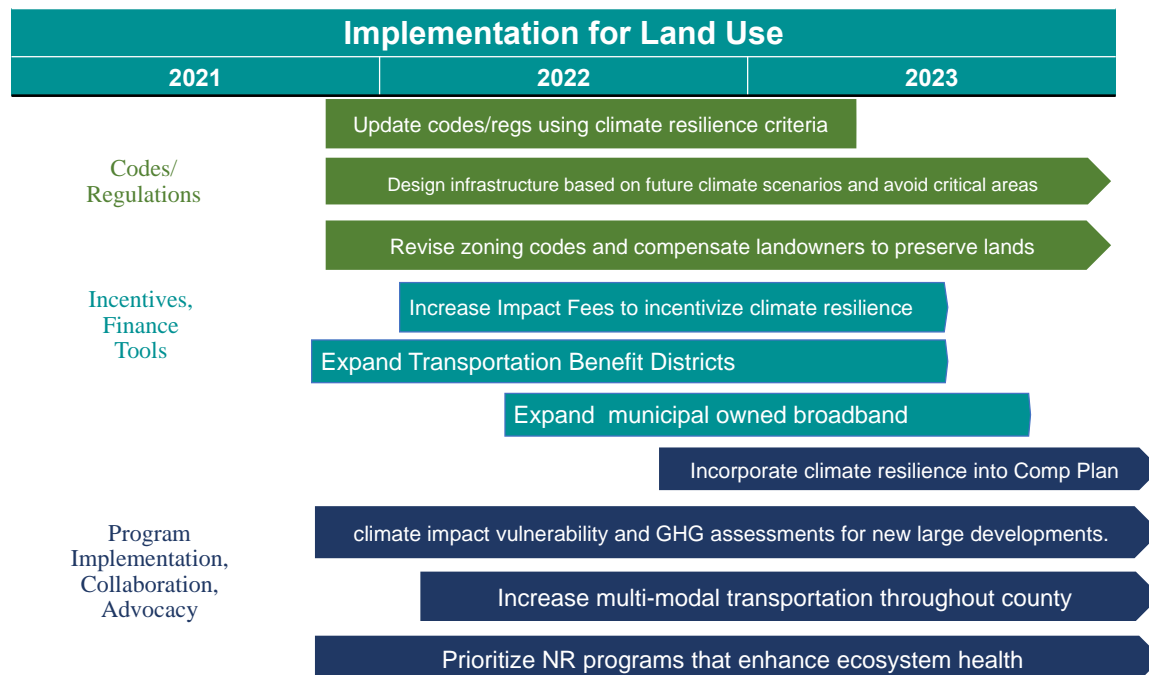
2.Reduce the growth of food waste through better utilization, collection, and composting.
Actions
<p>2.1 Fund and expand the Sustainable Connections Food Recovery program. Add funding for a food kitchen to better utilize time-sensitive food use.</p> <p>2.2 Make Food Plus (the curbside food and yard waste recycling) mandatory for single and multi-family residents that do not have an on-site composting capability (e.g., compost bin or feed for livestock).</p> <p>2.3 Provide option of smaller trash containers at a reduced cost to offset the cost of action 2.2.</p>
3.Understand the impact of methane emissions from septic systems in the county.
Actions
<p>3.1 Evaluate the growth trend in septic systems in the County and determine how regulations can be used to limit future growth in methane emissions.</p> <p>3.2 Determine the costs and potential GHG emission benefit of switching current septic systems to nearby/accessible municipal sewage systems.</p>
4.Provide incentives to builders for the reuse of building materials in new construction.
Actions
<p>4.1 Revise the County’s Flow Control Ordinance (No. 91-041) to include construction and demolition debris to prevent disposal at undesignated disposal sites and encourage recycling of building materials.</p> <p>4.2 Evaluate potential for instituting recycling requirements for construction sites through the building permit program.</p>

Land Use Appendix

We would like to acknowledge the following people who provided valuable suggestions to the early formulation and drafts of this section on land use:

Reviewers	Role/Contribution
Kavlee Galloway	Lead author
Ellyn Murphy	Guidance and big picture
Steve Harrell	Guidance and text editing
Dave Kershner	Guidance; Land Use lead for CRP Report
Phil Thompson	Advised on transportation and infrastructure
Chris Elder	County Staff
Cliff Strong	County Staff
Matt Aamot	County Staff
Karlee Deatherage	RE Sources, Water and Land Use Policy

Timeline for Land Use



Land Use Strategies and Actions

1. Buildings, Industry and Land Development: Develop and implement a sustainable and climate resilient regulatory framework for new County developments (residential, commercial and industrial) that includes improved building energy use, greater density, multimodal mobility options, and minimal impact to natural ecosystems.

Actions

- 1.1 Use climate resilience as a criterium for updating the Comprehensive Plan, land use codes and building codes in rural areas. Consider building energy efficiency and density, drought-tolerant landscaping, and maintenance of tree canopy cover. Also revise codes to encourage the siting of community-scale renewable energy.
- 1.2 Update land use/housing regulations to concentrate new developments in urban growth areas (UGAs) that can be serviced by city utilities to eliminate expansion of septic and well water systems. Promote increased building energy efficiency and density of single and multifamily housing and encourage cities to also increase density to reduce urban sprawl. Provide incentives to build mixed-use neighborhoods.
- 1.3 Exclude residential development in riparian corridors, floodplains, and on shoreline areas subject to storm surge. In addition, preserve rural and commercial forest lands and agricultural lands.
- 1.4 Require climate impact vulnerability assessments and projected GHG emissions and mitigation in the planning of large new county residential, commercial or industrial developments.
- 1.5 Collect or increase impact fees in rural areas to help offset the climate-related costs to the County. Use these fees to fund projects that reduce GHG emissions and promote climate resilience.
- 1.6 Use the updated County Wildland Urban Interface (WUI) map from the DNR to require International Building Codes in WUI areas to reduce wildfire damage

2. Transportation: Develop a climate resilient County transportation system that maximizes safe and efficient multimodal mobility, while protecting natural ecosystems and reducing GHG emissions.

Actions

- 2.1 Require multimodal transportation plans for new large-scale developments²⁸⁵, and encourage for smaller developments, to identify public multimodal options, impact on traffic congestion, access to basic services and emergency response, safe evacuation routes, as well as improved quality of life.²⁸⁶
- 2.2 Promote equitable transit-oriented development policies and standards that support efficient use of land, affordable housing developments near transit corridors, reduced volume of single occupancy vehicles, and increased urban access and circulation within the UGA.
- 2.3 Work with Whatcom Transportation Authority to ensure service is planned for high density areas. The target should be for new residential projects consisting of 25 units or more to be located within 0.5 mile of a transit node, shuttle service, or bus route with regularly scheduled daily service.

²⁸⁵ For residential development, examples of large-scale developments may include planned unit developments, manufactured home parks and subdivisions, trailer/mobile home parks, and large multi-family residential complexes. For commercial and industrial, major industrial development as defined in [RCW 36.70A.365](#).

²⁸⁶ Are there thresholds proposed? If a duplex or a minor commercial addition is proposed, will they have to do the plan? How will this add to the cost of housing and other development?

- 2.4 Require bicycle/walking trail infrastructure planning and development in new multi-unit developments, long subdivisions, and in developments where relevant County codes already require sidewalks. Emphasize trail connectivity to schools and services.
- 2.5 Expand Transportation Benefit Districts under RCW Chapter 36.73 to fund transportation projects that reduce greenhouse gas emission such as new trails, electric vehicle charging stations, and park and ride lots.
- 2.6 Require new County buildings be located in areas with convenient multimodal transportation systems, including public transit and bicycle/walking trails. Include an assessment of employee commute emissions and projected public emissions based on the current transportation options.

3. Infrastructure: Require a climate-focused risk assessment of the project’s ability to function under future climate scenarios for all new County infrastructure (e.g., roads, bridges, emergency services, etc.) over the projected lifespan of the new infrastructure.

Actions

- 3.1 Develop a climate resilient infrastructure plan that identifies, protects, connects, and enhances ecosystem resilience. Require all new county infrastructure to meet resilient criteria. Plan should identify critical infrastructure, such as roads, bridges, and emergency services at risk in climate impact zones or related hazardous areas and a plan to upgrade or relocate.
- 3.2 Avoid infrastructure development in critical watershed areas, wetlands, and high value ecosystems.²⁸⁷
- 3.3 Prioritize replacement or retrofits of all county culverts that impact fish passage with fish friendly and climate resilient alternatives.
- 3.4 Collaborate with the Port of Bellingham and Whatcom PUD to fully fund and implement municipal-owned broadband service, especially in rural and underserved areas.

4. Natural Resources: Strengthen zoning codes and regulations to limit development in sensitive areas and high ecological value lands such as riparian corridors, floodplains, shorelines, forestry, agricultural lands, and climate impact zones that are not part of the urban growth area.

Actions

- 4.1 Accelerate and increase funding for the County’s Purchase of Development Rights program to compensate landowners willing to sell conservation easements.
- 4.2 Revise zoning codes to reduce development potential in high value working lands and ecosystem areas, including the Rural Study Areas²⁸⁸ and climate impact zones. Consider zoning changes based on water availability. Compensate landowners subject to a rezone based on the estimated value of the rights removed.
- 4.3 Update the Whatcom County Comprehensive Plan to require 1) net ecological gain as a component of land use actions (HB 1117²⁸⁹), and 2) vulnerability assessments using science-based future climate scenarios.
- 4.4 Develop and implement a County ecosystem conservation plan or program that implements protection of critical habitat, critical core wildlife habitat, and climate migration corridors, and incorporate into relevant county plans and codes, as currently assigned to the Wildlife Advisory Committee.

²⁸⁷ Refer to [WCC Chapter 16.16 Critical Areas](#) definitions for critical watersheds and ecosystems

²⁸⁸ https://www.whatcomcounty.us/DocumentCenter/View/44710/Final_Rural-Land-Study-Report-2019-Update

²⁸⁹ <https://app.leg.wa.gov/billssummary?BillNumber=1117&Year=2021&Initiative=false>

Water Resources and Fisheries Appendix

We would like to acknowledge the following people who provided valuable suggestions to the early formulation and drafts of this chapter on water resources and fisheries:

Reviewers	Organization or Technical Expertise
Lisa Wilson, G.I. James, Kara Kuhlman, Karl Mueller	Lummi Nation Natural Resources
John Thompson	Whatcom County

Strategy, Action, Benefit Table for Water Resources & Fisheries

1. Resolve uncertainty in current and future water supply by accurately measuring water supply and understanding the impact of climate change on watersheds.	
Actions	Benefits of Actions
<p>1.1 Support resolution of WRIA 1 water supply by utilizing groundwater/surface water model analyses of current water use and supply, including projections of future water supply based on climate science.</p> <p>1.2 Expand monitoring of residential, industrial, and agricultural water use, including metering to ensure an accurate baseline for climate action planning.</p> <p>1.3 Evaluate smart water meter technologies for application locally.</p> <p>1.4 Encourage connection to available water systems for households currently using permit-exempt wells.</p> <p>1.5 Create a County-hosted public database that includes all the relevant field measurements on water levels & other environmental measurements that are routinely collected by various organization in the County.</p>	<ul style="list-style-type: none"> Provides the quantitative information needed to make decisions that will ultimately ensure an adequate water supply. (all actions) “You can’t manage what you don’t measure.” <i>Peter Drucker</i>

2. Restore and protect streamflow and temperature that ensures year-round salmon migration and survival.

Actions	Benefits of Actions
<p>2.1 Develop and demonstrate projects that increase in-stream flow such as, surface-to-groundwater conversions, restoration of mature forest hydrology, and innovative approaches such as water banking and water spreading.</p> <p>2.2 Prioritize restoration and protection of wetlands in headwater areas and in the floodplain to improve base flows.</p> <p>2.3 Adopt innovative tools to decrease the impact of land use (e.g., forestry, agriculture, development) on summer stream flows such as minimizing impervious surfaces, restoration of mature forests, and maintenance of green infrastructure corridors.</p> <p>2.4 Restrict development that negatively impacts functionality of wetlands and effective aquifer recharge.</p>	<ul style="list-style-type: none"> • Preserve current and future salmon runs in the Nooksack River Basin. (all actions) • Increase the base flows in rivers and streams. (all actions)

3. Maintain and enhance estuarine, marine shoreline and coastal wetland habitats for fish and shellfish.

Actions	Benefits of Actions
<p>3.1 Include climate change and sea level rise in the codes and regulations associated with the Shoreline Management Program.</p> <p>3.2 Measure ecological function health of shorelines and require vulnerability assessments for new buildings and infrastructure in the shoreline impact zone.</p> <p>3.3 Facilitate shoreward migration of coastal wetlands through removal of hard shore protection (e.g., bulkheads, dikes, seawalls) or other barriers to tidal flow.</p> <p>3.4 Preserve and restore structural complexity and biological diversity when undertaking wetland enhancement activities.</p> <p>3.5 Promote and maintain mechanisms for sediment transport and deposition.</p>	<ul style="list-style-type: none"> • Reduce economic damage to property and shoreline ecosystem functions. • Preserve a diverse habitat for shellfish juvenile fish and other marine organisms. (3.2, 3.3, 3.4) • Maintain water clarity and decrease pollution of shellfish beds (3.5)

4. Reduce water demand through conservation and efficiency and improve drought readiness.	
Actions	Benefits of Actions
<p>4.1 Expand outreach and education programs to promote water conservation and efficiency for domestic, municipal, and agricultural water users.</p> <p>4.2 Reduce water demand by promoting drought tolerant landscaping and crops, and promotion of agroforestry principles.</p> <p>4.3 Evaluate/adapt agricultural drainage management to increase storage and promote subirrigation (e.g. permaculture swales, swales on contour, drainage ditch weirs).</p> <p>4.4 Provide incentives and cost-share to support farmers and homeowners to switch to more efficient irrigation processes.</p>	<ul style="list-style-type: none"> • Outreach and education promote public participation in solving the problem. (3.1, 3.2, 3.3) • Rewards early adopters for their efforts to reduce water demand (3.4)
5. Protect existing and develop new or alternative water supplies.	
Actions	Benefits of Actions
<p>5.1 Implement advanced wastewater treatment for water reuse.</p> <p>5.2 Encourage rainwater harvesting to provide water supply for buildings and agriculture.</p> <p>5.3 Implement new technologies such as reverse osmosis for desalination.</p> <p>5.4 Evaluate feasibility and sustainability of deep aquifer resources.</p> <p>5.5 Protect and restore mature forest hydrology in headwater areas, perennial and non-perennial stream corridors, and upland wetlands.</p> <p>5.6 Restore mature forest conditions throughout uplands to achieve greater than 50% mature forests to provide improved hydrology and streamflow.</p>	<ul style="list-style-type: none"> • Reuse of water and new aquifer sources will improve water quantity. (4.1, 4.2, 4.3, 4.4) • Increases water quality and quantity through the use of natural systems. (4.5, 4.6)

6. Promote climate resilience by incorporating climate scenarios in all aspects of floodplain management and infrastructure needs.

Actions	Benefits of Actions
<p>6.1 Incorporate probabilistic scenarios for riverine/coastal flooding to inform planning and management and restrict development in the floodplain zone.</p> <p>6.2 Incorporate future climate scenarios into riverine and coastal floodplain management planning and flood risk assessment.</p> <p>6.3 Inform landowners, developers, and contractors about the climate change risks of developing in the floodplain (Conservation Reserve Program - CRP).</p> <p>6.4 Modify flood zone designations, and update County code to incorporate sea level rise/storm surge and increased peak flows.</p>	<ul style="list-style-type: none"> • Reduce the economic losses associated with flooding. (5.1, 5.2, 5.3 5.4) • Smart climate resilience planning reduces taxpayer expenditures on infrastructure damage. (5.1, 5.2, 5.4)

7. Use natural processes that increase the capacity to store floodwaters and attenuate flood peaks to reduce flood risk.

Actions	Benefits of Actions
<p>7.1 Establish channel migration zone and/or meander limits sufficient to accommodate increase in peak flows and sediment.</p> <p>7.2 Identify and prioritize opportunities to reconnect floodplains by removing, lowering, or setting back levees to reduce maintenance costs, reduce flood risk, and increase opportunity for restoration.</p> <p>7.3 Restore riparian vegetation and wetlands within floodplains, including prioritization of 300' landward of the historic migration zone.</p>	<ul style="list-style-type: none"> • Natural processes are often the most effective and least costly approach. (all actions)

8. Reduce flood risk by moving people and infrastructure out of harm's way.

Actions	Benefits of Actions
<p>8.1 Identify critical infrastructure at risk of river/coastal flooding and relocate as needed.</p> <p>8.2 Evaluate public and private developments and develop managed retreat plans as appropriate.</p> <p>8.3 Acquire properties in the floodplain to reduce repetitive flood loss, reduce need for flood protection, and allow for floodplain restoration.</p> <p>8.4 Remove development rights within floodplains through voluntary and regulatory pathways.</p>	<ul style="list-style-type: none"> • Ultimately the least costly and most effective approach to reducing damage and the economic losses to individual landowners and County infrastructure. (all actions)

9. Manage stormwater infrastructure for increased frequency and magnitude of rainfall/flood events.	
Actions	Benefits of Actions
9.1 Incorporate future climate scenarios into stormwater management. 9.2 Accelerate construction or retrofit stormwater flow control, runoff treatment and infiltration facilities to increase capacity to accommodate future rainfall/flood. 9.3 Plan, create incentives for, and expand green stormwater retrofit projects such as rain gardens and other low-impact designs. 9.4 Restore fish passage at artificial barriers, prioritizing barrier replacement in cool-water tributaries that can function as cold-water refuge habitat.	<ul style="list-style-type: none"> Incorporating climate now into stormwater planning will ensure infrastructure integrity into the future and reduce replacement costs. (all actions)

Implementation of Strategies:

Throughout this Climate Action Plan we have stressed the need for actual information/data as a foundation for formulating strategies and for measuring the effectiveness of strategies and actions.

For example, it is anticipated that strategy 1 will provide the information needed to implement strategy 2 including the following:

- What are the minimum flows (in cubic feet per second) that must be maintained for fish health and long-term sustainability, and how do these values vary across watersheds and season?
- How much do stream flows need to be increased, where (by sub-basin watershed), and when?
- How are we to achieve this goal of increasing streamflows?
- What are the costs to do that?
- What entities are responsible for the projects that increase streamflows?
- What are the determinants of success to know when flows have increased sufficiently?

Agriculture Appendix

We would like to thank the following people who reviewed versions of this chapter and added valuable insight and suggestions:

Reviewer	Organization or Technical Area
Henry Bierlink	Washington Raspberry Commission
Nichole Embertson	Whatcom Conservation District
Michael Anderson	DVM
John Steensma, Karen Steensma, Kate Steensma, Zach Steensma	Steensma Dairy and Cleamery
Galen Smith	Coldstream Farms

Strategy, Action, Benefit Table for Agriculture

1. Adopt farm management practices that maximize soil carbon storage and increase water and nutrient availability	
Actions	Benefits of (Actions)
<p>1.1 Promote no-till and reduced-till agricultural practices to increase soil carbon storage, nutrients, and water-holding capacity of soils.</p> <p>1.2 Support County-sponsored local workshops on regenerative agriculture taught by the Soil Health Academy.</p> <p>1.3 Work with local agricultural organizations to develop a regenerative agriculture program that supports and incentivizes landowners to participate and monitors results.</p> <p>1.4 Increase incentives for the maintenance or restoration of areas within agricultural zoned property, such as wetlands and ponds, that function as carbon sinks, promote water storage, and provide other ecosystem services.</p> <p>1.5 Promote agroforestry practices to protect soil, animals, and crops from extreme weather events, improve water quality, sequester carbon, and promote long-term agricultural production.</p> <p>1.6 Develop & implement a carbon credit trading and offset program to pay farmers to sequester carbon.</p> <p>1.7 Initiate demonstration projects to educate our communities on the benefits of regenerative agriculture and carbon sequestration.</p>	<ul style="list-style-type: none"> • Increased carbon storage (all actions) • More efficient water use & conservation (1.3, 1.4) • Reduce runoff & erosion (1.1, 1.2) • Lower temperature of microclimate above land and water bodies. (1.1, 1.3, 1.4, 1.5) • Additional farm income for increasing carbon storage. (1.6)

2. Avoid the conversion of agricultural lands to maintain farm production at a level that sustains a vibrant and climate-resilient agricultural economy.	
Actions	Benefits of (Actions)
<p>2.1 Strengthen codes to discourage the conversion of agricultural lands for residential, commercial, and industrial development.</p> <p>2.2 Significantly increase purchase of agricultural conservation easements in Agricultural and Rural Zones through an expanded PDR Program</p> <p>2.3 Re-zone Rural Study Areas to lower density zoning such as Ag 20 or Ag 40 zoning</p> <p>2.4 Work with farmers to develop approaches to incentivize retiring farmers to sell land to new farmers</p> <p>2.5 Subsidize new farmers' land purchase through low-interest loans and other supportive mechanisms</p>	<ul style="list-style-type: none"> • Maintain a critical mass of agricultural land (all actions) • Discourage sprawl, preserve farmland, encourage small & diverse farms & a new generation of farmers (2.1-2.4) • Allow people to begin farming without large amounts of capital (2.5)
3. Enlist the agricultural community in preserving and enhancing water storage and stream-flow levels that enable salmon migration, healthy ecosystems, and agricultural irrigation.	
Actions	Benefits of (Actions)
<p>3.1 Develop and seek funding for demonstration projects on water conservation and augmentation to develop a basis for changing or eliminating the state water law on relinquishment.</p> <p>3.2 Allow water spreading, leasing, and transfer through establishment of a water bank, in coordination with Natural Resource Market development.</p> <p>3.3 Encourage farmers to manage adjustable weirs in drainage ditches to maintain higher water levels in the unsaturated zone.</p> <p>3.4 Support local organizations that improve floodplain connectivity and restore riparian zones and wetlands.</p> <p>3.5 Implement irrigation modernization and efficiency technologies.</p>	<ul style="list-style-type: none"> • Prevent escalating water conflicts, encourages cooperation and more efficient water use (all) • Reduce the threat of flooding and/or reduce runoff (3.4) • Maintain cooler water temperatures for fish (3.1, 3.5) • Improve water use efficiency & conservation (all actions) • Encourage development of water-trading and reduce opposition to water metering (all)
4. Reduce agriculture-related emissions and increase renewable energy, while providing farmers with new income opportunities.	
<p>4.1 Work with agricultural groups to explore economic incentives that may encourage farmers to reduce emissions and chemical fertilizer use, enable installation of nutrient treatment systems</p> <p>4.2 Incentivize and invest in modern manure management such as Anaerobic digesters, Farm to Fresh Water Systems, or other technologies/systems</p> <p>4.3 Incentivize and support development of renewable energy projects such as wind and solar that complement farm operations.</p> <p>4.4. Encourage reduced use of petrochemical fertilizers and pesticides.</p>	<ul style="list-style-type: none"> • Make nutrient treatment & low-carbon farming economically attractive (4.1) • Reduce methane emissions and pollution. Mitigate public opposition to animal agriculture (4.2) • Green power plus income source (4.3) • Reduced GHG emissions & improve soil quality (4.4)

5. Strengthen agricultural diversity to expand the eat local market and increase farm incomes.	
Actions	Benefits of (Actions)
5.1 Prioritize purchase, sale, and distribution of local agriculture and fisheries products to local facilities, groceries, and schools. 5.2 Expand the farm-to-school food program.	<ul style="list-style-type: none"> • Provide markets for locally produced food & transportation emissions (5.1) • Improve school children’s diets (5.2) • Increase farm incomes. (all)
6. Encourage increases in research and development of drought- and heat-resistant agricultural crops at the state and federal level and flexible infrastructure to support these crops.	
Actions	Benefits of (Actions)
6.1 Develop crop varieties that will use less water and thrive in warmer conditions. 6.2 Introduce new crops adapted to a changing climate. 6.3 Anticipate invasive pests and develop resistant varieties or other biological control methods. 6.4 Research and prepare for animal diseases that are likely to occur here under future climate scenarios. 6.5 Prioritize development of flexible food processing and local distribution facilities.	<ul style="list-style-type: none"> • Decrease demands for water & increased crop resilience to warming temperatures. (6.1) • Increase climate resilience (all) • Reduce dependence on chemicals (6.3) & decrease disease outbreaks (6.4) • Diversified markets reduce dependency on single crops & provide jobs in food processing (6.2, 6.5)

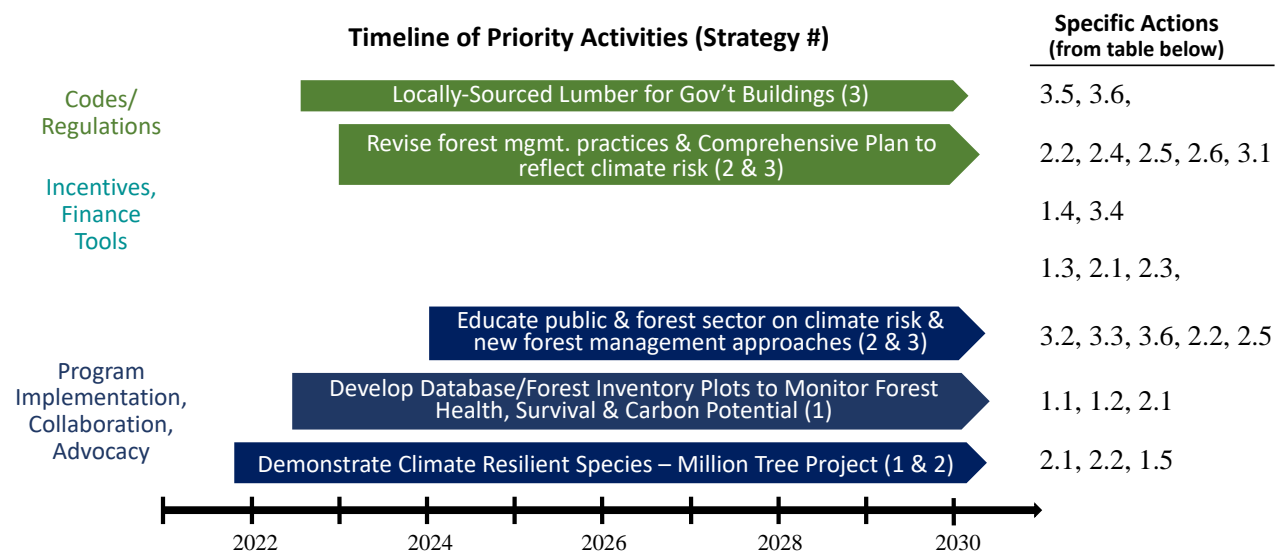
Forestry Appendix

We would like to acknowledge the following people who provided valuable suggestions to the early formulation and drafts of this chapter on water resources and fisheries:

Reviewers	Organization or Technical Expertise

Timeline for Forestry Actions

The timeline below shows the adoption year to institute different actions in order to realize actual benefit to climate resilience and reduction in emissions over the next decade. Unlike the timeline shown in Section 3 on [Forestry](#), this timeline includes all the recommended actions.



Strategies, Actions and Benefits Table for Forestry

1. Protect and enhance carbon storage and sequestration in forest ecosystems.	
Actions	Benefits of Actions
<p>1.1 Include the ClearPath protocol for assessing GHG emissions and removals from forests and trees outside of forests every five years to understand general trends in carbon storage, sequestration, and emissions.</p> <p>1.2 Work with local forest conservation, research, and educational organizations (including tribal governments) to develop measures to assess carbon storage potential: i) associate carbon storage with descriptors such as soil type and tree species and age; ii) identify a variety of ecosystem plots to monitor including wetlands, and iii) create a database to identify changes over time.</p> <p>1.3 Identify and preserve the most important forest resource lands based on carbon storage and sequestration potential through i) expanded PDR programs to rapidly retire development rights where pressure of conversion is greatest, ii) purchase of forestry conservation easements in Rural and Rural Forestry zones, and rezone Rural Forestry to Commercial Forestry to remove development potential.</p> <p>1.4 Fund a study to evaluate the potential of setting up a carbon market in the County to encourage and reward forest landowners for enhancing carbon storage and sequestration.</p> <p>1.5 Assess the potential for increasing carbon sequestration on County-owned forest lands and measure the results of these programs.</p>	<ul style="list-style-type: none"> • Maintain or increase carbon mitigation and storage potential of forests (All actions) • Maintain and increase species diversity (Actions 1.2, 1.3) • Preserve important hydrologic features for trees, fisheries, and wildlife (Actions 1.2, 1.3). • Enhance the ability of rural forestry to extend rotation age before harvest (1.4).
2. Increase forest health, survival and climate resilience through forest management practices that reduce wildfire risk, increase soil moisture, and stream flows, and preserve wildlife habitat.	
Actions	Benefit
<p>2.1 Work with local conservation, research, and educational organizations (including tribal governments) to actively measure and assess forest health in Forest Inventory Plots.</p> <p>2.2 Plant one million trees in Whatcom County by 2030 and incorporate forest management practices that include selective thinning, diversity of tree species, elimination of invasive species and attention to the local microclimate. Experiment with assisted migration using tree stock from more heat- and drought-tolerant seed zones.</p> <p>2.3 Increase soil moisture in forest ecosystems by i) mapping wetlands and identifying key function(s) and measures for health; ii) maintaining mature forest cover on and around wetlands, headwater areas, and significant watershed</p>	<ul style="list-style-type: none"> • Educate the public on the important role forests play in our local economy and the need to preserve (Actions 2.1, 2.2) • Preserve important hydrologic features in forests to maintain soil moisture and critical habitat for wildlife (Actions 2.3, 2.6) • Reduce the damage, intensity, and extent of wildland fires (Actions 2.4, 2.5) • Reduce property destruction and loss of life (and wildlife) during wildfires (Action 2.5, 2.6)

<p>features; and iii) increasing the width of no harvest buffers along fish-bearing, perennial, and non-perennial streams.</p> <p>2.4 Harvests and reforestation should be designed to increase diversity in tree species and age, and to create natural firebreaks to control wildfires.</p> <p>2.5 Promote the National Fire Protection Association Firewise USA® Program and wildfire preparedness and planning concepts to communities and individual landowners in the county. Adopt and enforce International fires codes for building construction in DNR-designated wildland-urban areas. Ensure that local fire departments have the equipment and training to manage wildfires.</p> <p>2.6 Identify and designate critical habitat cores and climate migration routes and fund the acquisition/protection/restoration of these areas through the PDR program. Consider expanding PDR program to WUI high-wildfire risk areas.</p>	
<p>3. Promote climate resilient planning and programs to maintain our forests economy for recreation and wood products through leadership and education.</p>	
<p>Actions</p>	<p>Benefits of Actions</p>
<p>3.1 Incorporate climate change risk into county planning activities such as the Comprehensive Plan and permitting when considering forest zoning or new roads and developments.</p> <p>3.2 Educate the public about the importance and role of natural resource management in climate resilience and producing food and fiber to support our economy, environment, and wellbeing.</p> <p>3.3 Engage local foresters on the impacts of climate change and promote ecological forestry practices including certifications such as the Forest Stewardship Council (FSC).</p> <p>3.4 Prioritize management and harvest for lumber production to maximize carbon sequestration. Encourage the development of new forest products like Cross Laminated Timber that can reduce the carbon of new buildings.</p> <p>3.5 Use locally sourced lumber for all County building projects and promote this concept to local builders.</p> <p>3.6 Initiate demonstration projects on climate resilience that increase public education and build partnerships with local agencies such as Whatcom Conservation District, DNR, WWU and Whatcom Land Trust, WSU Ext. Forestry.</p>	<ul style="list-style-type: none"> • Improve emergency ingress and egress for wildfires, floods, landslides, and other natural disasters (Actions 3.1, 3.6) • Strengthen public knowledge and appreciation of our local forestry resource (Actions 3.2, 3.6) • Improve the climate resilience of forests throughout the County (Actions 3.3, 3.4, 3.5, 3.6)

Ecosystems Appendix

Strategies, Actions and Benefits for Resilient Ecosystems

3. Increase community awareness on the importance of healthy, climate-resilient ecosystems to our economy and quality of life.	
Actions	Benefits of Actions
<p>3.1 Prioritize the preservation of healthy, climate-resilient ecosystems throughout the Comprehensive Plan.</p> <p>1.2 Support local non-profit organizations and institutions to i) raise awareness of the importance of ecosystem services and the role these services play in building resilience to climate change, and ii) promote climate change education in school systems.</p>	<ul style="list-style-type: none"> • Demonstrates commitment to the community to address climate issues. (1.1, 1.2) • Community buy-in (1.2)
2. Incorporate projected climate change impacts into revised land use and development codes to reduce destruction and increase the climate resilience of vulnerable ecosystems.	
Actions	Benefits of Actions
<p>2.1 Conduct climate vulnerability assessments when planning and developing infrastructure (roads, bridges, stream crossings, buildings) in sensitive ecosystems.</p> <p>2.2 Require climate vulnerability assessments when permitting new development or land use projects in or adjacent to climate impact zones (100+ yr. floodplains, coastal shorelines, geohazard areas, etc.).</p> <p>2.3 Designate climate impact zones within the Critical Areas Ordinance and regulate according to projected climate impacts and climate resilience needs, for example, include migration corridors and refugia to allow shifts in species distribution.</p> <p>2.4 Consider future climate conditions into the identification of fish and wildlife habitat conservation areas and wetlands.</p> <p>2.5 Incorporate greater diversity of topography and climate conditions in areas protected from development such as riparian and wetland habitats to allow for shifts in species distribution and ensure ecosystem resilience.</p> <p>2.6 Rezone areas immediately adjacent to high-value habitat areas and climate movement corridors to maintain larger, undisturbed tracts of intact ecosystems.</p> <p>2.7 Protect wetlands, riparian areas, and associated buffers from logging and other stressors.</p>	<ul style="list-style-type: none"> • Better understanding of the true value of ecosystems. (2.1, 2.2, 2.3, 2.4) • Expand habitat for wildlife and avoid human-wildlife interaction (2.3, 2.4, 2.5, 2.6) • Protect sensitive hydrologic systems and prevent fragmentation (2.5, 2.6, 2.7, 2.8) • Increase freshwater availability for humans, wildlife, fish, and ecosystems (2.4, 2.5, 2.7, 2.8) • Maintain maximum diversity of species (all actions).

2.8 Incorporate climate change into the Ecosystem Plan and develop an adaptation plan that leverages the work already done by the Nooksack Indian Tribe. ²⁹⁰	
3. Provide technical, logistical, and financial support for community efforts to restore and enhance ecosystems.	
Actions	Benefits of Actions
<p>3.1 Support the planting of one million trees in Whatcom County by 2030 by identifying non-forested County-owned lands and by partnering with other organizations and private landowners. Provide logistical support and tree stock for County-owned lands.</p> <p>3.2 Expand support for non-profit conservation programs that build ecosystem resilience to climate change through land protections, restoration, and community engagement.</p>	<ul style="list-style-type: none"> • Raise community awareness and support for climate action (3.1, 3.2) • Increased community funding to preserve natural systems (3.2)
4. Implement long-term monitoring to assess the impact of climate on ecosystem health.	
Actions	Benefits of Actions
<p>4.1 Monitor the status of critical areas and priority habitats (e.g., ecological processes sustaining these habitats and factors limiting them) and incorporate findings into planning and regulatory updates.</p> <p>4.2. Assess and monitor ecosystem health on County owned properties, including parks, right of ways, floodplain properties, etc.</p> <p>4.3. Develop goals, risk tolerances, and restoration strategies on County owned properties to address climate impacts and climate resilience.</p> <p>4.4. Expand County-sponsored citizen science programs for terrestrial ecosystems, modeled after programs sponsored by the Marine Resource Committee. Western Washington University faculty and staff could support these efforts.</p>	

²⁹⁰ Nooksack Indian Tribe Climate Change Adaptation Plan for Key Species and Habitats, <https://cig.uw.edu/wp-content/uploads/sites/2/2020/05/Nooksack-Indian-Tribe-Climate-Change-Adaptation-Plan.pdf>

5. Preserve and enhance ecosystem health to build climate resilience in our hydrologic processes, air and water quality, carbon storage, and ecological connectivity.

Actions	Benefits of Actions
<p>5.1 Significantly increase the rate and scale of conservation easement acquisition of important ecosystems through the Purchase of Development Rights Program.</p> <p>5.2 As part of the County’s Natural Resource Marketplace, develop a carbon valuation program to compensate property owners who voluntary protect and increase carbon stores (forests, wetlands, soils) to mitigate climate impacts.</p> <p>5.3 Restore floodplain connectivity, native vegetation, and forest ecosystems within floodplains to enhance natural flood storage and mitigate flood impacts to ecosystems.</p> <p>5.5 Identify and protect mature forest stands that form connected habitat blocks from the Puget Sound to the Cascade Mountains (e.g., Chuckanut Wildlife Corridor, Nooksack River, and associated tributaries) through regulations, codes, and management guidelines.</p>	