Community Research Project

Prepared for:
Whatcom County Climate Impact Advisory Committee

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Bellingham Youth Climate March - September 20, 2019
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Executive Summary

Community Research Project

Ellyn Murphy

Climate change is fundamentally impacting our health, environment and economy in Whatcom County and its effects will only accelerate in the future. The average global atmospheric concentration of carbon dioxide (CO₂) is currently over 400 parts per million (ppm). To put this value in context, over the 800,000 years before 1950, CO₂ concentration has fluctuated between about 170-280 ppm. The last time CO₂ reached current levels, may have been during the Pliocene era (2 to 4.6 million years ago), when temperatures were 3.6 to 5.4°F higher than pre-industrial levels and sea levels were 60-80 feet higher than today.¹ There is already enough CO₂ in Earth’s atmosphere to achieve these Pliocene era conditions. In addition, the annual rate of increase in atmospheric CO₂ over the last 60 years is about 100 times faster than previous natural increases.

To provide a sense of the urgency we face in Whatcom County, one only needs to look at the climate challenges facing our county as illustrated for the Nooksack River Basin (Fig. 1). These

Figure 1. Climate Change in the Nooksack River. A quick reference guide for decision makers.²

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climate impacts are based on current scientific information compiled by the University of Washington Climate Impacts Group. Spring snowpack that feeds the Nooksack will decline by almost 30% by the 2040’s and stream temperatures will increase by 2.6°F. In about 20 years 40 miles of the Nooksack River will exceed salmon thermal tolerances compared to zero miles today. Clearly, we can no longer sit on the sidelines and watch these changes take place. We must act now.

The County Council established the Whatcom County Climate Impact Advisory Committee in December 2017 to review and recommend to the County Council and Executive issues related to the mitigation of greenhouse gas (GHG) emissions and adaptation for a changing climate. In the face of a rapidly changing climate, our community needs to lessen our contribution to greenhouse gases in the atmosphere, while becoming more resilient to changing environmental and economic conditions.

The Community Research Project was launched in March 2019 to collect information from local stakeholders and thought leaders. We interviewed over one hundred community leaders and climate experts to gather information on strategies to reduce or mitigate GHG emissions and/or to support climate resiliency and adaptation. This report is primarily based on those interviews, but also relied on scientific publications, Washington State reports, and best practices from communities outside of Whatcom County. This project and subsequent report were done solely through the effort of volunteers who contributed many hours to interviewing, compiling interview notes, and creating a summary of their findings. The individual interview notes are contained in the appendix.

A summary has been provided for each of these areas which emphasizes the key issues that were raised and how climate change is impacting these areas. A set of strategies, actions and measures were developed that may be considered and evaluated for the county’s revised climate action plan. Any final strategy that is considered for inclusion in a revised climate action plan for the county needs to be evaluated based on its environmental, economic, and public health and social benefits.

Table 1. Community Research Project areas and volunteers. League of Women Voters of Bellingham/Whatcom County (LWV), Citizens Climate Lobby (CCL), and Climate Impact Advisory Committee (CIAC)

<table>
<thead>
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<th>Area (or Chapter)</th>
<th>Lead</th>
<th>Affiliation</th>
<th>Associates (affiliation)</th>
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<td>LWV</td>
<td>Dave Hostetler (CCL)</td>
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<td>Karen Dalenius (LWV)</td>
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<td>Transportation &amp; Mobility</td>
<td>Jayne Freudenberger</td>
<td>LWV</td>
<td>Kathy Gablehouse (LWV)</td>
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<tr>
<td>Waste Reduction &amp; Recycling</td>
<td>Vicki Thomas</td>
<td>LWV</td>
<td>Marge Laidlaw (LWV)</td>
</tr>
<tr>
<td>Public Safety &amp; Preparedness</td>
<td>Ellyn Murphy</td>
<td>CIAC &amp; LWV</td>
<td>Joanne Knittel (LWV)</td>
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<tr>
<td>Water Quantity &amp; Quality</td>
<td>Judy Hopkinson</td>
<td>LWV</td>
<td>Ellyn Murphy</td>
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<tr>
<td>Agriculture &amp; Food Security</td>
<td>Stevan Harrell</td>
<td>CCL &amp; UW</td>
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<td>Forestry</td>
<td>Ellyn Murphy</td>
<td>CIAC &amp; LWV</td>
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<tr>
<td>Land Use, Recreation, Wildlife &amp; Habitat</td>
<td>David Kershner</td>
<td>CIAC</td>
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What Does Climate Resiliency Look Like?

Although climate mitigation and adaptation are generally understood as necessary goals, an equally important, yet less widely understood goal, is climate resilience. Mitigation is reducing or stabilizing the levels of GHG in the atmosphere. This can occur through reducing our dependence on fossil fuels for electricity, heat or transport or enhancing the sinks that accumulate or store these gases. Adaptation is literally to adapt to life in a changing climate with the goal of reducing our vulnerability to the harmful effects of climate change. Resilience is the ability of a socio-ecological system to absorb, recover from, and more successfully adapt to adverse events. As climate change accelerates, more and more communities are recognizing the need to increase their resilience to climate-induced adverse events, such as flooding, water shortages, and wildfires to name a few. Mitigation and adaptation strategies should ultimately seek to maximize our resilience (Table 2).

In some areas such as Energy and Transportation, the emphasis is to reduce GHG emissions, so primarily a mitigation effort. Adaptation in these areas is largely about changing peoples' behaviors, such as converting to electric heat pumps, electric vehicles, and avoiding single-occupancy vehicle commuting, which are all mitigation strategies as well.

Adaptation is sometimes easier to understand in Agriculture and Forestry. For example, changing the way we manage our farms and forests may involve developing and planting more drought-resistant species or simply taking climate change into account when we locate and design logging operations. In a hotter and drier climate, it may be very difficult to re-establish forests on a south-facing slope, so resource managers may need to weigh the relative benefits of mitigation, CO₂ uptake by trees, versus the adaptation of a new generation of trees to current and future climate. Adaptation to climate change is somewhat easier in Agriculture where crop decisions can be made on an annual or perennial basis. Decisions in Forestry are often based on 40 to 50-year rotations.

Resilience, the ability to recover/survive or even thrive in a changing environment, relies on effective mitigation and adaptation strategies. Climate resilience is not a new idea. The Department of Defense has been pursuing energy resilience for military bases and operations for well over a decade. Their approach is to build advanced microgrids and onsite generation that allow bases to operate independently of the commercial grid during emergencies. This same approach is important for critical public facilities in the county, such as hospitals and fire and police stations. Resilience looks different depending on the area we are describing.

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3 NASA, Global Climate Change definitions. https://climate.nasa.gov/solutions/adaptation-mitigation/
4 A group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid.
## Table 2. What does mitigation, adaptation and climate resilience look like for the different areas?

<table>
<thead>
<tr>
<th>Area in Report</th>
<th>Mitigation</th>
<th>Adaptation</th>
<th>Resilience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 1 Energy Conservation &amp; Renewable Energy</td>
<td>Reduce/eliminate fossil fuels from electric grid.</td>
<td>Rooftop or Community solar Microgrids, batteries, Net zero energy buildings</td>
<td>Sustainable electric power without GHGs. Buildings have back-up power in emergencies or access to reliable power.</td>
</tr>
<tr>
<td>Chapter 2 Transportation &amp; Mobility</td>
<td>Mass transit; High fuel standards; Hybrids/electric vehicles; Alternative transportation</td>
<td>Electric cars fueled by renewables with battery storage; Commute data that supports new transit routes &amp; options; multi-modal transportation.</td>
<td>Vehicle transportation and bikes powered by renewable energy and/battery storage. Electric vehicles should be the norm.</td>
</tr>
<tr>
<td>Chapter 4 Public Safety &amp; Preparedness</td>
<td>Electrify emergency vehicles; proactive distribution of emergency resources; better understanding of impacts of climate change.</td>
<td>Proactive plan for climate-related disasters based on scientific data. Demonstrate the use of microgrids for critical county systems. Communication and education of county residents.</td>
<td>Microgrids/batteries for all critical systems (communication, life support, including hospitals, fire/police, and utilities.</td>
</tr>
<tr>
<td>Chapter 5 Water Quantity &amp; Quality</td>
<td>Restore healthy ecosystems including natural stream-flow, fish habitat, &amp; wetlands, while still supporting a healthy agricultural &amp; forest economy.</td>
<td>Conserve water resources; shift to crop varieties that use less water; recycle waste water. Develop deep groundwater resources &amp; consider county-wide PUD delivery of water.</td>
<td>Ample water for irrigation of crops and healthy ecosystems year-round; Flood risk minimized through long-term planning &amp; clear emergency response plans.</td>
</tr>
<tr>
<td>Chapter 7 Forestry</td>
<td>CO₂ sequestration by live trees and lumber for construction. Plant trees!</td>
<td>Changes in forest mgmt practices such as mixture of species; species from southern seed zones; alter structure, size &amp; possibly age of clearcuts; protection of streams, etc.</td>
<td>Healthy forests &amp; habitat that supports community needs in a rapidly changing climate. Significant reduction in the severity of wildfires. A sustainable forest industry in the county.</td>
</tr>
<tr>
<td>Chapter 8 Land Use, Recreation, Wildlife &amp; Habitat</td>
<td>Protect forest and agricultural land from development through voluntary land conservation purchases and various planning tools. Concentrate development in existing urban areas through infill incentives; require carbon-intensive new industrial projects to offset emissions</td>
<td>Identify &amp; protect sensitive natural habitats with high ecosystem services; Require increased setbacks and design standards for new structures, including recreational structures, that account for projected sea level rise and higher peak flows; maintain habitat connectivity to allow species to adapt to a changing climate</td>
<td>Long-range planning factors use climate change projections and vulnerability; all landscaping and restoration work is done with drought-resistant species and species that are adapted to a changing climate; corridors that allow vulnerable species to move from lower elevations to higher elevations are protected</td>
</tr>
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**Interdependencies Among the Different Areas**

Complicating the effort to achieve resilience are the interdependencies among the various areas listed in Table 2. These interdependencies must be considered in the development of mitigation and adaptation strategies. To illustrate the complexity of the different interdependencies, we have taken just one example in Figure 2 to show how the different areas may contribute to energy conservation and renewable energy or how energy conservation and renewable energy supports other areas. For example, renewable energy is critical to transitioning our transportation area to fossil-free electric vehicles (EVs). Agriculture will benefit from renewable energy and also contribute in the formation of biogas to increase renewable energy. Reducing urban sprawl and increasing density will lower energy use and may enable innovations in community solar and microgrids. Similar diagrams could be constructed for the other areas.

One caveat is that our electricity also needs to be sourced from renewable energy. Although state-wide the average percentage of electricity sourced from fossil fuels is 25%, in Whatcom County well over 50% of residential and commercial electricity is sourced from fossil fuels according to Puget Sound Energy’s published fuel mix (Chapter 1). The exception would be those residents and municipalities that have purchased electricity through the PSE Green Direct or Solar Choice Programs. Eliminating fossil fuel in the state’s electricity has been addressed in the recently enacted Clean Energy law.

These interdependencies are important because our interviews resulted in several proposed climate strategies that could be considered for a revised county climate action plan. The eight focus areas in this report can be divided into two groupings: the built environment (energy, transportation, waste and public safety) and natural/environmental resources (water, agriculture, forestry and land use planning).

The built environment grouping requires changing the general public’s behavior in respect to what are often daily activities in energy use, transportation and waste disposal. Public communication, education and incentives will all play a critical role in changing people’s behaviors. The natural/environmental resources grouping generally requires changing practices of a subset of commercial enterprises. Traditionally farmers have been very adept in changing crops based on price signals, demand, and overall sustainability of their land and livelihood. Changing forest management prac-
tices is a more difficult challenge because one must rely on predictions of how the climate will change over several decades and its potential impact on tree species that are planted today.

The climate strategies are listed in each chapter along with potential actions and measures. These strategies can be summarized as follows:

- **Energy Conservation and Renewable Energy (Chapter 1):** The county must aggressively pursue deployment of all forms of renewable energy and energy conservation/efficiency resources possible. Of particular importance to stakeholders was the widespread deployment of community solar. Assertive leadership by the county is essential at all levels, from modifying building regulations to funding renewables to public communication and to quickly defining and executing its own long-term facilities plan that demonstrates leadership.

- **Transportation and Mobility (Chapter 2):** Transportation is one of the leading emitters of GHGs. Electrification of transportation (e-bikes, hybrids, full electric vehicles, etc.) will disrupt transportation and should be included when planning new roads and bike paths. Every large employer in the county should be evaluating commute trip reduction. Reduction of urban sprawl will facilitate the expansion of bus service between county urban centers.

- **Waste Reduction and Recycling (Chapter 3):** Readily accessible data is needed on the county’s waste stream in order to better understand the problem and create solutions. Reducing and eliminating the use of plastic is critical. Food waste is another major contributor to GHGs. The county should increase their support of programs that reduce food waste while increasing food security.

- **Public Safety and Preparedness (Chapter 4):** A better understanding of the local impacts of climate change, such as sea level rise and the influence of local topography on storms, are needed. This information can then be incorporated into periodic hazard identification and vulnerability analyses. Leadership in energy resilience can be achieved by partnering with utilities on demonstration projects that incorporate microgrids and distributed energy resources for critical emergency infrastructure.

- **Water Quantity and Quality (Chapter 5):** A senior leader is needed in all water-related issues to develop and implement water strategies. Knowledge of climate change impacts on water, the ability to create water-augmentation demonstration projects, and influence water policy at the state level are all needed. Water shortages associated with climate change will have a devastating impact on the county’s economy under climate change.

- **Agriculture and Food Security (Chapter 6):** This area is directly tied to water strategies and the need to reform water law under a changing climate to maintain our agriculture and fisheries industries. Encourage and facilitate a sustainable and diversified food production infrastructure. This may include finding or developing more drought and heat resistant crop varieties along with innovative water conservation and stream augmentation projects.

- **Forestry (Chapter 7):** Forestry management practices should incorporate climate change to ensure a healthy forest industry in 40 to 60 years. Improving climate resilience starts with design-
ing clearcuts that reduce wildfire damage; planting tree species from southern seed zones or more drought-tolerant species; and diversifying tree species and ages. The economic value of natural carbon sinks should be evaluated.

- **Land Use, Recreation, and Wildlife and Habitat (Chapter 8):** Smart development in rural areas is needed in order to protect ecosystem services, protect agriculture, fisheries and forestry, and reduce transportation emissions. This includes protecting wildlife migration routes, while maintaining accessibility of recreation lands.

Any climate action strategy that is undertaken for one area must recognize and address the interdependencies with other areas. In many cases, a climate action strategy that benefits forestry, such as reducing the likelihood of forest fires, will also benefit public safety, agriculture (smoke slows down crop growth), water quantity and quality (reducing pollution), while protecting the built environment, recreational opportunities, wildlife and habitat. This added value needs to be considered when evaluating alternatives.

Conversely, some strategies that benefit one area, may adversely impact another area. A good example of this arose during a discussion of wind energy. The best potential wind sites in Whatcom County are often along mountain ridges. A wind turbine site requires road access for construction and maintenance. Roads provide public access and it is known that 70 to 90% of all wildfires are caused by humans. Wildfires can pollute watersheds, destroy wildlife and habitat, and the smoke impacts agricultural crops. In addition, wildfires are a public safety and health issue. This does not mean that we cannot do wind energy projects. It just means the relative risks need to be weighed.

In each of the chapters we discuss the strategies in more detail. All of the strategies have economic, social and environmental costs. These costs have not been evaluated but should be before any strategy is included in an updated climate action plan for the county. Another consideration is understanding where the county can exert direct local government influence versus indirect government influence. Topics like clean energy, energy codes and building codes are being addressed at the state level and the county can have an indirect influence on these policies. The county has direct local government influence on policies expanding transit, EV charging, recycling, food waste, and forest and agricultural land-use practices, to name a few.

**General Themes That Emerged**
Throughout the course of our interviews some general themes emerged, including a lack of data and leadership in confronting the challenge of climate change, and a desire for more proactive actions and solutions to address climate change.

Data, or more accurately the lack of data, was apparent in many of the areas during our interviews. Information on the carbon footprint of energy for every county facility informs the need for lighting and heating upgrades and can also be used to develop plans for replacing county buildings. Other questions, such as what is the carbon footprint of commuting for the county employees, is harder to answer. Companies that incorporate commuting into their employee benefits program can readily answer this question with great accuracy. These companies also use this information to justify new bus routes, bike paths, roads, or to better understand the impact of relocating or co-locating different
departments or office space. This example illustrates that greater access to data will facilitate decisions and long-term planning, which ultimately creates cost savings.

The need for more information on the local impacts of climate change and predicted impacts were also expressed in several of the interview areas. Resulting strategies cited the need for more research, sampling and integrated databases. For example, several organizations in the county collect information on streamflow and water quality in the Nooksack River Basin. If all of this information were recorded in a common database that could be accessed by researchers and the general public, then a general understanding of this complex river system would be accelerated, that in turn could lead to solutions and action. Snohomish County has such a system at tableau.com where information can be analyzed and graphed to indicate trends and get a better understanding of changes occurring over time.

A general lack of leadership or fragmented leadership in issues related to climate change was a recurring theme during our interviews. A full-time energy conservation planner was hired as a result of the 2007 climate action plan for the county, but that position was eliminated during the 2008-2009 recession. Many county employees expressed concern that climate change is not considered or emphasized by their management. Comparisons were highlighted between the City of Bellingham Climate Task Force, which has three staff members supporting their effort and the County Climate Impacts Advisory Committee, which has 0.1 FTE support. Many governments and private companies, worried about the impact of climate change on their business, have a senior strategic advisor in climate change that reports directly to senior leadership.

The financial risk of climate change for Whatcom County could be substantial, whether we are talking about the built environment or natural resources. In the early 2000’s, insurance companies started tracking the effects of climate change on the frequency and severity of weather-related disasters. These weather-related natural disasters worldwide have increased significantly and have resulted in annual economic losses to the built environment in the billions of dollars. Insurance companies no longer rely on historical averages and now include climate change in their predictive risk models. Local governments also need to plan proactively for the economic losses and adapt to our changing climate.

An example of financial risk for natural resources was quantified by Earth Economics, a non-profit in Tacoma. They evaluated the value of ecosystem services in rural Pierce County. Ecosystem services are the benefits people obtain from ecosystems such as clean water, clean air, nutrient cycling, etc.; basically, the environmental services that sustain life on Earth. Their analysis showed the total value of ecosystem services provided by natural and open spaces in the county between $860 mil-

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6 Tackling climate change, the vital contribution of insurers. CEA Insurers of Europe. 
https://www.insuranceeurope.eu/climate-change

7 How the Insurance Industry is Dealing with Climate Change, the rising chance of extreme weather is forcing insurance companies to adjust their models as they take on more risk. Smithsonian.com: 
lion and $2.9 billion every year. One only needs to look at the lawsuits and debates surrounding water use over the last decade to understand the need for county leadership on climate change.

Tied to the desire for leadership was the desire for more action in developing solutions to climate change. Reducing carbon emissions will result in cleaner air and cleaner water. Protecting forests and restoring riparian habitat means more fish spawning in streams and more economic activity from commercial and sport fishing. Reducing energy use in government-owned facilities reduces operational costs. Integrating climate change science into the planning and design of county projects and programs reduces financial risk and costly repairs and retrofits in the future.

Any endeavor that involves changes to policies and practices must include public education and communication throughout the process. The quality of clear and concise public communication can mean the difference between the success and failure of a climate action plan. This Community Research Project was a good start because it reached out to, and started a dialogue with community leaders, stakeholders, and citizens. It is important that the Climate Impact Advisory Committee (CIAC) continue an open dialogue with the public.

It is the project team’s hope that the information that was collected for this report will provide a basis to start the necessary work on updating the county’s climate action plan. In the vernacular of today’s youth, most residents of the county are now “woke” and realize that climate change is already here. As economic and ecological disasters proliferate, both around the world and locally - the loss of salmon leading to a die off of our beloved orcas, the wildfires that are devastating forests and impairing the very air we breathe, the glaciers disappearing and the snow pack dwindling, reducing our water supply - citizens are being impacted and demanding to know what our leaders are doing. It is past time to take action. We are the last generation that can make a difference in the outcome and we must all step up for our future and the future of our children. With climate change, we the people may become an endangered species. The planet is changing and we can no longer wait to see if it can continue to support life as we know it, especially when science is sending alarms. Failure to act is not an option.

Acknowledgements

In addition to the untold number of volunteer hours from the people listed in Table 1, we also want to acknowledge David Hopkinson, who provided review and editing of the summaries.

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8The costs of Sprawl, The Potential Impacts of Development in Pierce County, Washington, Earth Economics, 2019. [https://static1.squarespace.com/static/561dcd6e4b039470e9afc00/t/5e951d9471c10b898eb48134/1553276344991/The CostsofSprawl_EarthEconomics_March2019w.pdf](https://static1.squarespace.com/static/561dcd6e4b039470e9afc00/t/5e951d9471c10b898eb48134/1553276344991/The CostsofSprawl_EarthEconomics_March2019w.pdf)
Science, technology and innovation enabled the Industrial Revolution and the current standard of living, which was powered by fossil fuels. Unfortunately, we have known for some time those same fossil fuels are the primary cause of climate change. It is now past time for us to adapt, and we must proceed aggressively or face the risks that our best science and technology predicts.

The Energy Conservation and Renewable Energy team focused on those strategies that community stakeholders currently use and/or propose be studied and adopted to bring down carbon emissions. Our stakeholders were organizations that directly impact the conservation/renewable energy sector: solar and wind companies, local non-profits, utilities, county government departments, and private companies. We met with twenty-two professionals representing fifteen organizations, plus follow-up contacts. The interview results are a rich source of knowledge from our stakeholders which is intended to inform the county and its citizens.

The information is presented in context with Washington State’s “2019 Biennial Energy Report: Issues, Analysis and Updates” published in December 2018. This provides the reader with relevant, informed background and a focus on actions that are most important to Washington state and Whatcom county from stakeholder interviews. The full interviews and other material are included in the appendices.

First, some important definitions to be used throughout:

- Distributed Energy Resources – distributed energy, distributed generation, on-site generation or district/decentralized energy is electrical generation and storage performed by a variety of small, grid-connected devices referred to as distributed energy resources (DERs).
- Microgrid - a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid.
- Demand Response - a change in the power consumption of an electric customer to better match the demand for power with the available supply, often in response to variable pricing.
- Community Solar – for the purpose of this report community solar is defined as a solar-electric system that is owned by multiple community members and provides power and financial benefit to these members. The purpose of this type of system is to expand access to solar power for renters, those with shaded roofs, and those who cannot afford to install a system on their roof.
- Virtual Net Metering (VNM) – a bill crediting system for community solar. It refers to a situation in which solar is installed off-site and the power generated (or credit for the power generated) is shared appropriately among subscribers. The subscribers or owners receive credits on
their electric bill for excess energy produced by their share of the renewable energy. VNM could potentially be used for wind also.

- Sustainability – most often defined as meeting the needs of the present without compromising the ability of future generations to meet theirs. It has three main pillars: economic, environmental, and social.
- Resilience – the capacity of a system to recover from disruptions.

**Past and Present Efforts**

As background for future Whatcom County climate action, a summary of recent history concerning climate related activities follows based on stakeholder interviews.

Since 2000 Washington law has required that electric utilities disclose to retail customers the fuel sources of their electricity, since customers cannot choose their electricity supplier.\(^\text{12}\) Figure 1.1 shows Puget Sound Energy’s 2017 fuel mix disclosure by percentage of all electricity delivered to customers. State-wide, the average amount of fossil fuel in electricity generation is about 25%. Therefore, it is often surprising to Whatcom County residents that our local electricity fuel mix is over 50% fossil fuel (59% in 2017, Fig. 1.1).\(^\text{13}\) In addition many Whatcom County homes use natural gas for heating and hot water, which means our homes have a much higher carbon footprint than one might expect in a hydroelectric-rich state. The state’s 2019 Clean Energy legislation will require utilities to significantly reduce fossil fuel use for electricity generation in the coming years, eliminating it by 2045.

Across Whatcom County all three consumption sectors: industrial, commercial and residential have made significant accomplishments in energy conservation. In 2016, the Transportation consumption sector has the largest energy consumption statewide at 640 trillion BTU’s, and the Industrial sector was second at 342 trillion BTU’s.\(^\text{14}\) For Whatcom County however, the industrial sector may be the largest consumer since the county has an unusually large energy footprint with two petroleum refin-

\(^{12}\) 2019 Biennial Energy Report – Issues, Analysis and Updates; December 2018 Report to the Legislature; Brian Bonlender, Director; pg 25.

\(^{13}\) 2017 Electricity Fuel Mix, Puget Sound Energy, https://www.pse.com/pages/energy-supply/electric-supply

\(^{14}\) 2019 Biennial Energy Report – Issues, Analysis and Updates; December 2018 Report to the Legislature; Brian Bonlender, Director; pg 65.
eries and an aluminum manufacturing plant too. The Phillips 66 (Ferndale) refinery’s “top five” federal Energy Star ranking is a significant accomplishment. The Phillips Ferndale plant has demonstrated best practices for energy efficiency judged against its peers nationally.

Energy conservation in the commercial and residential sectors also has had many successes. Construction standards for residential and commercial buildings set the stage for the energy efficiency of buildings. Two notable standards, LEED (Leadership in Energy and Design) and Built Green are well known for sustainability measures, which include energy efficiency over and above local building codes. “Built Green” is a residential green building certification program with three levels (3, 4, and 5 stars of successively higher sustainability levels). A post occupancy study in Seattle measured the benefits of each Built Green level for energy efficiency only. Built Green homes had significant energy savings over non-certified homes built to the state energy code requirements (3-star = 25%; 4-star = 33%; and 5-star = 40% savings). Many Whatcom County builders are trained to be able to build homes certified as Built Green. But, their customers must want and pay for that certification, and affordability is an important consideration. For the majority of new buildings, minimum Washington state and local building codes apply to construction. Whatcom County and the City of Bellingham require that their newly constructed government-owned buildings be LEED Silver certified.

Local nonprofit organizations like the Opportunity Council, Sustainable Connections and RESources have leveraged various funding sources to assist owners of commercial and residential buildings to improve energy efficiency, thereby lowering long-term energy costs and GHG emissions. Puget Sound Energy and Cascade Natural Gas also have conservation programs that are regulated by the Washington State Utilities and Transportation Commission (or UTC) and are compensated per individual agreements.

In addition, Puget Sound Energy (PSE) has an active program to increase the use of electric vehicles (EVs) in the region. PSE determined that car dealers typically don’t understand and market electric cars as well as gas powered ones. Electric cars have lower maintenance, cost less to fuel and have proven and safe batteries. The environmental and public health benefits of electric vehicles are often not considered but worth mentioning, as they apply generally to burning fossil fuels. EVs do not emit toxic air pollution that harms health and can cause premature death. EVs do not directly emit greenhouse gases; indirect emissions are eliminated if electric charging is from 100% carbon-free sources. And EVs protect Puget Sound waterways by not contributing exhaust pollutants to our roadways, which are transported in runoff into our waterways.

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15 Eddy Ury, Clean Energy Program Manager, RE Sources, April 2, 2019
16 Atul Deshmane, Commissioner Whatcom County PUD; Member, Whatcom County Planning Commission; Owner, Whole Energy Fuels; April 3, 2019
17 Lauren Turner, Business Performance Engineer; Tim Johnson, Director, Public & Government Affairs; Phillips 66; May 10, 2019
18 Built Green Publications (https://www.builtgreen.net/resources)
19 Rob Lee, Executive Officer; Jacquelyn Styrna, Government Affairs Director; Building Industries Association of Whatcom county; April 29, 2019
20 Lynn Murphy, Senior Government Affairs Director; Puget Sound Energy, April 1, 2019
In addition to powering EVs, batteries are very important for storing intermittent renewable energy like solar and wind. As battery prices continue to drop and find wider usage, several stakeholders expressed concern for the environmental impact of batteries, on both ends of the lifecycle (manufacture and disposal). A two-tiered lifecycle is evolving. With the ramp up of EVs worldwide, services for EV battery reuse and recycling are developing. Once lithium-ion batteries from EVs need to be replaced, they still have value for less demanding applications like solar and wind storage. After this second use, the batteries are recycled to recover as much useful material as possible.²²

Shifting to the important area of residential and commercial building retrofits, a well-developed process determines which program best fits any applicant and then assigns the appropriate trained energy auditor. The auditor determines what the priority upgrades are for the building (starting with those that are most cost effective and have the greatest potential for energy savings and other benefits) and then helps connect the client to resources to complete the project. Funding resources appropriate to the situation (e.g. REAP, LIHEAP, RESIP, CEC) vary and change with time. For example, the Community Energy Challenge is well known and widely appreciated resource for helping homeowners and businesses quickly investigate energy improvements appropriate for their situation. These programs are very effective in executing their tasks but are limited by financial resources available. This must change in future scenarios in order to step up the transition away from fossil fuels.

For low income households, the Weatherization Assistance Program (WAP) offers fully subsidized energy efficiency upgrades, and over one thousand households in Whatcom County have been served in the last 10 years. An average 25% reduction of energy usage per household has been achieved, which is equivalent to about 6,800 kWh/year, or a $450 average annual cost savings. Assuming an average of 100 houses per year upgraded, yields 680 MWh/year saved.²³

Whatcom County has two major local solar installation companies (Ecotech Solar and Western Solar) and a solar manufacturer (Silfab, formerly Itek). Silfab builds solar panels largely for the United States market. The installed cost of solar on a per-watt basis has decreased 75% over the last 15 years, largely due to the drop in the cost of solar panels, but this is starting to level out. Typical residential system costs are around $15,000-$20,000.²⁴

Ecotech Solar has installed solar on about 650 homes and businesses in Whatcom County and another 200 in other NW Washington counties – roughly 95% are on homes. These installed systems to date generate about 7,700 MWh of electricity each year. Western Solar has similar installation numbers. By doubling Ecotech’s installed capacity, roughly 15,000 MWh of electricity per year is generated by primarily residential solar in Whatcom County.²⁵ Currently, only 1/4 of 1% of Washington state energy is derived from solar. Solar must be increased substantially throughout the grid to help replace fossil fuels. Grid stability impacts will not occur until solar is >15% of total

²³ Ross Quigley, Director, Home Improvement with Opportunity Council and Mark Schofield, Manager, Community Energy Challenge; April 8, 2019
²⁴ Dana Brandt, Owner, Ecotech Solar; April 5, 2019
²⁵ Dana Brandt, Owner, Ecotech Solar; April 5, 2019
energy supplied. Over 15% of California’s electrical energy comes from solar.

A valuable incentive called net metering allows renewable energy generators like solar households/businesses to “store” their generated energy at retail rates on the electrical grid for use later when needed. The 1:1 exchange is required by state law until a cap is reached, and this cap has just been increased 8-fold, which will allow many more homes and businesses to go solar. To “store” energy on the grid, the utility actually credits the customer’s account with that energy, effectively allowing equivalent use at another time.

However, a look at the history of solar incentives shows a lack of equity. Low income households don’t have the funds to reduce their GHG emissions by investing up front in solar. Under the Washington State incentive program, 83% of solar capacity installed has been on residential homes. These systems will generate approximately $350M in power value over 25 years, and $150M in immediate tax credit benefits to the owners. A significant portion of our community is not able to participate in the clean energy economy because of the way the incentives are structured. Consider that the above reference applies mostly to homeowners, yet much of our population rents with utility costs typically passed on to renters by the landlord. The landlord may have little incentive to invest in energy efficiency or renewable energy. There is a vicious circle here that will be hard to break in order to provide equity.

Some of the organizations we interviewed described Whatcom County government as a barrier to forward progress in transitioning to renewable energy in the community. Our interviewers detected evidence of this in two specific examples. First, county staff themselves stated there was a need to add sufficient, experienced energy conservation staffing, which was dropped in the last recession. Second, there is a strong need for the county to develop a long-term facilities plan so that long-term investment decisions like energy conservation and renewable energy can be made. These examples pertain just to the county’s stewardship of its own resources, not the need for leadership of the county as a whole in matters of climate action.

There are other renewable energy efforts underway, with varying degrees of success. There are 5 anaerobic digestors producing biogas on large dairy farms. In most cases, the biogas is used for electricity generation on that farm, and the electricity sold to PSE under a power purchase agreement (not net metering). Refer to the Agriculture and Food Security Chapter for more information. There do not appear to be agricultural biogas feedstocks available in quantity for sale to natural gas companies like Cascade Natural Gas and Puget Sound Energy; however, Phillips 66 has joined with Renewable Energy Group to design and build a facility to deliver renewable natural gas.

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26 Markus Virta, Director of Sales and Business Development, Western Solar, April 17, 2019
27 Less Uncertainty, More Stability: PNNL expertise helps power system professionals add renewable energy to the grid; https://www.pnnl.gov/news-media/less-uncertainty-more-stability
28 Dana Brandt, Owner, Ecotech Solar; April 5, 2019
29 Mia Devine, Spark Northwest, Project Manager; April 22, 2019
30 Rob Ney, Whatcom County Facilities Manager and Craig Cummings, Facilities Maintenance Lead; April 10, 2019
31 Lauren Turner, Business Performance Engineer; Tim Johnson, Director, Public & Government Affairs; Phillips 66; May 10, 2019
The interviewees strongly advised the county to explore ongoing activities and projects in nearby counties on deep-earth geothermal energy, community solar, and/or microgrids. For example, Snohomish County PUD has explored deep geothermal resources for power production in the Cascades. There may be potential geothermal resources to be explored at areas around Mount Baker in Whatcom County according to geologist Pete Stelling at WWU.\(^{32}\) In-stream hydro might also have use where it does not cause issues with in-stream flow or salmon. The need for community solar, in particular, was mentioned over and over by many stakeholders. Also, large wind turbines over 50 kW are rarely considered since zoning and permitting place undue burdens on such development.\(^{33}\)

As a separate municipality within Whatcom County, the City of Bellingham has taken a leadership position in climate action. The City of Bellingham’s Climate Action Plan Task Force has done considerable research and has developed GHG reduction recommendations. They also already developed a 2018 Climate Action Plan. Much of their work, including presentations by local experts, can be found on their website: https://www.cob.org/gov/public/bc/climate They are an excellent resource for the county as it updates its Climate Action Plan.

Concluding a summary of past efforts with the most recent history, the Clean Energy (Senate Bill 5116) and related legislation that was recently enacted mandates that all Washington utilities provide 100% fossil-free energy by 2045.\(^{34}\) By 2030, utilities in Washington must be “carbon-neutral” in its electric generation, with 80% of power coming from non-fossil sources. The remaining 20% or less that is still fossil-based must be offset in one of three ways: 1) Renewable energy credits (RECs); 2) Energy transformation projects (ETPs); or 3) an administrative penalty on tons of carbon.\(^{35}\) In addition to replacing all fossil fuels by 2045, the electric grid must accommodate any growth during that time (e.g., added electric vehicle charging, transition of gas heating to electrical, increasing population and new/expanding industry). That’s a big deal and a big challenge.

Other states have as big or bigger challenges that they are addressing. The Clean Energy law grants the Washington UTC the authority to change the utility business model with performance-based measures, as needed in order to accomplish the state’s energy goals. Among other metrics, utility performance must include in decision-making: a) the social cost of carbon, b) public interest and equity, and c) energy assistance to low income households.\(^{36}\) Most stakeholders felt these are huge steps in the right direction, but much work remains and the playing field has changed.

To the citizen volunteers conducting the interviews, tension exists among utilities, government, renewable energy and non-profit organizations, and the private sector, as is to be expected during this turbulent period of market disruption. This tension can and must be managed successfully. It is now up to all of us to develop the best strategies for how to accomplish these goals over time. The next few years will be critical in decision making since all organizations, especially utilities, must be adapting their long-term strategic plans in order to accomplish the objectives recently set forth by the state. Citizen engagement and active, sustained involvement in the review and decision-making

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\(^{32}\) Eddy Ury, Clean Energy Program Manager, RE Sources, April 2, 2019

\(^{33}\) Nick Smith, Permit Center Specialist and Mark Sniffen, Division Manager/Dpty. Fire Marshal; Whatcom County Planning Dept; March 29, 2019

\(^{34}\) Final Bill Report E2SSB 5116 C 288 L 19, Synopsis as Enacted

\(^{35}\) A closer look at Washington’s superb new 100% clean electricity bill, Vox, by David Roberts, April 18, 2019

\(^{36}\) A closer look at Washington’s superb new 100% clean electricity bill, Vox, by David Roberts, April 18, 2019
process will be critical to informing our government leaders. Otherwise, large organizations and lobbyists will have out-sized influence on the process.

**Possible Climate Strategies**

The county has many resources available for forming an updated climate action plan. The state’s energy plan provides data, analysis, and guidance. The state’s laws provide a legal framework for action. And the stakeholder interviews sent a clear message – think bigger picture, longer term. Stakeholders provided many valuable suggestions on how to do that, based on their individual business experiences. These experiences informed the possible strategies that follow.

First and foremost, mitigate or reduce GHG emissions aggressively through energy conservation and the addition of renewable energy to replace fossil fuels. Plan for the predicted future impacts and build equitable, resilient solutions while adapting for future conditions. In fact, the state’s energy plan has Chapter 5 dedicated to resilience. Paraphrasing from the Chapter’s opening, by preparing for disasters both natural (e.g., earthquakes, floods, wildfires) and human-caused (e.g., toxic spills, accidents, cyber/terror), we all can help the state’s energy system operators and supporting entities improve their ability to recover when disruptions occur.\(^{37}\)

There are at least three overarching drivers that the strategies must address in order to reduce the state’s GHG emissions from all consumption sectors (see Figure 9.1 Sources and Consumers of Energy in Washington in 2016)\(^{38}\):

- **Electric Grid and Distributed Energy Resources** – The fossil fuel sources feeding the state’s grid must be completely replaced by 2045. For Whatcom County, over half the electric energy provided by PSE is fossil-based, almost twice the state average. In Whatcom County alone, there are three (3) PSE natural-gas-fired plants that must be phased out.\(^{39}\) *Strategy: Rapidly adapt the electric grid for distributed energy resources like solar, wind, energy storage, biogas, microgrids, and others. Ramp up quickly.*

- **Energy System Waste** – Nearly 1,600 trillion BTUs of energy went into powering the state in 2016, and over half of that resulted as waste heat. Energy conservation (and efficiency) are an essential resource in lowering our energy use. Any energy saved reduces the need for more power. *Strategy: Emphasize residential and commercial building energy efficiency and achieving net-zero-energy capability. Develop a plan to assist industry in improving energy efficiency. Support electrification of hot water heating and HVAC.*

- **Transportation Waste** – The largest single energy consumption sector is Transportation. Most people probably don’t realize that about three fourths of petroleum used to power vehicles is wasted. There is a critical need to support rapid conversion to electric vehicles (EVs), but that places even greater demands on the electric grid. *Strategy: Support electrification of transportation with EV infrastructure.*

\(^{37}\) 2019 Biennial Energy Report, Issues, Analysis and Updates; December 2018 Report to the Legislature, Brian Bonlender, Director; pg 43

\(^{38}\) Ibid; pg 65.

\(^{39}\) List of power stations in Washington, Wikipedia

Based on these three overarching drivers we suggest the following four key strategies that are discussed below and summarized in Table 1.1:

1. Quickly ramp up the use of distributed energy resources to increase energy sustainability and resilience.
2. Demonstrate leadership in energy efficiency and conservation in buildings.
3. Promote a county-wide effort for electrification of transportation and heating.
4. County leadership to support changes in state energy policy, regulations and financial incentives.

Table 1.1. Energy Conservation / Renewable Energy Strategies, Actions, and Measures

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Actions</th>
<th>Measures</th>
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| Quickly ramp up the use of distributed energy resources to increase energy sustainability and resilience. | 1. Work to provide consistent solar permitting regulations across the county & fix the small and large wind turbine regulations to enable wind energy deployment.  
2. Develop proposal to state’s clean energy fund for a microgrid providing low-income assistance and resilience of community services (police, fire, safety).  
2. Achieve Clean Energy Funding of microgrid project in the next budget cycle.  
3. Maintain a publicly available dashboard of up-to-date, grid-connected renewable energy sources over time against planned.  
| Demonstrate leadership in energy efficiency & conservation in buildings. | 1. Develop a multiyear master plan for upgrading and/or consolidating county government facilities to maximize energy conservation & efficiency.  
2. Define a transition plan for requiring all new residential and commercial buildings be net-zero-energy (NZE) ready.  
3. Define a transition plan for upgrading existing residential and commercial buildings to NZE-ready.  
4. Secure increased funding through energy transformation project (ETP) sources. | 1. Get council approval NZE plans after the required review processes.  
2. Incentivize NZE designs over others in permitting and inspections. |
| Promote a county-wide effort for electrification of transportation and heating | 1. Support rapid electrification of transportation (EVs) through infrastructure investments.  
2. Support rapid electrification of hot water heating and HVAC through requirements and incentives.  
3. Evaluate demand response capability implementation along with electrification incentives. | 1. Track electrification results. Report % increase of electrification against goals for targeted markets.  
| County leadership to support changes in state energy policy, regulations and financial incentives | 1. Clearly evaluate and communicate economic, social and environmental factors for policy implementation.  
2. Work with legislature to pass well-funded PACE40 legislation (both residential and commercial PACE) in 2020.  
3. Define a plan for managing key-interdependencies and get council implementation approval yearly in January. | 1. Virtual net metering required statewide to enable community solar (& wind).  
2. PACE legislation passed and funded to subsidize energy conservation & renewable energy improvements to buildings.  
3. Plan completed and approved by county council. |

40 Property Assessed Clean Energy; https://www.energy.gov/eere/slsc/property-assessed-clean-energy-programs
The strategies in Table 1.1 focus on the residential, commercial sectors and transportation, but not industrial. The industrial sector is probably a larger consumer of energy in Whatcom County than the other sectors. Individual manufacturers have unique business requirements and impacts. A strategy must first be developed on how best to support our industries in doing their part to increase energy conservation and renewable energy consistent with their business objectives. The strategy might be as simple as subsidizing select businesses in the use of new products for conversion of low temperature waste heat to electricity, such as the Climeon Heat Power System (http://climeon.com) backed by Breakthrough Energy Ventures, which was founded by Bill Gates.

Quickly Ramp Up the Use of Distributed Energy Resources to Increase Energy Sustainability and Resilience. Distributed energy resources (DERs) are essentially small power resources connected to the grid but close to the consumer. Example DERs can be as simple as rooftop solar, batteries, solar + batteries, or the more elaborate and flexible microgrids like Snohomish PUD’s Arlington Microgrid and Clean Energy Technology Center. This Center represents a new approach that offers grid resiliency and renewable energy integration (500 kW solar, 1000 kWh lithium ion battery, and several EV charging stations), plus community solar for increased social equity.

In the pursuit of non-fossil energy, it may help to review those energy sources and contributions at present. Statewide, after hydroelectricity and energy conservation, wind energy in 2018 was the largest non-fossil fuel source of energy at more than 3,000 MW operating capacity (which ranks Washington state 9th in the nation). The best wind resources in the state are found in the Columbia Gorge or eastern Washington. PSE owns or has investment in three wind farms in the state. The Wildhorse facility east of Ellensburg has a wonderful renewable energy education center on their wind farm site that is well-worth visiting. PSE plans increased investment in utility-scale wind, solar, and battery farms in eastern Washington.

Although the available solar resource is generally better for southern states, there clearly is solar resource in northern states too (Table 1.2). For solar in 2018, Washington state’s operating capacity ranked 14th. The amount of installed solar in each state depends largely on individual state policies and federal/state incentives, along with the local price of electricity. As mentioned above, PSE plans to increase its utility-scale solar in eastern Washington which will help address its heavy fossil fuel dependence.

In Washington state’s latest round of competitive funding in the 2018-2019 Clean Energy Fund 3, $46.1M was authorized. The largest allocation was for Grid Modernization at $11M. The scope of

<table>
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<th>Rank</th>
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<td>1</td>
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<tr>
<td>4</td>
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<td>2,355</td>
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<td>5</td>
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41 2019 Biennial Energy Report, Issues, Analysis and Updates; December 2018 Report to the Legislature, Brian Bonlender, Director; pg 11
42 Lynn Murphy, Senior Government Affairs Director; Puget Sound Energy, April 1, 2019
43 Smart Electric Power Alliance (SEPA), 2019 Utility Solar Market Snapshot, Appendix A:2018 Solar Capacity by State and Select Territories (MW-AC); pg 28
44 Dave McCarty, General Manager and COO, Silfab, April 17, 2019
that fund can be found in the state’s report, but an excerpt follows: “Funds will be available to public and private electric utilities serving Washington consumers and must advance clean, renewable energy technologies and transmission and distribution control systems; support integration of renewable energy sources, deployment of distributed energy resources and sustainable microgrids; or increase utility customer choice in energy sources, efficiency, equipment, and utility services…”45

The Department of Defense has been pursuing energy resilience for military bases and operations for well over a decade. Their approach is to build advanced microgrids and onsite generation that allow bases to operate independently of the commercial grid.46 Now, non-defense microgrids are growing rapidly around the country. U.S. Department of Energy has been pursuing microgrids for resiliency in the electricity infrastructure.47 From the U.S. Department of Energy Microgrid Initiative, “the benefits of microgrids include:

- Enabling grid modernization and integration of multiple smart grid technologies.
- Enhancing the integration of distributed and renewable energy sources that help reduce peak load and reduce losses by locating generation near demand.
- Meeting end-user needs by ensuring supply for critical loads, controlling power quality and reliability at the local level, and promoting customer participation through demand-side management and community involvement in electricity supply.
- Supporting the macrogrid by handling sensitive loads and the variability of renewables locally and supplying ancillary services to the bulk power system.”48

Washington State’s Clean Energy Funds have already supported development of at least 4 microgrids since 2015. Staff in the Washington state energy office welcome public-private partnership proposals to the Clean Energy Fund. The suggestion was to focus on sustainable microgrids that offer resilience to public-safety facilities in the face of power outages, and community solar that provides better social equity. Refer to the Public Safety and Preparedness chapter.

The challenge and opportunity are clear. Whatcom County can assert leadership by developing a set of proposals to seek funding from the state and federal sources, thereby demonstrating newer technologies and gaining that critical experience as the next decade unfolds. Whatcom County and PSE could form a public-private partnership to pursue such funding.

Revise zoning and building codes and regulations as soon as possible in order enable much greater energy conservation and renewable energy adoption:

- Wind – revamp zoning and permitting requirements, then let developers assess the feasibility of wind energy on a location and customer specific basis. An Environmental Impact Statement (EIS) should not be required.
- Solar – standardize installation practices in order to eliminate individual permitting and design for rooftop installations, thus decreasing installation cost and time. The cost of solar installations is lower in Washington than many other states, but it still can go lower. For example,

45 2019 Biennial Energy Report, Issues, Analysis and Updates; December 2018 Report to the Legislature, Brian Bonlender, Director; pg 52
47 Pacific Northwest National Laboratory https://ei.pnnl.gov/rm.asp
installation costs in Washington are 2-3 times more expensive than in Europe (particularly Germany). Special requirements, permits, design and other factors increase construction time and cost.49

Solar energy should be aggressively pursued as the most widely available renewable energy resource, using utility-scale solar, rooftop residential/commercial solar and community solar. Each of these approaches are discussed as follows.

- **Utility scale solar** is being pursued by PSE in eastern Washington because of higher solar exposure and inexpensive land. While the vast majority of all power sources (e.g. hydro, nuclear, wind) are in eastern Washington, the majority of consumers are in western Washington. This situation incurs time, cost, and risk associated with building and maintaining transmission lines from the east to west sides. Risk has to do with disruptions caused by man-made and natural disasters occurring along the length of transmission lines. One only has to look at recent California wildfires to wonder about the magnitude of risk in Washington state.

Resilience in the face of a disruption in transmission is a reason interviewees, indeed Washington state’s own 2019 Biennial Energy Report, recommends development of policies that support clean on-site and renewable energy production.50 The combined approach of eastside utility-scale and westside distributed energy resources is complimentary, and accelerates the movement away from natural gas. It also enhances grid sustainability and resilience to future disruptions. We will need DERs throughout the grid, before we move natural gas peaking plants offline. Energy supply must be substantially diversified with much more solar and wind.51

Utility stakeholders make a good case for keeping a natural gas peaking plant in order to handle extreme weather cases in the winter, when renewables are less likely to deliver needed capacity. Perhaps renewable natural gas has a role here in powering a peaking plant. Also evaluate the Clean Peak Energy Standard being developed by states like Massachusetts, which will incentivize the use of clean energy technologies that can supply electricity or reduce demand during seasonal peak demand periods.52

- **Rooftop residential/commercial solar.** There are many rooftops with adequate solar exposure to provide on-site, clean power thus enabling those buildings to move toward net zero energy. New legislation has expanded the net metering cap, incentivizing more growth of solar. Improvements in regulations and financing can fuel growth as installation costs continue to decline over time.

As battery pricing declines in the future, “behind-the-meter” batteries will provide many advantages such as load shifting, resilience during outages, and possibly even demand management. Solar, batteries and small microgrids are rapidly changing the options in this space. Green Mountain Power and Tesla have a pilot program putting batteries in homes for backup power and

49 Markus Virta, Director of Sales and Business Development, Western Solar, April 17, 2019
50 2019 Biennial Energy Report, Issues, Analysis and Updates; December 2018 Report to the Legislature, Brian Bonlender, Director; pg 12
51 Markus Virta, Director of Sales and Business Development, Western Solar, April 17, 2019
52 https://www.mass.gov/service-details/clean-peak-energy-standard
to reduce peak power demand. In another example, later this year, manufacturer Enphase Energy will release its 8th generation micro inverter and microgrid with battery storage and load management that can automatically switch between backup power and the grid when needed. These new developments should be followed closely for potential application to Whatcom County’s climate action plans.

- Community solar is the fastest growing segment of the USA solar industry, doubling capacity in 2017. Community solar enables purchase of solar by anyone, even if they cannot afford or install solar themselves, whether they rent or own. Furthermore, this enables set-asides for low income households to improve social justice in solar benefits. There are many examples of community solar around the state of Washington, even as nearby as Snohomish PUD and Orcas Power and Light Cooperative. We too can grow our solar capacity rapidly using our ample local commercial resources.

The primary impediments to developing community solar are virtual net metering has not been supported by PSE, the need for financing reform, and land use issues. PSE’s position on VNM seems to be evolving, as they have proposed options for community solar to the City of Bellingham recently. Hopefully, this will enable virtual net metering as soon as possible in order to unleash pent up demand for community solar and provide mechanisms for rebalancing social equity. Olympia has not yet passed legislation mandating virtual net metering, although many PUD’s around the state offer it anyway. The Smart Electric Power Alliance (SEPA) has studied the utility costs associated with administering virtual net metering for community solar.

Demonstrate Leadership in Energy Efficiency & Conservation in Buildings. The approach the buildings work group for the City of Bellingham’s climate task force was recently summarized in Whatcom Watch. Key strategies involve rapid improvement of regulations (zoning, permitting, building codes) to support improved building energy efficiency, including financial incentives:

- **New Buildings** – Transition quickly to requiring net-zero-energy (NZE) designs (or net-zero-energy “capable” after renewables are added), also now referred to as “Zero-Code”

  Consider incentives such as expedited permitting of standardized, proven NZE designs similar to many available offerings today. An example is proven zero energy home plans offered by local builder Ted Clifton, Sr of Coupeville, WA, and his zero energy plans for sale on his website. His son, Ted Jr, of TC Legend Homes in Bellingham builds net-zero homes at relatively low cost. And there are other online offerings too.

- **Existing Buildings** – Establish a process to upgrade existing buildings to NZE, including the definition of events that trigger specific upgrades (e.g., for added insulation, new windows, upgraded HVAC, lighting, hot water). Example trigger events might be a change in ownership or

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55 SEPA, Community Solar Program Design Models, 2018, Smart Electric Power Alliance
56 Partially funded by the state’s 2015-2017 Clean Energy Fund 2.
57 City of Bellingham Climate Task Force Meeting, August 7, 2019
58 Local Entities Address Climate Crisis, Buildings Workgroup, Whatcom Watch, August, 2019, pg 4.
59 Ross Quigley, Director, Home Improvement with Opportunity Council and Mark Schofield, Manager, Community Energy Challenge; April 8, 2019; https://architecture2030.org/zero-code/
60 Clifton View Homes; http://cliftonviewhomes.com/
61 Eddy Ury, Clean Energy Program Manager, RE Sources, April 2, 2019
a significant remodel. Remodels might range from full building envelope upgrades to sealing the building to be extremely airtight, if that is appropriate. Full building envelope upgrades are expensive and will require very specific triggers as the technology improves; however, this high cost emphasizes the importance of mandating proper envelope design of new homes.

- Maintain and enhance low-income assistance programs. Emphasize energy transformation project (ETP) funding in order to accelerate energy conservation efforts and create many good jobs in the community while updating our building infrastructure for the future. ETPs are one method energy producers have to offset continued use of fossil fuels after 2030.62

**Promote a County-Wide Effort for Electrification of Transportation and Heating.** The electrification of transportation and heating are so important because of the large amount of fossil energy used in those processes. However, converting vehicles and heating systems from fossil to electrical sources places greater pressure on the electrical grid at a time when the grid uses way too much fossil fuel itself. A sort of double-whammy. This is just another reason to do everything possible to accelerate deployment of energy conservation and renewable energy, as described above.

In addition, we must also explore other distributed energy solutions such as demand response of important customer electric loads – like EVs, water heating, and HVAC. Demand response (or management) practices allow the utility to reduce load in specified ways when enough generation is not available, such as:

- Turn down hot water heater setpoint,
- Turn down room temperature setpoint, or
- Delay EV charging until later or reduce charging rate.

As part of the conversion process for vehicles, water heaters, and HVAC, consider implementation of demand response capability at the same time since incremental costs would be small and gains probably large. Help offset the double whammy mentioned earlier. The state’s energy report recognized that the region has developed very little demand response (DR) and needs more to help meet capacity needs as older generating resources retire. Utilities have encountered barriers to implementing more DR, yet recognize the longer-term value for DR resources. Specifically, the technical potential for DR remains high in end uses such as electric water heating.63 There is much innovation taking place on the demand side, and variously referred to as demand response, demand management and even “virtual batteries” or “virtual power plants.”64 Perhaps electrification efforts offer such opportunities. Consider incentivizing demand response with a lower electric rate, a one-time rebate, or credit toward installation of solar (if appropriate).

**County Leadership to Support Changes in Energy Policy, Regulations and Financial Incentives.** In the discussion above we presented specific strategies in support of rapidly increasing energy conservation and renewable energy. The cost of key renewable energy products (e.g., solar, wind, battery storage) has dropped dramatically in the last decade, and there is no reason to think these trends

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62 Ross Quigley, Director, Home Improvement with Opportunity Council and Mark Schofield, Manager, Community Energy Challenge; April 8, 2019
63 2019 Biennial Energy Report, Issues, Analysis and Updates; December 2018 Report to the Legislature, Brian Bonlender, Director; pg 55
64 Buildings-Grid Integration, Pacific Northwest National Laboratory, Richland, WA.
https://bgintegration.pnnl.gov/virtualbatteries.asp
won’t continue. The vast majority of cost for these renewables, however, is upfront in purchase and installation. Operating costs are usually small in comparison while the benefits accrue gradually over long time periods – like our infrastructure investments in roads, bridges, airports, schools, hospitals and hydroelectric dams (which were infrastructure investments that enabled Washington some of the lowest electricity prices in the country).

Key strategies include improving financial incentives and social equity in their distribution:

• Energy conservation and renewable energy investments benefit both the owner/occupant and the community-at-large. Such investments increase the value of the building and should be included as part of an overall mortgage at reduced interest in order to facilitate a long-term, sustainable solution. In addition, financing must be supported for leased or rented spaces that are not owner occupied.

• The property assessed clean energy (PACE) model is an innovative mechanism for financing energy efficiency and renewable energy improvements on private property. PACE-like financing should be provided, as has been done successfully in many other states.65 This is critical to increasing adoption of renewable energy and energy conservation across all income groups, and greater social justice. A version of PACE legislation almost passed this year in the state legislature. Consider collaboration with local state legislators to support PACE legislation and sufficient funding in the 2020 legislative session.66

**Barriers to Implementation**

There are a number of barriers to achieving the state’s energy goals. These are summaries of the most important, current barriers mentioned earlier as part of the strategies:

1. **Financial Incentives** – These are arguably the most important and most difficult to address, often requiring legislation and considerable community outreach and involvement. PACE financing is not currently allowed in Washington State. Financing of energy conservation and renewable energy must be treated as long term investments (not short-term loans) that are important enhancements to buildings. These enhancements have long-term benefits to the owners in building value, to occupants in electricity cost, to the community, and to the environment.

2. **Decreasing federal incentives** – Decreasing federal incentives are a big barrier. The current 30% federal income tax credit for solar will drop to 26% next year, 20% in 2021, with a phase out of residential credit after 2021 (commercial only will maintain a 10% credit).67

3. **Virtual net metering to enable commercial community solar** – Virtual Net Metering (VNM) is a bill-crediting system essential for community solar. Utilities use it to allocate energy generation to the correct customer account. Hopefully, PSE will embrace this practice system-wide because of the value to the community.

4. **Modification of zoning to enable growth of renewables** – Examples include commercial buildings that are unnecessarily required to get permits for solar installation. Solar farms can’t be stand-alone entities and must be accessories to something else, plus they must be built only in heavy industry zones. The cost and complications of leasing land for community solar are complicated and prohibitive, and change is needed.

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65 Markus Virta, Director of Sales and Business Development, Western Solar, April 17, 2019
66 Sarah Vorpahl, Washington State Energy Office, Dept. of Commerce, telecon, June 21, 2019
67 Markus Virta, Director of Sales and Business Development, Western Solar, April 17, 2019
5. **Cultural/Political** – Public perception/information about resources and the urgency of the problem are insufficient to the task. Leadership has been lacking in the county government to transition both the community and the government sectors to lower energy usage.

**Conclusions**

The overarching challenges to transitioning to renewable energy in Whatcom County are money, leadership, and public will. An outreach and marketing campaign is seen as vital to both inform the public and enlist their support for solutions. This report is an important resource for citizen organizations. First and foremost, we must reduce GHG emissions aggressively while adapting for expected impacts of climate change and other adverse events. Build equitable and resilient long-term solutions for all citizens, including investment to mitigate impacts of man-made and natural disasters. This means adopting a triple bottom line planning directive to evaluate economic, social, and environmental aspects fully in decision making, as the City of Bellingham is doing. The state’s Clean Energy law now requires similar considerations.

The county should substantially increase staff and resources to directly address the energy conservation and renewable energy planning and projects as soon as possible. This should include 1-2 full time equivalent staff resources focused on updating the county’s 2007 climate action plan and then executing it. It should be possible to quickly learn from the wide variety of experiences across the country, starting with the City of Bellingham’s climate action efforts, to nearby public utilities and cooperatives like Seattle City Light and Snohomish PUD, and on to other states across the northern tier of the country such as Minnesota, New York, Illinois and Massachusetts. These states are rapidly embracing policies and supporting incentives for distributed energy resources with renewables into their electric grids in order to reduce use of fossil fuels.

By embracing the above, efforts will focus specifically on the three main drivers of Washington state’s energy picture and implement solutions to these problems:

- **The Electric Grid** – Adapt the electric grid to robustly support distributed energy resources, including a smarter grid that manages demand and supply in a resilient and sustainable way with minimal fossil fuels. Develop microgrids of renewables to provide flexibility, sustainability and resilience in the face of man-made and natural adverse events that will surely occur in the future.

- **Energy System Waste** – The United States has contributed the most total GHGs to the atmosphere of any country, and our per capita energy consumption is among the highest in the world. The fact is, the United States must be a world leader in solving the climate dilemma, or it probably won’t happen in time. Our innovation and drive can help overcome this dilemma and create many new living wage jobs and opportunities for our citizens, and a more sustainable and healthy future for those that follow us.

- **Transportation Waste** – The innovation of Henry Ford’s automobile and the interstate highway system helped transform America, but America is now transforming again. Whatcom County must embrace our part in this transformation. It is imperative for our health, the health of our descendants, and for the planet.
Chapter 2

Transportation and Mobility
Jayne Freudenberger (lead)

“The primary focus of the 2012 Washington State Energy Strategy was transportation efficiency. Transportation was and is, the state’s largest energy user by sector and is also the least efficient sector.”

Transportation is important, but what is the practical impact on a household budget? A lot. In 2016, adding energy used for personal transportation nearly triples the annual energy bill for the average Washington household to $3,975, with vehicle transportation being about 60% or $2400. As in most places in the United States, the automobile is the primary choice for personal trips. The average household in Whatcom County owns two motor vehicles (cars and/or light trucks) and takes about seven vehicle trips per day, with an average trip time of just over 17 minutes. Most people probably don’t realize that the transportation sector is the least efficient user of energy, with about three-fourths of petroleum used to power vehicles is simply wasted due to the inefficiency of the internal combustion engine.

The challenge is to change our citizens’ behavior in favor of other, more efficient modes of transportation and mobility that still meets their needs. Examples include walking, biking, busing, carpooling, ride sharing, taxis or trains. This is no small challenge as the personal motor vehicle has been a central part of America’s history and all its infrastructure, plus a vast supporting supply chain of vehicle manufacturers, dealers, parts, service, and fossil fuel suppliers. Well-targeted and timely investments in the county infrastructure, incentives, and public outreach over a long period of time will be required to make this happen. But science tells us that time is of the essence, and our state is responding with action. So must we.

The Transportation and Mobility team interviewed organizations that directly impact transportation and mobility: Whatcom County Transportation Authority, Parks, Public Works, Bicycle & Pedestrian Committees, three school districts, the Smart Trips Program, and Council of Governments (COG). The information is presented in context with Washington State’s “2019 Biennial Energy Report: Issues, Analysis and Updates” published in December 2018. The interviews and other material are included in the appendices.

First, some important definitions to be used throughout:

- Transportation - the movement of humans, animals, or goods from one location to another.
- Mobility - the ability of people to move from one location to another.
- Multimodal - the use of multiple modes of transport, such as to walk and use a bus or train in a single trip, or to use multiple modes over the course of a week or day.
- SOV - single occupant vehicle

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68 Washington Department of Commerce, 2019 Biennial Energy Report, December 2018; Report to the Legislature, Brian Bonelender, Director, pg 58.
69 ibid, pg 82
70 ibid, pg 66
71 2019 Biennial Energy Report, Issues, Analysis and Updates; December 2018 Report to the Legislature, Brian Bonlender, Director
Past and Present Efforts
The overall goal is and has been to lower carbon emissions by driving less while offering citizens acceptable alternatives to their current modes of transportation and mobility – which is primarily the personal fossil-fueled vehicle, often only a single occupant vehicle (SOV).

Futurist Tony Seba predicts a coming world where driving a personal vehicle will be nonexistent. This may be true, especially in densely populated areas, but the transition may take decades. Other than the apparent convenience and cost, citizens primarily choose alternative modes of transportation based on the route of travel available and the people/goods to be transported. Alternative modes of transportation include walking, biking, car-pooling and public transport, such as buses and trains. Walking and biking have the most positive impact on public health (exercise and lack of pollution) and require the least infrastructure costs. Single occupant vehicles that use fossil fuel pollute and require high investments in infrastructure. Another option that is not mentioned would be to not go on a trip (for example, either combine trips, or work/shop from home).

There are three primary entities or governing bodies that guide transportation planning within Whatcom County: the Whatcom Council of Governments (COG), the Whatcom Transit Authority (WTA) and Whatcom County government. Of course, the cities within the county also coordinate with these organizations on transportation issues, but the focus of this report is primarily on the areas outside the cities. The following discussion highlights the roles of each organization.

Whatcom Council of Governments (COG) is leading the effort to increase mobility in Whatcom County. The Whatcom COG serves as the region’s federally recognized transportation policy board for the Bellingham Urbanized Area and is designated as the Regional Transportation Planning Organization for all of Whatcom County. Public transit, biking and walking are alternatives to get us out of our cars. As funds have allowed, the county has been working to upgrade and add to the existing trail system for walking and biking. The use of pedestrian and biking trails has a relatively small carbon footprint and contributes to the health of our citizens. These alternatives usually don’t apply to longer routes and when more people/goods need to be transported.

According to Whatcom Mobility 2040, walking for an entire trip in Whatcom County now accounts for about 11% of all trips. For urban areas walking rates are higher. In Bellingham, 24% of walking trips are one mile or less and 12% when you consider all walking trips. For people with disabilities, seniors and children, the percentage for walking is much higher at 30%. Children walking home from a neighborhood school most likely bumps up this statistic as well as people unable to drive. Throughout Whatcom County, 3% of trips are made by bicycle, but in Bellingham biking is 6%. In the most urbanized area of Bellingham west of the Interstate, the bicycle trips jump to 11%, where shops, services and restaurants are close to dense residential neighborhoods.

In 2010 Whatcom County had 201,547 residents. Fast forward to 2018 and we find 225,685 residents---a gain of almost 25,000 people in 8 years. The COG’s recent planning document Whatcom Mobility240-Regional Significant Systems projects population increases with an alarming increase.

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72 https://tonyseba.com/portfolio-item/clean-disruption-of-energy-transportation/
74 www.co.whatcom.wa.us/1171/Current-Comprehensive-Plan
75 www.whatcommobility.org
in traffic. COG estimates that population (and miles driven) will increase 42% from 2013 to 2040. Clearly these are significant challenges.

**Whatcom Transportation Authority (WTA)** is an independent public agency overseen by a 9-member board. WTA operates 30 bus routes, ADA para transit, Van Pools and limited zone service with 47,591 boarding’s in 2018. Their major source of funding is sales tax (0.6%) and fares, with some federal help in buying buses. Their no idling policy saves 2% on fuel costs and reduces emissions and noise pollution. Roundabouts are also very effective in moving traffic and reducing idling time.

WTA has been forward thinking in buying 6 hybrid buses, extending bus service to the county to discourage SOVs and providing free bus passes for students and seniors. The hybrid buses were part of a learning curve as they arrived needing much more work to integrate them into the system. Hybrid buses get better mileage using less gas, but their tires wear out faster.

The higher cost of electric buses is still an issue compared to diesel and the charging station is another $100,000. Still WTA plans to move ahead with an electric bus lot, envisioning 10 charging stations. Two electric buses are on order using Federal grant money and grant money may provide some funding for two more electric buses. WTA would like to move faster to electric buses, but money has been the barrier. WTA paid $1million for each electric bus, but there is some indication that the price of these buses is declining with the declining cost of batteries. In addition, consider expected improvements in reliability and reduced maintenance with electric vehicles in general.

Another upgrade to their fleet is changing their 40 para transit buses from diesel to propane. This would enable a 30% reduction in CO₂ emissions and a 2 ½ year pay off. This upgrade should be weighed against waiting for all-electric para transit buses, as the cost of electric batteries is decreasing, and would probably result in lower lifecycle maintenance of the overall vehicle.

WTA prides itself on service. They have expanded their service to the county, but were disappointed to learn that the carbon footprint was not reduced from this expansion. They, like many community bus services are actually losing riders. They attribute this to the ease of Uber and other ride shares, the relatively cheaper gas prices as well as more affluence. The “every 15-minute” schedule on the busiest routes is hugely beneficial and those buses carry more passengers. Anticipated growth in daily WTA bus boarding’s suggests a ridership increase of 35 percent between 2016 and 2040, going from 20,000 to 27,000 a day.

The majority of transit trips take place in the region’s urbanized areas, especially Bellingham. The travel demand model forecast does not take into account the likelihood that WTA will implement new transit routes to meet travel demand generated by the region’s projected growth in population and employment. Also, when combined with the fact that the local jurisdictions continue to promote transit and, in some cases, plan for infrastructure to support it, it is very possible that transit ridership will surpass the travel demand model’s 35 percent growth forecast.

**Whatcom County.** In 2007 when the county began to look at transportation in their climate action plan, motor vehicles accounted for 37% of CO₂ emissions and there were 533 hybrids registered in Whatcom County. One can imagine these numbers have gone up significantly due to growth of population and businesses. The county embarked on a climate action plan in 2007 to reduce these
emissions but when the recession hit, budgets were tight and they lost their full-time Conservation
Resource Analyst. Since then many projects were derailed and the 2016 comprehensive plan con-
tains many of the aspirations articulated but not finished in the 2007 wish list. Several departments/ 
groups contribute to transportation within our county government, including Public Works, Parks
and Recreation, and the Bicycle/Pedestrian Advisory Committee, which are discussed below.

*Whatcom Public Works* is the largest of Whatcom County departments. Public Works' primary ob-
jective is to maintain the integrity of the Whatcom County road system in an efficient, cost effective
manner that provides safe travel for the public using primarily automobiles and trucks. Public
Works considered switching their fleet to bio-diesel and gave up. Over the last decade, approxi-
mately 8% of their fleet has been gas-electric hybrids. Many appropriate all-electric vehicles (e.g.,
trucks) are still too expensive. The “no idling” policy for county workers is good but there is no data
to quantify the benefits.

Roundabouts are used extensively to smooth traffic flow, reduce citizen idling while stopped and
reduce the high cost of installing and maintaining traffic lights. The county has received Federal
funding support to create more roundabouts. They are now ubiquitous on our county roads and
keep traffic moving without long stops at traffic lights or stop signs. Public Works plans to build
more of them as they save on emissions and the cost of maintaining traffic lights.

Planning for climate change has been slow although some new regulations are in place. A project
that qualifies for federal funds from the Surface Transportation Block Grant (STBG) program must
show greenhouse gas emissions reduction along with energy conservation, habitat restoration and
storm water management. Such a project that is in progress is the upgrading and rehabilitation of the
Telegraph Road corridor from Deemer Road to James Street. This is a multi-funded and multi-
modal project to increase transit, bike lanes, sidewalks and flashing pedestrian crosswalks.

*Whatcom County Parks & Recreation* currently manages or oversees 16,000 acres comprised of 69
park and recreation properties. These include natural areas, parks, gardens, tidelands, beaches, his-
toric buildings, special use areas and undeveloped lands. In addition to recreation, parks provide im-
portant connecting routes for biking and walking. A customer service survey in 2015 indicates that
park visitors overall were pleased with the park facilities giving a good approval rating 92% of the
time.

New bridges are being planned in parks and on roads and all must meet new standards as to heights
in consideration of rising waters and extreme weather events. Along the saltwater beaches, parks
have concrete toilet facilities as their only building. Parks and WTA are already coordinating to
provide bus service to trail heads. This has been done with the Sudden Valley route, where the bus
serves both Valley residences and hikers accessing the Lookout Mountain trail-head.

The *Bicycle/Pedestrian Advisory Committee* assists the county in the planning, funding, develop-
ment and implementation of facilities and programs that will result in the increased safety and use
of bicycle and pedestrian travel as a significant and beneficial mode of both transportation and rec-
reation. Many trails have been on the list for a long time due to low priority ranking in 2016 in
comprehensive plan review.
Gradually new bike routes are being added. A long-awaited trail from Bellingham to Ferndale is in the works as the Port is willing to designate airport property for this connection. Work is on-going with the Bay to Baker trail and work has started on a bike corridor from Birch Bay to Blaine, directed by Blaine but supported by Whatcom County Public Works. In the 2016 comprehensive plan there is a list of 19 priority project rankings to improve pedestrian and bicycle safety.

Although School Districts are separate governing bodies, they represent daily destinations for many people (e.g., students, staff, and parents) and were part of this interview process. Discussions centered around school buses and if schools had concrete plans on alternatives to single occupant vehicles. Walking and cycling are not encouraged because of “unsafe” road conditions and no incentives for ride sharing for teachers.

Missing at the county level is an active plan to improve bike and walking corridors for county schools. It is way down the list of priorities. Often isolated from neighborhoods, school personnel think buses are the best way to transport kids. They do not encourage walking and biking for safety reasons. When improving roads, a bike corridor, either an off-road trail or impervious barriers separating the lanes from the traffic, would be an excellent improvement.

Like WTA, many county schools are looking at converting their bus fleets to propane at a savings of 30% of their CO₂ footprint. County school personnel feel electric buses do not provide enough range to use effectively and will not consider them unless the range per charge is improved.

Education of the next generation to learn about biking, walking and bus transportation is on-going. Seventeen hundred 4th graders were brought to Bellingham last year on WTA buses to teach them how to navigate the system. Kids from K to 2nd are being taught to ride bikes. One disappointment remains: teachers are not modeling the alternate modes of travel, as most still arrive in a single occupant vehicle. A suggestion from Bellingham’s staff was to have the district office provide E-bikes for school personnel to shift more trips from cars to biking. They felt this would also show a commitment from the top to shift the car culture.

The Smart Trips Program was initiated in 2007 by the Whatcom Council of Governments. The purpose of this program is to encourage the use of alternative methods of transportation and reduce single occupancy car commutes to and from work. Employees can earn rewards when they make trips by walking, biking, riding the bus, or carpooling. This is a voluntary program that can provide important historical data on the use of alternative transportation for commuting for Whatcom County and the City of Bellingham.

Whatcom Smart Trips can be considered a “passive” program that facilitates alternative commuting for residents who already want to find an alternative commuting method. These types of programs have not been shown to significantly change commuter behavior. The proof of this can be seen in data reported by the city and county.
Approximately 300 county employees have registered in the Smart Trips Program. A 2018 Smart Trips update indicated that 76 out of ~850 FTEs (full time employees of the county) used alternative commuting 47% of the time. This is an equivalent of <38 out of 850 FTEs, or ~4% of workforce, use full-time alternative commuting (walking, biking, bus, carpool). The trend in county employee participation has declined over the last six years as shown in Figure 2.1, as has the use of alternative commuting.76

The county’s 4% of alternative commuting is well below Bellingham’s average of around 30%. This is likely explained by the isolated location of many of the county’s offices that may not be served by public transportation or trails for walking and biking. Transportation and employee commuting should be considered in any future facility plan for the county.

The City of Bellingham has conducted an annual survey to track mobility in the community (Transportation Report on Annual Mobility or TRAM77). Between 2000 and 2017 single occupancy vehicle use has varied from approximately 70% to 68%, while alternative commuting has varied between approximately 30% to 32% over this same 18-year period.78 Alternative commuting includes car-pooling, walking, biking, public transport and work from home. These variations may be statistical error in the sampling method and do not indicate a trend.

Although the population of Bellingham has grown by approximately 20,000 between 2000 and 2017, the city’s TRAM data over this 18-year interval remains relatively consistent. It suggests that a certain percentage of the population is predisposed to alternative means of transportation. It also suggests that programs such as Whatcom Smart Trips may have had minimal impact on changing peoples’ commute behavior among city employees. Although city officials feel that biking and walking will increase as the city completes connecting these trails over the next several years, the eighteen years of TRAM data shows the challenge of reaching the city’s long-term goals for alternative transportation of 39% by 2026 and 50% by 2036. Both the Whatcom County and the Belling-

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76 Smart Trips data for the county was provided by Suzanne Mildner in the Whatcom County Executive Office.
77 https://www.cob.org/Documents/pw/transportation/2017_TRAM_FinalPublish.pdf
ham transportation information suggest that Smart Trips has not changed commute behavior and more aggressive and innovative approaches may be needed.

**Possible Climate Strategies**

In its simplest formulation, the challenge is to incentivize as much walking and biking as possible since they are the best alternatives for public health, reduced environmental impact, least infrastructure costs, and probably the quickest to deploy (if behavior can actually be changed). This is much harder to do in rural areas than it is in densely populated neighborhoods. Many, many trips are currently short duration and distance. For situations where distance, timing, and the amount of people/goods to be transported cannot be accommodated with walking and biking, develop the other alternatives. In addition to hybrid/electric vehicles, two rapidly developing transportation technologies are being implemented around the world and should be considered here in Whatcom County: 1) commute management platforms for large organizations and 2) rapid emergence of electric bikes that extend biking range, enable wider group of participants due to ease of use, and the ability to carry more goods/kids.

Many companies and government organizations, especially in large metropolitan areas, are using new, innovative technologies and methods to reduce single-occupancy-vehicle commuting. For metro areas, commute is the 3rd most common reason people leave a job. These programs use both a carrot and stick approach. For example, a company might provide free monthly bus passes while at the same time increasing the cost of vehicle parking. Commuter benefits are important for both job satisfaction and for changing commute behavior. In 2020, a Seattle ordinance will require employers to provide pre-tax commuter benefits. New York City, the Bay Area and others are doing the same. Seattle also is mandating drive alone rates for employers and refusing to give development permits unless certain goals are agreed upon (e.g., the number and daily cost of parking places).

The City of Seattle and many major companies in downtown Seattle are adopting a carrot and stick approach tied directly to their benefit programs. When this type of program is tied into benefits, the company knows exactly how far their employees commute to their respective work locations, the routes they need to take and the methods they use. Using this information helps employers develop/recommend new approaches to employee commuting, such as having data to justify new bus routes or bike paths. This information also helps inform large public infrastructure investments over time, such as new facilities and businesses.

Bellingham is expected to grow substantially in the coming years, but it will not be a Seattle anytime soon. An employee commute benefit program described above still can be used to collect the data, but just for a different mix of commute alternatives and behaviors. Encouraging large Whatcom employers to review and embrace these new approaches, may be an effective approach for reducing the county’s transportation carbon footprint. The employer improves employee satisfaction while appropriately rewarding alternative commute behaviors. And the county wins by gathering real-world datasets to most effectively invest in future alternatives and transportation infrastructure.

In Table 2.1 below we outline some potential strategies, actions and measures that may be considered to reduce the emissions related to transportation. As mentioned above, access to accurate

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information on employee commute behavior to develop alternative transportation approaches, and the rapid growth of E-bikes and EV’s may be disruptors in the transportation sector. With good data, the county can facilitate the future growth of alternative commuting through dedicated trails and bike paths.

Table 2.1 Transportation and Mobility Strategies, Actions and Measures

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<tr>
<th>Strategy</th>
<th>Actions</th>
<th>Measures</th>
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<tr>
<td>Evaluate and adopt new and emerging approaches for collecting data on employee commuting and use that information to change commute behavior &amp; guide transportation planning.</td>
<td>1. Review latest tools and methods 2. Establish preferred measurement tools/methods 3. Establish citizen outreach and education methods 4. Recruit public/private organizations to new methods</td>
<td>➢ Gain approval for an implementation plan in 2020. ➢ Measure and publish usage of alternatives over time ➢ Measure public engagement and participation ➢ Track results of each participating organization (to the extent made public)</td>
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<tr>
<td>Accelerate the electric vehicle transition (e-bikes, hybrids, full electric vehicles)</td>
<td>1. Evaluate investment mixes for alternatives. 2. Track citizen behavior and choices over time</td>
<td>➢ Adjust investment mix as needed over time ➢ Use public dashboard to communicate outcomes over time</td>
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<td>Integrate transportation &amp; mobility into a long-term county facility plan.</td>
<td>1. Define long-term county transportation &amp; mobility requirements (for both county government functions and probable citizen needs). 2. Develop a long-term county facility plan to meet those needs.</td>
<td>➢ Gain approval of the plan in 2020 and begin execution. ➢ Revise the plan annually, publicize progress against goals, solicit citizen input, and continue execution of revised plans.</td>
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<tr>
<td>Greater county leadership in transportation to lower the transportation carbon footprint and enable more mobility options.</td>
<td>1. Develop a long-term transportation plan for the county that is updated every few years. 2. Reduce urban sprawl in rural areas and include a transportation plan for any new developments. 3. Preserve and foster increased rail transportation for the public and industries. 4. Explore with the Port the feasibility of building multi-modal transfer stations to move freight from trucks to rail.</td>
<td>➢ Gain approval of a plan in 2020, revise annually in conjunction with citizens, and continue execution of plan. ➢ Higher use of mass transit in the County. ➢ Reduction of freight transportation by trucks.</td>
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*Evaluation and Adoption of Tools/Methods for Understanding Commute Behavior*

To manage a transportation system effectively requires observation and measurement of important system components and behaviors. This strategy seeks to identify emerging tools and methods for such use in the county. Once tools/methods are identified, the county can embrace them and lead by example. Other large organizations may be encouraged to follow, so that transportation information can be shared for planning and investment purposes. Each participating organization should be motivated to help their staff or members, and to share commute datasets in order to better influence future infrastructure investments. The implementation of a commute management platform by Oregon Health Sciences Center provides a good case study of how this type of program can be developed based on employer/employee needs. A similar approach by a few large employers in Whatcom County (e.g., Western Washington University, hospitals and the distributed network of

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hospital affiliated clinics) would provide a tremendous amount of commuter data to the county, while also incentivizing alternative commute behaviors. Some metro areas or counties subsidize such new tools in order to gain valuable, living datasets over time about actual commute behavior related to past public infrastructure investments. This data helps optimize future investments for desired impacts.

**Accelerate Vehicle Electrification Powered by a Fossil-Free Electric Grid**

This strategy is both doubly important and doubly hard to do. Transportation must be electrified rapidly in order to reduce carbon pollution but doing so depends on the electrical grid – which is simultaneously being modernized to be fossil-free by 2045 under Washington state law. Unfortunately, the electrical grid in Whatcom County is now over 50% fossil-powered and major, targeted investments are necessary to convert to fossil-free. The Transportation & Mobility strategy must be closely coordinated with the Energy Conservation & Renewable Energy strategy in order to invest optimally for the quickest and most effective transition.

Consider an emerging, disrupting technology development and its possible impact on viable alternatives: the electric-bike or e-bike. As previously stated, many SOV trips in the county are short duration and distance. Both walking and biking are not carbon polluting, are good for public health, and are relatively lower cost to implement than other alternatives. The key question is how to get citizens to embrace this mode of transportation? Regular biking is growing, but not nearly fast enough. However, a European study shows that e-bikes roughly double user range, increase carrying capacity and increase the variety of people using bikes (e.g., electric assist enables faster speeds, climbing hills, and lowers necessary physical stamina required). What is needed to take advantage of this? Cheaper e-bikes, safe bike routes, and secure bike storage. Cheaper e-bikes are rapidly coming to market, and the routes and storage are a matter of planning and investment. Both the e-bike and the supporting infrastructure are much less expensive and quicker to deploy than equivalent electric car and truck transportation. E-bikes don’t pollute and also provide healthy exercise for the participants too.81

Puget Sound Energy (PSE) has an active program to increase the use of electric vehicles (EVs) in the region.82 Electric cars have many advantages including lower maintenance, proven and safe batteries,83 and no direct emission of toxic air pollution or GHGs. Indirect GHG emissions from EVs are eliminated if electric charging is from 100% carbon-free sources. And EVs protect Puget Sound waterways by not contributing exhaust pollutants to our roadways, which are transported in runoff into our waterways.84 There has been some concern about the environmental impact of vehicle batteries, but a multistep recycling industry is emerging as described in Chapter 1 and a recent Bloomberg article.85

Transforming the county’s fleet will not solve the problem of other gas vehicles on the road, but by converting its fleet to electric the county leads by example. A good start would be electrifying

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81 [https://www.treehugger.com/bikes/3-things-are-needed-e-bike-revolution.html](https://www.treehugger.com/bikes/3-things-are-needed-e-bike-revolution.html)
82 [https://www.pse.com/pages/electric-cars](https://www.pse.com/pages/electric-cars)
83 Lynn Murphy, Senior Government Affairs Director; Puget Sound Energy, April 1, 2019
county vehicles and WTA buses. Bloomberg News in their April 16, 2018 issue predicts that plummeting battery prices will make electric cars cheaper than gas in 3 years. “Achieving parity for up-front initial cost means the buying decision for electric vehicles is about to become a no-brainer. And that means decarbonizing much of the transportation sector is also becoming a no brainer.” Though this timing seems overly ambitious, the trend toward cheaper electric vehicles seems true.

The cost and performance of electric buses and vehicles is constantly improving. For example, Proterra Catalyst E2 buses offer over 20 miles per gallon equivalent to a diesel bus and maintenance costs are significantly lower.86 Proterra’s buses have come down from $1.2M to $700,000 with most of the savings due to lower battery pricing.

The county’s comprehensive plan lays out a scenario for electric charging stations including a streamlined permit process, incentives for those willing to install rapid charging facilities and partnerships with Puget Sound Energy to reduce costs.87 In addition, the Washington State Department of Transportation has provided funds to install 15 new charging stations, several on the I-5 corridor. Two of these charge stations were recently installed at Whole Foods in Bellingham. The county should install another half way to the border.

More frequent bus service and more county routes were also suggested during our interviews. Greater frequency of bus service among Bellingham, Ferndale and Lynden is needed. WTA is working with the county’s Parks and Recreation to provide bus service for connecting trail heads and bike paths. The county can take advantage of House Bill 2024, Advancing Green Transportation Adoption, that the governor signed in May 2019. This bill adds a six-year sales and tax exemptions for alternative fuel, EV passenger cars, business and commercial vehicles, as well as a six-year capital grant program for fleet electrification of transit agencies and fuel car-sharing programs for underserved communities. The county can also use banked tax capacity to fund a faster transition to electric vehicles.

**Integrate transportation & mobility into a long-term county facility plan**
Consider where county staff live and how they commute to work. Next, consider their transportation options and mobility while providing the best possible services to the county. Finally, keep in mind the citizens’ future mobility and needs when developing a long-term, facilities plan for the county. For example, when extending more bus service to outlying hubs (e.g., Ferndale, Lynden) in the county’s transportation network, accommodate increased biking to these hubs by providing for safe bike routes and secure bike storage. Addressing these “last few miles” to/from the transportation hubs enables more multimodal transportation. This plan can guide long-term investments in facilities (new or old) both for energy conservation and renewable energy, but also transportation and mobility. County staff themselves cited the need for this type of plan to enable optimal decision-making.

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Greater county leadership in transportation

The county can provide greater leadership in transportation. This includes direct local influence on issues such as reducing urban sprawl, increasing the number and frequency of bus routes, and installing EV charging stations. Leadership also means influencing regional transportation approaches that will ultimately reduce the county’s carbon footprint.

Rail transportation is generally more efficient than trucks with regard to fossil fuel use. Railroads are, on average, at least three times more fuel efficient than trucks in terms of ton-miles per gallon. This could mean purchasing abandoned rail lines or right-of-ways, and/or encouraging the Port to build multimodal transfer stations to move freight from trucks to rail. Enhanced rail transportation should also be considered for people. This includes within the county, but also connections to neighboring areas and the greater northwest region. The tremendous rail network that once dominated transportation in America could be partially revived/reclaimed for use again, this time as multimodal transportation networks of rail, bike trail, and walking. The Rails to Trails organization has been spearheading this type of effort nationally. The City of Bellingham has already taken advantage of some opportunities for its trail system.

The county should reevaluate their zoning policies to prevent urban sprawl. Urban sprawl leads to greater transportation and mobility issues in the future, and does not preserve farmland, open spaces, or forest. Consider alternative transportation planning for new developments. Climate change should be considered when approving major new developments or transportation infrastructure. For example, if the only road leading to a new development will be inundated by sea-level rise or flooding in a decade or two, who is responsible for providing access to that development? There are many benefits to minimizing sprawl and building a network of connecting transportation nodes across the county that can be used to efficiently move people and goods between urban centers.

Given the expected migration from south of the border and other states to find a cooler refuge, we will most likely have an even higher growth of population than currently projected. Making sure that land use is addressed is of prime importance. The price of housing is sky-rocketing and attention has to be paid to increasing housing availability for low and middle income people. The City and county need to work on this issue together and it is important in transportation issues. Clustering housing into urban villages with amenities close by and keeping sprawl at a minimum is necessary for an efficient bus system and to minimize car trips.

Work is slow on taking inventory on what needs to be assessed in the inevitability of future natural and human-caused disruptions. Time is running out and challenges must be addressed immediately and forcefully. We have nationally known experts on climate change and sea level rise at Western Washington University. Convene a summit to assess with them, City of Bellingham, and the smaller cities to come up with a plan to actively address these challenges—the effort seems piecemeal now.

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**Barriers to Implementation**

Many of the people we interviewed cited the usual lack of money, but also the lack of leadership by the county when it came to addressing problems related to climate change. It is hoped that attitudes are changing with the regional focus to traffic problems and our continuing problem of climate change. Greater county leadership in transportation is needed to influence policies such as intercity transit within and outside the county using buses or rail.

WTA and all the county offices we interviewed cited lack of money or small budgets were limiting their number of projects and speed of implementation. Consistent with a leadership vacuum was frustration that there was no clear policy on how we might engineer our way out of climate change problems. Increasing river levels are already affecting places like Hovander Homestead Park.

Another barrier for school districts is the perception of unsafe commutes on county roads. Also fear of predators in the city is a concern. Safe bike paths, separate from county roads or busy city streets, are needed to encourage more students and staff to ride bikes to school. One mother picking up one child is observed quite often. There was some disappointment in the community that schools do not educate students enough on the safety and pleasures of bike riding.

There is widely varying opinion about whether the Smart Trips program is a success. The data made available for this research project, in our opinion, has not demonstrated a change in alternative commuting behavior for county employees. Smart Trips does make it easier for interested and motivated employees to find alternative transportation options. Smart Trips also has an effective educational outreach program to introduce a range of ages (school children to seniors) to the ease and benefits of biking, walking and riding the bus.

**Conclusions**

Today in 2019, we have new and specific mandates from the Washington State Legislature for reducing emissions and transportation is one of the major contributors to GHG emissions. County leadership must quickly move to authorize sufficient resources for updating the Whatcom County Climate Action Plan, hiring/assigning key county staff supporting climate action efforts, and then executing that updated plan.

County-wide strategic planning for transportation and mobility should be updated in the context of today’s needs and the outcomes used to help justify investments, such as Bellingham’s Transportation Benefit District (TBD). The TBD allows city or county governments to create transportation benefit districts and impose an additional vehicle registration fee to fund local transportation projects. This should be considered to accelerate multimodal transportation.

Changing technology, government mandates/incentives, and the public interests are creating disruption that must be actively understood and taken advantage of in order to meet the needs of the citizens. Since changes will surely keep coming, these strategies adopt tools and methods to continually adapt the electrification of transportation and mobility, as quickly as practical. Doing so lowers the carbon emissions in the most polluting sector of the state’s energy plan as quickly as possible.
Waste Reduction and Recycling

Vicki Thomas

The Growing Problem of Waste

Human-created wastes, especially plastic, have increased in volume and toxicity to the point where they threaten the totality of life on Earth. Big multi-national corporations have sold us on a throwaway culture. We have done our best to hide away our garbage in landfills, by burning it, by shipping it thousands of miles across the globe for “recycling” or dumping it in waterways or pushing it on poorer communities here and abroad. Legislatures, local and national, have failed to either work with companies to reduce source pollution or to create legislation to hold them accountable. When people have noticed or complained, corporations have deflected accountability and sold us on the idea that if we just are better individuals and put our trash in the appropriate container, that it will magically be returned as a resource and that all will be well. All is not well.

Even as more and more communities, including ours, come to the realization that the way we handle wastes is unsustainable, corporations continue to make packaging that ends up in the waste stream. Many oil companies see plastic as their savior as the world turns inexorably to more sustainable energy. Exxon, Dow, Total, Shell, Chevron Phillips, and Procter & Gamble are forming the “Alliance to End Plastic Waste,” an organization that attempts to push the recycling theme rather than reducing waste at the source.\(^89\) Alarmingly, plastic production, now at 330 metric tons annually is poised to triple by 2050 (Figure 3.1).\(^90\) CNN reports that we may be eating as much as a credit card’s worth of plastic every week and if we drink bottled water that amount doubles.\(^91\)

China and Malaysia are rejecting being repositories of our trash. Other nations are following suit. Local, regional and national U.S. markets are preparing to take up the slack, but progress is slow. This poses a huge problem of where to go with recycling. We have a bit of a reprieve in that our trash in

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\(^89\) [https://www.greenpeace.org/usa/news/industry-group-seeks-to-maintain-single-use-plastic-status-quo](https://www.greenpeace.org/usa/news/industry-group-seeks-to-maintain-single-use-plastic-status-quo/)

\(^90\) 2018 UN Environment/GRID Adrenal, Riccardo Praventtoni, [http://www.grida.no/resources/6923](http://www.grida.no/resources/6923)

Whatcom County is cleaner because we sort it at the curb, but even that advantage will go away as markets overseas disappear.

Organic waste tops the list of commercial and residential waste yet there is significant hunger in the county, with some estimates being 1 in every 5 or 6 people having food insecurity. 17% of the State of Washington’s landfill load is food waste.

Our interviews focused on solid waste management initiatives and plans within Whatcom County to determine current and future activities/plans to deal with climate change. The county has a Solid Waste Executive Committee (SWEC)\textsuperscript{92} and an extensive Solid Waste Management Plan\textsuperscript{93} from which some of the information in this report is derived. Whatcom County is fortunate to have both a populace and stakeholders in the local government and community who are motivated to address the sustainability of waste reduction and recycling.

**Topics Covered:**
- Curbside Waste and Recycling - which forms the major part of this report
- Sewage Treatment
- Animal and Agricultural Waste
- Construction and Demolition Waste
- Hazardous Waste
- Vactor Waste (street waste)

**Background on Waste Management in Whatcom County.** Whatcom is one of only two counties in the state that has a privatized solid waste management system, which is shown in Figure 3.2. Additionally, some large companies and agricultural entities do direct hauling to the transfer stations.

Whatcom county has no open landfills and will not open any in the future due to shallow groundwater. There are five closed landfills in the county that are monitored and currently considered to be virtually free of any contamination danger. All new landfill material is sent to either the Columbia Ridge landfill in Oregon or to the Roosevelt landfill in Klickitat County, Washington.

Organic waste is sent to Green Earth Technology in Lynden for composting. The proximity of Green Earth Technology is a bonus in that it reduces travel time, expense and greenhouse gases related to transport of these materials.

\textsuperscript{92} https://www.whatcomcounty.us/674/Solid-Waste-Management
Whatcom County does not currently incinerate curbside waste; however, the Bellingham Postpoint Water Treatment Plant does incinerate its solid waste and transports the ashes to a landfill. Agricultural waste, much of which is manure, is recycled by adding water to make a slurry to create fertilizer or digested to create fuel. This process is addressed in the Agricultural section of this report.

Construction and Demolition Waste (C&D waste) is handled by the following facilities:

- RE Store
- RDS Transfer Station
- SSC facilities
- Cando Recycling Transfer Station
- Northwest Recycling
- Granite Construction Company
- Whatcom Builders
- Henifin Recycling Facility
- Lautenback Industries in Skagit County also takes wood waste

Area builders are good at doing accurate materials estimates and creating as little waste as possible according to the Building Industries Association of Whatcom County (BIAWC). The Green Built program run by BIAWC provides environmental benefits on many fronts, including reducing waste.94

Hazardous waste is handled at the 3505 Airport Drive facility, which processes approximately 500,000 lbs/yr of waste chemicals. Hazardous waste disposal is funded by an excise tax on solid waste hauled by certified haulers and State Department of Ecology grants. An estimated $315,000 or 25% of the overall $1.26 million Solid Waste budget goes to toxics disposal. Some companies, like Intalco, have their own onsite landfills for hazardous waste. There is no current estimate on how much hazardous waste is improperly disposed.

Vactor Waste, street sweepings, were not investigated; however, vactor waste is discussed in the County Solid Waste Management Plan.4

Waste statistics from the Whatcom County Solid Waste Management Plan indicate that waste per household has trended downward as the public becomes more educated and aware of this problem (Table 3.1). RDS estimates a 15% annual growth in the amount of material brought to the transfer station, despite having an estimated county population growth rate of under 3% per year. This is a discrepancy that deserves some more exploration to resolve.

The Whatcom County Solid Waste Management Plan does not have waste stream analysis beyond 2013; however, the plan states that the county waste stream mirrors the state-wide profile. The most current statewide data for waste stream analysis (2015-2016) from the Department of Ecology is shown in Figure 3.3.95 Note that organics comprise the biggest portion of the waste stream at an overall rate of 28.8% but a whopping 42.5% in the residential sector.

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94 Jaquelyn Styrna, BIAWC, interview. See notes under Land Use Planning, Recreation, Wildlife & Habitat section.
95 Source: https://fortress.wa.gov/ecy/publications/documents/160732.pdf. Not shown in Figure 3.3 are Commercial Waste and self-hauled waste.
**Past and Present Efforts in Mitigation**

Recycling and solid waste collection was made mandatory for both residential and business sources about 25 years ago, but was never enforced.⁹⁶ Some places, such as Seattle, require that garbage be free of recyclables and do audits to enforce.⁹⁷ Seattle also requires multifamily buildings to offer composting for their tenants.

Table 3.1 Whatcom County Municipal Solid Waste Summary – Total and Per Capita 2003-2013.⁹⁸

<table>
<thead>
<tr>
<th>Year</th>
<th>County-Wide</th>
<th>Total Recycling (Tons/yr)</th>
<th>Total Diversion (Tons/yr)</th>
<th>Total MSW Disposal (Tons/yr)</th>
<th>Total Recycling (Tons/yr)</th>
<th>Total Diversion (Tons/yr)</th>
<th>Total MSW Disposal (Tons/yr)</th>
<th>Per Capita Waste Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>68,327</td>
<td>123,847</td>
<td>135,114</td>
<td></td>
<td>777</td>
<td>1,407</td>
<td>1,536</td>
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<tr>
<td>2004</td>
<td>80,447</td>
<td>157,417</td>
<td>140,913</td>
<td></td>
<td>983</td>
<td>1,747</td>
<td>1,564</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>93,643</td>
<td>107,677</td>
<td>142,324</td>
<td></td>
<td>1,013</td>
<td>1,164</td>
<td>1,539</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>109,583</td>
<td>105,430</td>
<td>152,664</td>
<td></td>
<td>1,153</td>
<td>1,109</td>
<td>1,606</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>132,007</td>
<td>88,602</td>
<td>156,043</td>
<td></td>
<td>1,349</td>
<td>906</td>
<td>1,595</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>121,917</td>
<td>28,232</td>
<td>149,751</td>
<td></td>
<td>1,234</td>
<td>286</td>
<td>1,515</td>
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<td>2009</td>
<td>92,358</td>
<td>75,300</td>
<td>138,623</td>
<td></td>
<td>925</td>
<td>754</td>
<td>1,388</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>103,385</td>
<td>88,194</td>
<td>133,943</td>
<td></td>
<td>1,028</td>
<td>877</td>
<td>1,332</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>129,553</td>
<td>55,679</td>
<td>130,171</td>
<td></td>
<td>1,282</td>
<td>551</td>
<td>1,288</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>120,215</td>
<td>88,347</td>
<td>132,539</td>
<td></td>
<td>1,181</td>
<td>868</td>
<td>1,303</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>114,055</td>
<td>62,653</td>
<td>135,134</td>
<td></td>
<td>1,108</td>
<td>609</td>
<td>1,313</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Tons landfilled data for 2003-2013 are taken from annual Ecology records. Recycled tons are taken from annual Ecology Recycling Survey.

Food Plus, the curbside food and yard waste recycling program, is currently voluntary. About 6,000 of the 20,000 residential customers in the city of Bellingham have the service and about 2,000-2,500 in the rest of the county that is serviced by SSC. Adoption reportedly goes up by 500-600 bins every spring. (Note: SSC services ~ 45,000 of the roughly 100,000 households in the county. That would make adoption in SSC serviced areas about 19%. We do not have data from the other haulers.) Western Washington University, Taco Time, most coffee shops and many office buildings participate in Food Plus. Many restaurants, malls, multi-family housing complexes and other organizations do not participate due to the need to correctly separate Food Plus and recycling from regular trash. A 2015 report from Green Earth Technology showed just under 6,134 tons of Food Plus material.

The county chooses to focus on educational and voluntary efforts to reduce waste and to promote recycling and composting. The three main educational outreach efforts are:

1. Sustainable Schools – through RE Sources
2. Improving Commercial Recycling (Toward Zero Waste) – through Sustainable Connections which conducts audits and recommends measures for improvement

⁹⁶ Whatcom County Code 8.13.
⁹⁷ https://www.seattlepi.com/local/article/Mandatory-recycling-program-working-well-1198413.php
⁹⁸ Table 2-5 in the Whatcom County Solid Waste Management Plan.
3. Master Composter/Recycler – through WSU extension – a program for individuals who wish to become better at reducing waste

Other programs include:
4. The Envirostar program which awards businesses between 2-5 stars if they adhere to certain specified green practices
5. Local Source Control – free technical assistance from the county to businesses to help reduce waste/pollution
6. Free Pharmaceutical Return – Whatcom was 1 in only 10 counties in the U.S. doing this. After this legislative session in Olympia, the program is going statewide.

Some newer projects that are in the works include mandated trash pickup at Pt Roberts, Cold Stone Farms Zero Waste Initiative, Sustainable Connections Food Recovery Program, and the new Post Point Wastewater Treatment proposal. These projects are discussed below.

*Mandated Trash Pickup at Pt. Roberts.* Point Roberts has long been primarily a seasonal community and trash pickup has not been required. This has recently been changed so that residents, seasonal or not, must have curbside pickup.99

*Cold Stone Farms Zero Waste Initiative.* Excerpt below from PUD Whatcom article.100

*Coldstream Farms of Deming, WA, a family farm in the Northwest corner of the state, is working to turn their 2,500-cow dairy into a zero-waste business with a cutting-edge filtration system that will transform the cow manure into clean water.*

*On average, the cows at Coldstream Farms produce about 60,000 gallons of cow manure a day—22,000 of which will go through the system’s combination of nanofiltration and reverse osmosis and transform that cow manure into 12,000 gallons of clean water daily. After treatment, the water will be clean enough for the cows to drink, irrigation for the farm’s crops, and even benefit local salmon runs by*

increasing streamflow. Other products of the system will be approximately 16 yards per day of nutrient rich solid manure and 8,000 gallons of nitrogen and potassium-rich concentrate which is suitable for use as chemical-free fertilizer. These concentrated nutrients will be used by the farm as well as other local commodities, like berries and potatoes, to replace imported fossil-based fertilizers.

Coldstream Farms will be the first and currently only farm to be using this type of clean water membrane technology in the state. The farm will be able to utilize some of their current manure management technology, the Beddingmaster, to treat the primary solids that come from the 60,000 gallons of manure a day.

Sustainable Connections Food Recovery Program101 This program has recovered 50,000 pounds of edible food and served 30,000 meals to Frances Place, Lummi Nation, The Lighthouse Mission and NW Youth Services. This program will come to an end in June if funding is not renewed, approximately $50,000 to $60,000 annually to continue and expand the food recovery initiative.

New Post Point Wastewater Treatment Proposal102 Bellingham has and is still incinerating the solids from the waste treatment plant and is transporting ashes to a land fill. However, there is movement towards a $196 million proposal to get rid of the end-of-life incinerators and build a digestor to create energy instead. This would mean a 30% reduction overall in emissions produced by the city of Bellingham. If this is achieved, Bellingham sewage treatment would join most other municipalities in having a digestor rather than an incinerator. This project represents the single largest piece of the Bellingham climate plan.

Potential Climate Strategies

There are critical areas within the county waste stream that are ripe for aggressive action but are conspicuous by their absence of priority and acceptance of business as usual. The waste stream in Whatcom County can be reduced and, by doing so, reduce the increasing economic, social and environmental costs to county. The strategies listed in Table 3.2 below will be discussed in detail.

Eliminate Plastic Use. Plastic in the U.S. is most often made from natural gas. According to Sightline Institute 67% of U.S. gas is produced by fracking. The more plastic we produce and use, the more we encourage fracking. Everyone, with the possible exception of plastic manufacturers, agrees that we cannot recycle our way out of our plastic waste crisis. Even with more and more recognition that plastics are an immediate threat to life on the planet, and with the collapse of the China and eastern trash depositories, there appear to be no specific actions being taken or planned on this front in the county, except attempting to stay as close as possible to business as usual. There are no attempts to deal with companies or legislators directly to reduce packaging waste or to produce products with alternative materials or to require products with higher percentages of recycled material. This is seen as something over which the stakeholders have no leverage or ownership. This does not need to be the case.

Just as the county decided to buy fossil-free electricity from Puget Sound Energy a decade ago, the county can also use their purchasing power to require potential vendors to reduce/eliminate plastic

packaging, require a higher percentage of recycled materials in products, or even require the vendor and/or manufacturer to take full ownership of the packaging or product lifecycle. Currently the county assumes these costs, which are not part of the bid consideration. At the very least, the cost of waste disposal and recycling should be added as an overall cost of the product.

The county can ban single use plastic, starting with plastic bags. It can follow the example of the city of Edmonds WA and ban single use plastic service items.103

Table 3.2. Potential strategies, actions and measurements.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Actions</th>
<th>Measurements</th>
</tr>
</thead>
</table>
| Eliminate plastic use   | 1. Reduction of packaging overall and total elimination single use plastic packaging, especially for food service and plastic bags via ordinances, such as single use plastic bag bans and bans of single use plastic containers.  
2. Require higher percentages of recycled materials in products & packaging purchased by county.  
3. Investigate approaches that requires product producers to take full ownership of product lifecycle, cradle to grave.  
4. Educate public and businesses in the county to reduce waste.  
5. Install water refill stations to avoid the need for people to buy water in plastic bottles | 1. A 10% reduction per year in total waste shipped to landfills.  
2. Ordinances to reduce plastic  
3. County purchasing guidelines changed, implemented, & enforced that adhere to new target guidelines and timetables.  
4. Pilot group, including businesses, local state reps and public stakeholders convened. May involve counterparts in other counties to identify early adopters. Provide incentives to early biz adopters and progressively make mandatory to do biz with county |
| Reduce food waste       | 1. Fund and expand the Sustainable Connections Food Recovery program annually. Add funding for a food kitchen to allow food to be served other than immediately  
2. Require multifamily building owners and mall owners to provide compost services for their tenants  
3. Make Food Plus a standard part of the curbside pickup throughout the county, just as recycling is today  
4. Enforce the regulations on the books that require everyone to have trash pickup and recycling  
5. Make offering of a smaller trash can at a reduced price a default to offset the increased cost of Food Plus and to encourage use of it, as Oakland CA and other places around the country do. Today the default is the large container. You would have to know to ask for a smaller/less expensive one. | 1. Budget allocated for maintenance and expansion of these programs.  
2. Enforce current mandatory ordinances on recycling and review and update county ordinances to accommodate stronger food and waste recycling.  
3. Work with waste subcontractors to offer smaller trash bin at a reduced rate and educate the public on this option.  
4. An increase in compostable waste and a decrease of food in waste stream to landfill. |
| Up our data game on the county’s waste stream and use this information to promote innovation. | 1. Make a county employee responsible for waste strategy, actions and measures to reduce the overall waste stream.  
2. Investigate the European system of Trash to Energy and reopen discussions with RDS on their program proposal.  
3. Develop new innovations in waste management. | 1. An individual who is available to the public to answer questions and educate public on the size, complexity, and cost of waste removal.  
2. Cohesive and up-to-date quarterly reports available to the public online. |

The county can also push our local state legislators to introduce new legislation to support existing pending legislation to regulate single-use products and packaging, such as HB1204. California is

considering legislation that would impose a far-reaching and significant regulation of consumer products and packaging that can serve as a model.\textsuperscript{104}

\textit{Reduce Food Waste.} Reduction of food waste is also very important. It is estimated that almost a third of all food raised and prepared in the world ends up in the waste stream. The food we waste contributes 4.4 gigatons of carbon dioxide equivalent into the atmosphere or about 8\% of GHG emissions.\textsuperscript{105} As such, food waste ranks third on the most effective ways to reduce GHG emissions. It is estimated that one pound of food waste in a landfill creates 3.8 pounds of greenhouse gases. Therefore, the Sustainable Connections Food Recovery effort of 50,000 pounds, is equivalent to saving 190,000 pounds of greenhouse gases from entering the air. If 80\% of the 100,000 households in the county used Food Plus and put just one pound of food a week into that bin instead of tossing that food into landfill, we would eliminate 16 million pounds of greenhouse gases per year. It has been estimated that the average household tosses out 7 pounds of organic waste a week. If we apply this metric to countywide adoption of FoodPlus it would eliminate \(\sim111\) million pounds of GHGs (about half CO\textsubscript{2} and half methane). This analysis does not count the savings in transportation costs and emissions to deliver it to landfills in Washington and Oregon. Clearly reducing food waste and/or utilizing it in methane digestors to create biofuels will reduce GHG emissions.

\textit{Up our data game on the county’s waste stream and use this information to promote innovation.} Understanding the scope of the county waste stream is not a strategy in and of itself, but a standard of management success which runs through everything. Most of the people I talked to did not have solid data, recent data, or sometimes, any data to measure the efforts being put forth.

The Solid Waste Management Plan is outdated and does not reflect the current state or the waste management universe. It will be very hard to claim success in any area that has no consistent, centralized and current measurements. That which can be measured can be changed for the better. Good intentions are not enough. We must have good data upon which to base and measure our efforts. At present, key data is not readily available to determine the trajectory or success of programs. A repository of selected statistics and reports on a quarterly basis that allows the county and businesses to monitor and respond to changing conditions should be doable. It is important that all data have an independent feedback loop to verify results.

Reducing the county’s waste stream to reduce cost and emissions requires that the county recognize this effort as a priority. Recognizing, understanding, and prioritizing waste will lead to new innovations.

\textit{Waste to Energy.} For many years European countries have been converting trash to energy. They have succeeded in creating some relatively clean methods of incinerating trash. The much-reduced residue can be put into landfills. RDS has done a detailed investigation of this approach for our area, which could be re-evaluated given the lack of markets for recyclables. Please note that this is an expensive and controversial initiative that should only be implemented if it can be scientifically shown to produce less air pollution and toxins than the burning of fossil fuels. Many environmental groups are against it and it is perceived to be a significant environmental justice issue as well.

\textsuperscript{14} \url{https://www.arnoldporter.com/en/perspectives/publications/2019/05/california-legislature-proposes}
\textsuperscript{15} Drawdown – the most comprehensive plan ever proposed to reverse global warming. 2017. Edited by Paul Hawken. Penguin Books.
**Barriers to Implementation**

While there are lots of good people doing good things on waste reduction and recycling, there does not appear to be a strong centralized leadership in the county with clear goals, target dates, adequate up-to-date measurements and routine, transparent reporting.

- Reduced budgets from Ecology to Whatcom County mean that there are fewer people to do the work of managing solid waste and impact the ability to fund or increase programs like the Sustainable Connections “Towards Zero Waste” program that helps businesses reduce waste.
- Perceived lack of political will to hold individuals/corporations accountable
- Privatized system creates complications in trying to introduce or measure programs
- Regulations often favor the oil industry. For example, clean air regulations favor gas over the burning of biomass, therefore the wood goes into landfill and the oil companies are incented to frack our lands to produce ever more gas.
- A lack of prioritization and leadership.

**Conclusions**

The piles of waste we are facing are not a personal or individual problem. They are a systemic problem. Waste reduction is not about people being better consumers, although that can help. It is about making less waste in the first place, especially in packaging, instead of foisting this waste upon consumers, who often have little recourse. It is about governments recognizing where the waste is coming from holding corporations and the manufacturer accountable. We cannot recycle our way out of our trash problem. Disposal of trash is becoming a growing problem. Shipping waste globally will soon no longer be possible.

Conditions in Whatcom County are still good, thanks to a motivated community and the efforts of the individuals in the public and private sector that work hard daily to keep life tidy for us all. In fact, those involved in managing solid waste have done such a good job that it is tempting to be complacent. However, we no longer have the luxury of just voluntary actions from some. Nor can we push waste reduction and recycling entirely onto individuals, which is generally the case now. As demonstrated above, we can get some relatively quick greenhouse gas reductions by reducing food waste or converting it to biofuels.

Plastic, like fossil fuels, must be significantly reduced in the short-term and eliminated long-term. This waste is an existential threat. Eliminating plastic can seem like something too big for a county to take on, but Whatcom County has been at the forefront of innovations before. And we are not alone. We have friends in the legislature, in other county governments, in the community and can partner with groups like Zero Waste Washington, Sierra Club, League of Woman Voters and others. People are watching to see what we do here. We can make a huge difference by stepping up to tough problems. The alternative is to, quite literally, keep eating ever more plastic and to destroy the water, air, land and creatures on which we depend. I saw a sign the other day that said “Land of the Free because of the brave.” Time for us all to be brave.
Whatcom County is fortunate to have dedicated officials who are committed to advancing public safety and preparedness. The county also has the advantage of first-rate facilities and equipment that are available for responding to a wide range of emergencies. These resources will better serve the county as natural hazards and emergencies increase in the future as a result of climate change and increasing population. Taking action now to prepare for emergencies related to climate change requires a proactive approach based on the local impacts of climate change. At present; however, specific, local information is often lacking or inadequate to develop plans or even revise codes.

Although we focused on extreme weather events in our interviews under Public Safety and Preparedness, climate change will also impact disease and epidemics. These areas will need to be considered in planning and future community outreach efforts. Public Safety and Preparedness intersects, or rather should be a component, of all the other areas in this Community Research Project. While many extreme weather-related impacts observed in recent history are expected to increase in magnitude and/or frequency with climate change, others like wildfires that have not occurred or are rare, are forecast to become increasing threats due to greater drought. Strategies to address the changing portfolio of impacts are therefore needed to ensure resilience across Whatcom County.

Past and Present Climate Change Impact Efforts
The Sheriff’s Office maintains the county’s emergency management plan\(^\text{106}\) that provides step-by-step instructions and authority for dealing with emergencies. This emergency plan addresses extreme weather events that can result in flooding, landslides, drought, and even epidemics. The County’s Emergency Operations Center (EOC) has become a regional resource for emergency response and training. The EOC has 2,000 volunteers and 500 trained CERT volunteers (Community Emergency Response Team). Every year the EOC runs an emergency training exercise that identifies issues that need resolution in planning, training, and even updating county codes. The EOC and the local search and rescue team are coordinated through the Sheriff’s Office.

Where the county’s emergency management plan focuses on the response to emergencies, the county’s Comprehensive Plan\(^\text{107}\) contains recommendations that can form the basis of a set of climate strategies and regulations that, in theory, could reduce the damage from extreme weather events on life and property. New regulations can be recommended at any time, but first we need a better understanding of the predicted local impacts of climate change in the county with respect to flooding, sea level rise (SLR), storm surge, landslides and wildfires. The following discussion illustrates ongoing work and research that will lead to a better understanding of how extreme weather events will impact Whatcom County.


Landslides and floods will be an increasing problem with climate change. The Department of Natural Resources (DNR) recently updated landslide maps and are applying risk assessment tools to landslide potential. The county planning department has recognized the need to prohibit the siting of critical public facilities in known hazard areas and to broadly inform the public of the location of known hazard areas in the updated comprehensive plan. These aspirations in the comprehensive plan, however, are not actual policy.

Whatcom’s Public Works department is in the second year of a multiyear planning effort to update the Lower Nooksack River Comprehensive Plan as part of their Floodplain Integrated Planning (FLIP). This project has already produced impressive reports on the structure and changes that have occurred over the last century for the lower Nooksack River Basin. Studies have shown that over the next fifty years extreme rainfall events and frequency could lead to a 27% increase in the Nooksack River streamflows during the winter and early spring. Eventually, the 100-year flood event may occur every 10 years. The comprehensive plan recommends siting new construction 12 feet above the high-water mark in building codes for Birch Bay; however, the December 2018 storm was 2 feet higher than this recommended level, suggesting a more rigorous analysis is needed.

The lower Nooksack planning will also take into account sea level rise and storm surge on river flooding events. Floodplains by Design (FbD) and The Nature Conservancy released a quick reference guide on climate change in the Nooksack River in 2018 that is reproduced below (Figure 4.1). Continued sea level rise will increase the extent, depth, and duration of coastal flooding and accelerate erosion along the shoreline. Eventually, this sea level rise may permanently inundate low-lying areas. Predicted heavier rain events could exceed the capacity of urban stormwater systems, culverts, and drainage ditches. The projected sea level rise, heavier rainstorms, and increased winter streamflows are expected to interact to make floods larger and more frequent. Sea level rise and/or storm surge can actually cause a restriction or “backup” in the Nooksack River flow, which will in turn result in more flood waters moving inland over banks and levees. Climate change will also cause the monthly peak flows to shift from the historical peak in May to January by 2050. Flows in the summer will decrease due to receding glaciers and lower snowpack.

Climate change increases the risk of wildfires and extreme temperatures (both hot and cold days). The county Emergency Medical Services (EMS) have noticed higher numbers of emergencies when days are very hot or cold. Few buildings have air conditioning in the county and nursing homes are especially hard hit. The County Fire Department is evaluating the communities where the FireWise program should be used. This program can also be applied to neighborhoods that are heavily wooded or adjacent to wooded areas.

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108 Lower Nooksack River Geomorphic Assessment Final Report, February 11, 2019, prepared for Whatcom County Flood Control Zone District, [http://www.co.whatcom.wa.us/2971/FLIP-Reports](http://www.co.whatcom.wa.us/2971/FLIP-Reports)
The Department of Natural Resources (DNR) maintains the largest fire-fighting force in the state. The DNR is taking a more pro-active approach to wildfires by identifying high-risk, hard to reach areas and placing equipment in these areas to speed up response to a wildfire. They are also conducting joint training exercises with local fire-fighting groups. The DNR was tasked by

Figure 4.1. Climate Change in the Nooksack River, A quick reference guide for local decision makers.
the State Legislature in 2018 to map on a county-by-county basis the wildland/urban interfaces (WUIs).\textsuperscript{112} It is known that 70\% to 90\% of all fires are human caused, hence the emphasis on WUIs. These maps will indicate where International Building Codes for WUIs will be required. More discussion on wildfires can be found in the Forestry section of this report.

As the work above illustrates, climate change will have a profound impact on Whatcom County resources and overall quality of life. The impact of flooding, heat waves, SLR, storm surge and other natural disasters will only increase with climate change. Understanding the potential magnitude of future extreme weather events is critical for updating emergency management procedures such as evacuation routes and the location of emergency response capabilities.

**Potential Climate Strategies**

The following potential strategies to enhance public safety and preparedness represent a culmination of numerous interviews and reports (Table 4.1). Any strategy that is considered for inclusion in a future climate action plan needs to be evaluated through a process that is based on a set of criteria established by the Whatcom County Climate Impact Advisory Committee (CIAC).

Studies on the local impacts of climate change are currently underway, but additional research is also needed. Whatcom County has more than 130 miles of marine shoreline that will be subject to flooding and wave impacts associated with sea level rise and coastal storms. As the recent December 2018 storm showed, local topography combined with weather conditions can produce devastating impacts. NOAA’s large-scale weather models do not take into account local topography and this can have a profound effect on wind direction and storm surge. In the December storm, NOAA models forecasted the wind direction from the SW in Birch Bay, but more wind from the west was observed.\textsuperscript{113} When combined with high tide, the westerly winds created a massive amount of storm surge. This illustrates that the county should consider, if feasible, an investment in a dynamic, downscaled version of NOAA’s weather model (or other model) that incorporates local topography. In addition, a detailed CoSMoS integrated hydrodynamic model of coastal storms, waves and stream flooding is needed to evaluate the total water level and wave-related impacts that occur during extreme events.

Stormwater runoff is another concern under future climate conditions, particularly whether the existing capacity can handle routing of more runoff as a result of expected extreme rainfall events. Stormwater often contains surface pollutants, such as animal waste, roadway oils, pesticides – basically any surface contaminant from residential, commercial and/or industrial activities. Increased sediment loads in surface water from extreme rainfall events will continue to cause drainage system failure resulting in increased flooding and outfalls are increasingly vulnerable to sea level rise and waves, corrosion from saltwater, etc.

The county needs to develop a plan for incorporating climate change strategies into actual policy and regulations. A common theme that emerged throughout this report is that county planners are typically consumed by daily permitting and short-term mitigation (e.g., annual or event seasonal/event flood planning). Long-range planning occurs when the Comprehensive Plan needs periodic

\textsuperscript{112} Washington state legislature passed bill 6109 in June 2018 that required the DNR to map wildland urban interfaces (WUI). These maps are being done by county.

\textsuperscript{113} Interview/tour of the Emergency Operations Center with John Gargett.
Table 4.1. Potential strategies, actions and measures for Public Safety and Preparedness.

<table>
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<tr>
<th>Strategies</th>
<th>Actions</th>
<th>Measures (at X yr intervals)</th>
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| Create a more complete understanding of the county-level impacts of climate change. | 1. Lead an effort to complete a CoSMoS model of the Whatcom County shoreline.  
2. Complete the integrated surface water/groundwater model of the Nooksack drainage basin.  
3. Evaluate stormwater runoff under extreme rainfall events and flooding. | 1. Publish a map evaluating the impacts of climate change, SLR & storm surge at decadal intervals to 2080.  
2. Publish a map showing changes in flood extent and frequency relative to today of 10-, 20- and 50-yr events used for engineer designs in addition to FEMA’s Base Flood Elevation.  
3. Frequent updates of locations & plans for evacuating people with disabilities. |
| Incorporate climate change information during periodic hazard identification & vulnerability analysis. | 1. Use rigorous risk assessment tools to guide training topics and update emergency plans.  
2. Support a downscaled version of NOAA weather model that incorporates local topography & conditions. | 1. Revise evacuation routes for extreme weather events every 5-10 yrs based on worst case scenarios.  
2. Reduced loss of life & economic damage from severe storm events. |
| Incorporate microgrids for critical infrastructure to promote energy resilience during emergencies. | 1. Develop a plan with city governments to create a microgrid for critical emergency capabilities for County Council approval.  
2. Develop a proposal for the state Clean Energy Fund. | 1. Plan created and approved by respective governments.  
2. Funding granted by the state’s Clean Energy Fund, grid modernization program. |
| Communicate & educate county residents on hazards associated with climate change. | 3. Expand the use of social media & cell phone alert systems to communicate hazards & receive information on developing hazards.  
4. Communicate & educate underserved communities & people with disabilities. | 3. Frequent presentations to neighborhood associations & other civic groups on emergency plans & evacuation routes.  
4. Develop quarterly articles for newspapers on current weather-related hazards. |

updating. It is not enough to simply state in the Comprehensive Plan that the county needs to broadly inform the public of known natural hazards under climate change or needs to establish acceptable levels of public risk. Needed, instead, is a team of long-range planners that are dedicated to developing and revising current codes and regulations.

Improving the resiliency of public safety and preparedness services is interdependent with the electrical grid, as highlighted in Chapter 5 Resilience of the state’s 2019 Biennial Energy Report.\textsuperscript{115} The state’s Clean Energy Fund has focused on funding development of resilient microgrids to meet specific public safety goals. A microgrid is localized energy generation and consumption that is normally connected to the grid but can operate independently during grid disruptions like windstorms, floods and earthquakes. Examples are the Microgrid Resiliency Project at a community center in

\textsuperscript{114} 2019 Biennial Energy Report, Issues, Analysis and Updates; December 2018 Report to the Legislature, Brian Bonlender, Director; Clean Energy Fund pg 52
\textsuperscript{115} 2019 Biennial Energy Report, Issues, Analysis and Updates; December 2018 Report to the Legislature, Brian Bonlender, Director; pg 43
Seattle, and the Snohomish County PUD Arlington Microgrid which address both public safety services and clean energy technology. Arlington’s microgrid includes a combination of solar, battery storage, and electric vehicles.  Communication and education are extremely important aspects of emergency planning. Social media will continue to be a powerful tool for collecting and disseminating information during an emergency. The county should continually revise its approaches for reaching the public during emergencies to alert as many people as possible.

Conclusions
As extreme weather events become more frequent with climate change, Whatcom County has leadership in place to respond to these emergencies. There is good coordination between the county’s Public Works and Sheriff’s Office, but the need for coordination among different departments within the county government and leadership will only increase with climate change. The county could prevent putting people in harm’s way of flooding and sea level rise in the first place. This would require a more proactive approach within planning to consider climate change as codes are revised for new buildings, developments and public infrastructure, such as roads and bridges.

116 Seattle City Light, Miller Community Center Microgrid [https://files.constantcontact.com/71e63237201/15596366-6327-4358-9c26-e548310c12dc.pdf](https://files.constantcontact.com/71e63237201/15596366-6327-4358-9c26-e548310c12dc.pdf)
Chapter 5

Water Quantity and Quality

Judy Hopkinson (lead) and Ellyn Murphy

The impact of climate change adds another layer of complexity to one of the most contentious issues in Whatcom County, water availability. Water quantity, quality and the equitable distribution of this critical resource is paramount to the livelihood and economics of the region through its role for salmon, ecosystem services, agriculture, municipal consumption, hydropower, and diverse cultural and recreational values. The Nooksack River is the primary source of surface water for Whatcom County. Water diverted from the middle fork of the Nooksack into Lake Whatcom combined with rainfall in the Lake Whatcom drainage basin constitutes the source of water for about 50% of Whatcom County residents. Approximately 20% of irrigation water for agriculture is drawn from the Nooksack river system (all three forks) and the remaining 80% from ground water – mostly the Abbotsford-Sumas aquifer (a shallow aquifer that extends into Canada).118

When averaged annually, Whatcom County has ample water for all requirements. This statement is generally acknowledged by those interviewed. This average abundance results from combining oversupply (with attendant flooding risk) in winter and early spring with the undersupply (with low stream flows and increased irrigation needs) in summer and early fall. As stated in the 1997 Reconnaissance Survey of Whatcom County Water Storage Options119:

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.

The limited availability of water in Whatcom County during irrigation season has been recognized for decades and has been the focus of numerous lawsuits, state laws and rule changes that are discussed in more detail below. Even though water supply may be sufficient for our needs on average, the quantity and quality of water is unsustainable, particularly under projections of Northwest climate change. Projections of a 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. Equally important, expected increases in rainfall and runoff in fall and winter will drive more pronounced flood risk. Glacial melt derived streamflow will continue or 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.120

Water quality is also being impacted by climate change. The steady disappearance of glaciers in the North Cascades does not only impact water quantity and streamflow during the summer months, but also impacts stream temperature and dissolved oxygen levels. Cold glacial meltwater lowers stream

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118 Henry Bierlink interview April 12, 2019
119 Nooksack Basin Water Users Steering Committee: Reconnaissance Survey of Whatcom County Water Storage Options, December 1, 1997
120 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
temperatures, which is extremely important to fish survival providing refugia when surface waters exceed their temperature tolerances during warmer summers. Even using a moderate emissions scenario going forward, by the 2040’s approximately 40 miles of the Nooksack River will exceed salmon thermal tolerances.\textsuperscript{121} Whatcom County Public Works is working hard to maintain water quality by identifying current point sources of pollution and eliminating these sources. This scope of work is important and has been successful. But at the same time their scope is quite limited and may not address new issues arising from climate change.

Water Quantity and Quality is perhaps the single largest and arguably important resource impacted by climate change in Whatcom County. Water intersects all of the other areas in this report to varying degrees. It is also the area where Whatcom County could have a major impact by providing strong leadership and coordination.

In the following sections we will discuss the current and ongoing efforts in the county that may address the impacts of climate change, potential new mitigation/adaptation efforts, and perceived barriers to implementation. We interviewed a dozen stakeholders and/or community leaders representing a spectrum of views and approaches to water quantity and quality. Many additional resources, such as reports and publications, were identified during these interviews and are often cited in this summary.

\textit{Past and Present Climate Efforts}

Water quality testing in Whatcom County falls under the Public Works department. Public Works has worked hard to establish \textit{a culture of cooperation rather than blame}. Their primary focus has been on reducing fecal coliform pollution in the county’s waterways. Through monitoring efforts, education and collaboration with other agencies, the county’s program has been very effective as evidenced by the decline in bacterial contamination over the past few years and the re-opening of Portage Bay and Drayton Harbor shellfish beds for longer harvest periods.

Agency collaboration and coordination has been a key to successful messaging and education. Public Works coordinates outreach with other agencies so that the public hears the same key pieces of information from multiple sources in multiple formats. They have not incorporated climate change into their education program. Other issues related to water quality, such as nitrate concentrations, temperature, salinity, acidity, and contaminants like pesticides and a suite of persistent toxic substances that remain and are bioavailable in the environment for a long time, are a concern and will be impacted by climate change. As a result, these issues will only increase in the coming years and will need to be addressed.

Water quantity in Whatcom County has been the subject of lawsuits and much debate and planning over the last several years. As stated above, the situation with water quantity is that it is basically unsustainable under climate change for the current population and economies in Whatcom County. If one considers population and economic growth, water quantity becomes a more difficult problem in light of climate change.

\textsuperscript{121} 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.
As shown in Figure 5.1, agricultural irrigation is by far the dominant use of water in Whatcom County, accounting for 44% of the total water use, followed by industrial (24%) and residential (20%). The remaining 12% is divided among livestock, aquaculture, mining and commercial. As shown in Figure 1 below, ~98% of irrigation water use is seasonal. Agricultural irrigation accounts for 68% of the water used during the critical summer months.

While it has been recognized for some time that Whatcom County faces water shortages in summer and fall, collaborative solutions to the problem have proved difficult. Substantial complexities and gaps in knowledge are problematic. There are also areas of disagreement among stakeholders that complicate collaboration efforts. Augmentation of stream flow is the primary focus of some groups while provision of adequate water for agriculture is the primary focus of others. It has been difficult to establish a culture of cooperation in addressing water quantity challenges similar to that achieved in addressing bacterial contamination of shellfish beds. Nonetheless, numerous government agencies, tribal councils, and non-government organizations are working to address seasonal water shortages. (see appendix for list of agencies).

Efforts to enhance stream flows using current water rights are complicated by the “use it or lose it” relinquishment provisions of Washington Water law. In order to augment stream water, water must be obtained using a legal water right. If a water right holder is not using all of his/her water rights, their water rights may be subject to review and potential relinquishment.

Whatcom County Public Utility District is facing such a dilemma. Through various industry water efficiency efforts, the PUD is currently using about 30% of their 53 million gal/day allocation. The PUD was awarded a $700K grant to put excess water into California Creek to enhance instream flow. However, this project is currently not being implemented until the state Department of Eco-

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logy (DoE) determines whether this is an “offset” or a “mitigation.” If they determine it is mitigation, then DoE is required to re-examine the PUD’s water rights, which could mean the existing water right would be lowered. This would in turn eliminate the PUD’s ability to pump excess water into California Creek.

This same issue also applies to a farmer who might want to pump excess groundwater to a creek to improve instream flows, or a farmer who might want to implement water conservation methods. In spite of the general recognition of the counterproductively of the relinquishment requirement, no agreement has been reached within WRIA-1 to recommend changing this rule.

In contrast to water shortages in the summer and fall, climate change is expected to increase the frequency and magnitude of extreme rainfall events in the winter and early spring causing severe flooding. According to one study, this will result in a 27% increase in Nooksack River streamflows, and the 100-year flood event may become the 10-year flood event. 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 is to develop an Integrated Floodplain Management Plan that addresses flood hazard management, agricultural protection, and salmon recovery needs.

Fifty people are involved in the FLIP effort that includes several projects that are producing information in the form of data and models that will help evaluate the impact of climate change on flooding in the Nooksack. At the same time, the USGS is developing a flood risk model (CoSMoS) for coastal areas of Bellingham which includes consideration of the combined impact in sea level, storm surge and stream flooding under climate change. Gary Stoyka is working to extend this model to the entire county coastline.

Given that the county will have abundant water in the winter and early spring and in fact potentially too much which will result in flooding, water storage is another adaptive approach for reducing the impact of water shortages in the summer and fall. Potential options for water storage during winter months for later use in summer and fall were explored in 1997 and again recently during the WRJA 1 planning for the Streamflow Restoration Act. In both instances they were rejected because they were not practical (too costly, too difficult to find available land, other technical and environmental issues). Future water needs may cause the county to re-evaluate the economics of these options.

The county could also consider developing new sources of groundwater to sustain agricultural needs. Both the Birch Bay Water and Sewer District and the City of Ferndale have drilled deep groundwater wells in the past few years. Birch Bay drilled an exploration well, EW-3, in May of 2017 that extended 600 ft below ground surface within the City of Blaine Groundwater Manage-

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124 Gary Stroyka interview 4/11/19.
125 Nooksack Basin Water Users Steering Committee, 1997
This confined aquifer is most likely screened in the Vashon-Olympia (V-O) aquifer and appears to have continuity with the deeper Possession-Whidbey (P-W) aquifer at this location. The V-O and P-W aquifers are several hundred feet thick and generally flow to the south/southwest beneath the BGMA. The available data indicates that the recharge areas for both aquifers extend a significant distance into southern British Columbia. Further, use of water from this deeper confined aquifer is expected to have little to no influence on surface waters and other groundwater sources currently in use. Therefore, it may be possible to utilize these aquifers in northwest Whatcom County without impairing established water rights or minimum instream flows.

The City of Ferndale also drilled a deep well (Shop Well #2) and encountered the P-W aquifer between 978 and 1,037 feet. The P-W aquifer is highly confined and separated from the regional V-O aquifer by over 800 feet of low permeability silt and clay in the vicinity of Ferndale. The P-W aquifer encountered by Shop Well #2 is saline and would need to be treated (reverse osmosis) before it could be used for municipal and/or agricultural purposes. The science is just beginning to reveal the deep aquifer potential in Whatcom County and whether or not this groundwater will be able to provide irrigation for agriculture.

It is clear that long-term planning that incorporates climate change scenarios will be required to achieve stability and maintain safety and productivity for our region. Water sustainability and resilience is critical to the economic, social, and environmental health of our county. Whatcom County’s Planning and Development Services has both a current planning section, which processes permits, and a long-range planning section, which plans for the next 20 years as required for Comprehensive Plans by the Growth Management Act. Longer term planning is not required and has not been encouraged by the current county administration. Climate change scenarios are not required in “long term” (20 year) planning and may or may not be considered, despite that an increasing number of studies around the world are showing significant savings and potential increases in economic growth and human well-being by planning for change to reduce or avoid expected impacts and costs. Moreover the number of staff positions allocated to long-range planning has decreased from 7 to 3.5 in the past 5 years.

The long-range planning department is aware of the climatology and glacial retreat models that have been developed by the Nooksack Tribe and Robert Mitchell's grad students at WWU (and other models that are being developed), but they are not incorporated into county planning or policy despite similar published projections for many of the Cascade Range watersheds. There is neither legal nor administrative pressure, despite growing support among the county residents, to do so in Whatcom County.

Potential Climate Strategies
The following potential mitigation and adaptation strategies represent a culmination of numerous interviews, reports, and research articles. None of the strategies in this project have been evaluated

126 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.
127 Charles Lindsay, Senior Principal Hydrologist, Associated Earth Science, Inc., personal communication.
129 Cliff Strong interview, April 12, 2019
to include environmental, economic and social costs, and are intended only for consideration by the CIAC for the future climate action plan. Five strategies are suggested for water quantity and quality and discussed below:

1. Create a senior leadership position to coordinate all strategies and issues related to water in the county.\footnote{130}
2. Augment instream river flow during low flows in the summer.
3. Increase water availability for irrigation during the growing season without reducing stream flows needed to support healthy salmon populations.
4. Use science on the impacts of climate change on water in the county permitting process.
5. Maintain sufficient clean water in the Nooksack River for fish, wildlife and recreation throughout the year.

\textit{Senior Leadership Position.}
Responsibility for various aspects of water management is subdivided among a number of different agencies in Whatcom County government making it difficult to coordinate overall planning and devise consistent policies. Consolidation of authority for water issues under a single department may facilitate integration of best available information cross-cutting all issues, stakeholders and sectors, and promote planning for the impact of climate change across Whatcom County. The county is not a purveyor of water and as a neutral party urgently needs to take a proactive leadership role in solving the county’s water issues while there is still time to do so. The county might consider a senior leadership position, “water czar,” to coordinate all strategies and issues related to water. The position would require a person who is trained in both water policy and water science/engineering and has the skills and experience to bring together disparate interests to formulate mutual solutions. The development of a comprehensive water plan, based on environmental, economic, and social benefits, and the current science of climate change is sorely needed.

\textit{Increase Stream Flow}
It is clear that in order to maintain a healthy ecosystem and to continue to receive attendant ecosystem services, 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. A demonstration project on stream augmentation may be an effective way to garner local and regional support for this approach. It also may justify the need to change state water regulations and laws that impact our ability to enhance stream flow under a changing climate.

A multiyear demonstration project 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 and NGO’s will 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, as needed, legislative fixes of state water laws and regulations.

\footnote{130 This issue came up in interviews with Cliff Strong, Jason Hatch, and Ander Russell. In addition, Steve Jilk mentioned that a “state water engineer” (like Montana) might make it easier for landowners to try innovative water augmentation projects.}
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<th>Strategies</th>
<th>Actions</th>
<th>Measures</th>
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<tr>
<td>Create a senior leadership position to coordinate all strategies and issues related to water in the county.</td>
<td>1. Develop a comprehensive plan for water use in the county that is based on: a. Science of surface and groundwater and the influence of climate change b. Development, economic needs and future growth. c. Sustainability &amp; health of the Nooksack watershed, fisheries, and wildlife. d. Maintain recreational opportunities. 2. Represent the County in all water issues &amp; communicate to the public. 3. Incentivize behavior change using monetary assistance from a wide variety of grant programs. 4. Recommend changes in permitting and land use regulations that minimizes urban sprawl and addresses Nooksack water rights.</td>
<td>1. Senior water leader hired. 2. Comprehensive water plan for the county developed and approved. 3. Strategies, actions &amp; measures associated with comprehensive water plan being implemented.</td>
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<tr>
<td>Increase stream flow during low-flow summer months using groundwater.</td>
<td>1. Develop a plan for a multi-year demonstration project with stakeholders that involves most areas of Nooksack basin that typically experience low stream flow during the summers/fall months. 2. Enlist various organizations and NGO’s to collect data on the economic, social, &amp; environmental impacts of the project. 3. Use this information to develop legislative fixes to existing practices and laws.</td>
<td>1. Approval and funding of demonstration project from the Dept of Ecology. 2. Development of an extensive data set that is accessible to researchers. 3. If needed, changes in state regulations &amp; laws to address instream flow.</td>
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<tr>
<td>Increase water availability for irrigation during growing season.</td>
<td>1. County and PUD develop infrastructure to deliver water to irrigation and residential users in rural areas. 2. Allow farmers to switch from surface water rights to groundwater withdrawals that reduce negative impact to stream flows. 3. Set up a multiyear demonstration project of a basin-based water bank.</td>
<td>1. Plans developed and funding secured for PUD groundwater wells &amp; infrastructure designed around target areas that reduce withdrawals from Nooksack. 2. Complete a feasibility study of the impact to instream flow if farmers can switch from surface to groundwater rights. 3. Water bank demonstration plan completed, approved and initiated.</td>
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<tr>
<td>Use science-based information regarding the impacts of climate change to water in the county permitting process.</td>
<td>1. Incorporate the surface water/groundwater model of the northern Nooksack basin to evaluate/change permitting for rural wells &amp; developments. 2. Identify areas where the interconnection between groundwater and surface water impacts stream flows. 3. Where existing wells impact instream flow, encourage deepening wells or converting to PUD water. 4. Monitor and adaptively revise uses for the benefit of all.</td>
<td>1. Number of permitting regulations revised or enacted to reflect the latest science on the impact of climate change on water. 2. No permits for groundwater wells that impact instream flow. 3. Number of wells identified, modified, and or discontinued to not impact instream flow.</td>
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Table 5.1 (con’t)

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<tr>
<th>Strategies</th>
<th>Actions</th>
<th>Measures</th>
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| Maintain healthy & sufficient water in the Nooksack River for fish, wildlife & recreation throughout the year. | 1. Create a database that easily integrates surface water information from all organizations gathering data.  
2. Expand county water testing of E.coli to include other simple measurements, such as water temperature, turbidity and pH, emerging contaminants  
3. Identify key non-fish bearing feeder streams & encourage protection (e.g., timber buffers or trust lands).  
4. Promote the use of carbon offset funds to invest in sustainable farming.  
5. Use Purchase Development Rights to buy land along stream beds to restore natural flood plain and prevent pollution.  
6. Develop a numerical model that simulates the flow-paths and transport of water and contaminants from the Nooksack River and urban creeks through the coastal zone. | 1. Online database and cooperating organizations established. Make data available to public through an interface like tableau.com.  
2. Better understanding of seasonal changes in stream flow & chemistry.  
3. Amount of money & number of sustainable farming projects funded through carbon offsets in county.  
4. Acres of land acquired through PDR. |

*Increase Water Availability for Irrigation*

Using the example from the Birch Bay Water and Sewer District, the county and PUD should also consider developing groundwater wells and infrastructure to deliver new sources of irrigation water for agriculture and rural residential developments. Wells should be located in deep aquifers that do not impact surface water flows and would supplant existing shallow wells that are currently impacting stream flows. Although this may appear to be a simple solution to alleviate pressure on stream flows and the impacts of climate change, it is actually very complicated and a major undertaking and expense to drill exploratory wells.

If high water yielding deep aquifers are found, other issues would also need to be resolved if the PUD were to take over water delivery. Landowners, for example, would need guarantees that their surface or groundwater rights would be applied to groundwater delivered by the PUD.

Another approach would be to allow farmers to switch from surface water rights to groundwater rights, as long as the well drilled is not impacting river instream flows. Creative financing and subsidies for the cost of these wells would need to be identified. Finally, the county and PUD should consider a multiyear demonstration project of a basin-based water bank.

*Use Science-Based Information of Climate Change for County Policies and Regulations*

While predictions of climate change impacts to specific water quantity and quality concerns may contain uncertainty, there is sufficient confidence in the projected trajectories of change that indicate efforts to conserve, plan and adapt for less water availability and compromised quality will benefit regional resilience. Existing surface water and groundwater models for the Nooksack basin should be refined as needed and used to predict the impact of climate change on water quantity under a range of climate scenarios. This information, in turn, should be used to evaluate and change rules for permitting rural wells and developments. In areas where existing shallow groundwater wells are shown to be impacting instream flow, the wells should be deepened (e.g., screened in a deeper aquifer that is not in hydraulic continuity with nearby rivers and streams) or encouraged to switch to PUD water where feasible.
Maintain Healthy and Sufficient Water for Fish, Wildlife and Recreation

Ecosystem services are the many benefits that humans gain from a healthy environment, such as, clean air, clean water, productive soils, climate regulation, and flood control, to name a few. In short, life on earth is dependent on ecosystem services. Assessing ecosystem health is difficult and often labor intensive. For the purpose of this section on water, a healthy river, wetland or estuary is one that has both sufficient quantity and quality of water to support aquatic life, wildlife and recreation.

Maintaining stream flows and stream temperatures conducive to salmon is a major problem in the summer and fall and intersects current forestry practices. In the upper Nooksack watershed stream buffers help to maintain flow and cooler temperature but are only required on fish-bearing streams. A study from Oregon State University showed that the age of the trees in the buffer or catchment also have an impact of water quantity.\textsuperscript{131} Younger Douglas fir (34- to 43-year old) have increased evapotranspiration rates and can cause as much as a 50% decline in stream flows. Increasing rotation ages in specific catchments may be another approach to managing instream flow.

As we interviewed stakeholders across the county, it became evident that many organizations own and maintain stream sampling and gaging stations. Some of this information is collected by county, state, tribal and federal agencies, and conservation organizations. Whatcom County should sponsor an online shared database/interface that is a repository for this information from various organizations. Snohomish County has data on tableau.com where this information can be analyzed and graphed to indicate trends and get a better understanding of changes over time. Ultimately, this type of database can inform future decisions and investments that may be needed to maintain healthy and sufficient water in the county.

Barriers to Implementation

The first step toward collaborative agreements on climate mitigation and adaptation strategies would be to address the barriers that have blocked the process in the past. Most of the barriers to implementing sensible climate mitigation and adaptation strategies for water revolve around the following issues:

- Confusing and contradictory Washington Water Law.
- Unclear water rights
- General lack of understanding of the hydrologic system in Whatcom County, the impact of climate change, and corresponding impact on ecosystem services.

\textit{Confusing and contradictory Washington Water Law}. Washington water law is based on the principle of “first in time, first in right” which gives priority (seniority) for water use to the earliest applicants. It does not prioritize uses relative to the public good. However, individual laws are contradictory such that water use can be designated legal even if such use impinges on senior water rights. This is most recently demonstrated with passage of the Streamflow Restoration Act in 2018 which continues the tradition of allowing water withdrawal without consideration of existing water rights or resources.

Unclear water rights. There are three main issues that add to the confusion on water rights in Whatcom County. The first issue is that senior water rights have not been quantified for the Nooksack Basin. While tribal water rights are considered “Senior”, they have not been quantified and therefore have never been enforced or taken into consideration in determining water allocation. The “instream flow rule” adopted as part of the State Water Resources Act of 1971 does consider fish survival needs, but stream flows were based on several factors besides fish habitat, including rights of citizens to have access to healthy streams and rivers for fishing, recreation, and other ecosystem services and the methods used to quantify instream flow needs have since been dramatically improved. Technical work conducted through the WRIA 1 Watershed Management Project developed updated recommendations for optimal instream flows, but those instream flows have yet to be adopted.

The second issue is that water right permits are not required for all users. During the course of our interviews, several interviewees stated that approximately 40% of water used for irrigation in the county is withdrawn without a legal water right permit. In addition, land use permits have been and continue to be granted by the county without water rights or demonstration of an adequate water supply for the area. Developers are allowed to drill “permit-exempt” wells and to withdraw water without evidence that such withdrawal does not impinge on existing senior water rights.

The third issue is that rural water use is not quantified routinely as it is in urban settings. Although newly granted agricultural water rights (note: this does not apply to permit-exempt wells) require metering, existing water use for agriculture is not metered. Other techniques for estimating water use are imprecise, therefore it is not possible to determine accurately whether use of water corresponds to legal water rights.

General lack of understanding of the hydrologic system in Whatcom County, the impact of climate change, and corresponding impact on biota. Although more and more progress is being made to understand the underlying hydrologic science of the Nooksack basin, we do know the trajectory of expected change sufficiently to warrant stronger adaptation planning before it is too late. Rivers usually have hydraulic continuity with shallow groundwater, so shallow irrigation wells near the Nooksack will likely impact stream flows.

The LENS Area Numerical Groundwater Model is currently under review. 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. The model resolution is such that it will not be useful in evaluating the impact of domestic wells on instream flow.

133 Lynden, Everson, Nooksack, Sumas (LENS) area of Whatcom County. Chuck Lindsay (Associated Earth Sciences, Inc.), Gilbert Barth (S.S. Papadopulos & Assoc., Inc.), and Christina Bandaragoda (University of Washington).
An example given by the LENS development group,\textsuperscript{134} shows the potential impact from one square mile of permit-exempt wells within the Bertrand Creek drainage. The example assumes that this square mile is divided into 5-acre lots, each with a permit-exempt well and allowing \(^\sim\)20\% of land area for roads. The Whatcom County Coordinated Water System Plan indicates that typical permit-exempt wells use about 350 gpd; however, for this analysis we use the revised DoE language for WIRA-1 that allows 500 gpd for indoor use.

Assuming that these 5-acre lots use on-site septic systems, only about 25\% of the water would be considered consumptive. This results in about 14 acre-feet per year (afy) for one square mile of non-exempt wells. The estimated input to the groundwater system in a one-square mile of Bertrand is 2,475 afy, therefore, the total consumptive impact to the groundwater system for these domestic wells would be 0.6\%. This analysis indicates that any simulated predicted impact to the stream using the LENS model would be statistically insignificant. It should be noted; however, that this analysis is averaged over a year and does not take into account finer spatial and temporal scales that can have an impact on instream flow, especially in dry summer months. Whether or not the LENS model could ever be used to resolve finer spatial and temporal scales is unknown.

\textit{Conclusions}

Water quantity and quality is by far one of the most important issues in Whatcom County, directly impacting agriculture, forestry, land use planning, recreation, wildlife and habitat. These impacts are expected to grow as climate change accelerates changes in our environment. In 2015 the county experienced anomalous hot and dry conditions that are believed by experts to be a window into the future. The impact of climate-induced extreme weather events also threatens public safety and preparedness through floods, sea-level rise and storm surge, as well as drought and wildfires. Even waste-reduction approaches in rural areas may be compromised by flooding. Fluctuations in water quantity may also impact the availability of renewable hydropower to the north and south of Whatcom County.

The results found here along with the “best available science” indicates that if Whatcom County takes a leadership role and proactively addresses water concerns and develops mitigation and adaptation strategies for water quantity and quality accounting for climate change, the Nooksack Basin will be more resilient and better able to sustain or even enhance its economy and well-being. The WIRA-1 teams in 2018 may provide a useful structure to continue dialogue with all the stakeholders and tackle these complex issues.

Food production, transport, and sales are an important part of Whatcom County economy, society, and culture. Projected climate change over the coming decades will affect the foods we produce, how we produce them, and how we market, sell, and consume them. Wise and forward-looking policies and practices on the part of the county government, undertaken in cooperation with state and federal government agencies, tribes, independent districts, research institutions, food producers and marketers, and the general public can help the people of the county adapt to climate change, and also to a limited extent mitigate our contribution to greenhouse gas emissions which are causing the earth’s climate to change.

Two kinds of food production are important for Whatcom County: agriculture and fisheries (broadly defined to include finfish and shellfish operations). Climate change will affect both agriculture and fisheries greatly, and both industries will need to adapt and will need help from other stakeholders in order to adapt in ways that are economically feasible, environmentally sustainable, and culturally acceptable. Agriculture and fisheries can also make limited but important contributions to mitigating climate change.

**Food Production in Whatcom County**

As of the 2017 National Census of Agriculture, there were 1712 farms in Whatcom County, operating 102,000 acres, of which 75,000 were cropland. Total value of agricultural products was $372 million, of which $218 million came from animal agriculture and $154 million from crops.

Whatcom County agriculture has several special characteristics that will affect any plans to adapt to climate change.

- Land here is expensive, averaging $16,000 per acre including buildings in 2017, almost triple the value in 2002, and it has grown more expensive since. Rental rates and taxes are also high. This restricts the crops that can be grown profitably.
- Our farms are mostly small and mid-scale family-owned and operated farms. Only 42 farms were more than 500 acres; the average size was 60 acres and the median size only 12 acres. Very small farms (10 acres or less) have more than doubled in number since 2002, but the majority of our agricultural products come from mid-sized farms, between 50 and 1000 acres.
- About half of our cropland is irrigated.
- We grow a very small number of crops: only raspberries, blueberries, dairy forages, and seed potatoes are major crops; beef forages, strawberries, mixed vegetable crops, tree fruit, and wine grapes are minor crops. Milk and berries combined accounted for $292 million, or 78% of total agricultural sales.
- Almost all of our agricultural products are sold as commodities and consumed elsewhere; only a very roughly estimated 3-5% of agricultural products are consumed within the county.\(^\text{135}\)

\(^{135}\) 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](https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/1/state/WA/county/073)
Whatcom County has both tribal and non-tribal commercial fishing industries, as well as a recreational fishing industry. The Lummi Nation and Nooksack Tribe rely on salmon as a major part of their diet and are actively promoting consumption of additional Native foods for their health and cultural value. Salmon is perhaps the only “traditional” food that has remained a mainstay of tribal diets. The Lummi Nation and its individual members are also heavily invested in commercial shellfish production and offshore salmon and bottom fish fisheries; the Nooksack Tribe and its members are also heavily involved in commercial salmon fishing, both in the Nooksack River and offshore. There are over one hundred commercial fishing boats (tribal and non-tribal) based in the county operating in the north Pacific, and several processing plants in Bellingham, Blaine, and Ferndale, as well as five commercial shellfish companies active in the county.

Concern for Climate Change in Agriculture and Fishing Communities
Climate change is a secondary concern to members of the Whatcom County agricultural community, not all of whom are even certain that anthropogenic long-term climate change exists or is problematical. At the same time, regardless of their positions on climate change as an overall phenomenon, Whatcom County farmers have a strong, multi-generational sense of stewardship of the land and of the environment. They are all concerned with the immediate and observable changes and trends in the biophysical environment, whether they are direct results of climate change or not. At the same time, farmers are concerned about the economic and regulatory environments in which they must run their businesses; some of these problems are the same ones that concern people worried more directly about climate change.

Because of this constellation of concerns among the agricultural community, gaining farmers’ support for any measures designed to mitigate or help stakeholders in the county adapt to climate change depends on these measures’ meeting two criteria: 1) they must be economically feasible and not impose an undue economic burden on agricultural operations, and 2) they must address more immediate concerns that exist whether or not they are connected to, or exacerbated by, climate change.

Climate change is, by contrast, a primary concern to tribal and commercial fishers and shellfish producers. Tribal communities have fought hard since the 1960s for enforcement of their treaty rights to take fish (which means there must be fish to be taken) as well as the chance to revitalize their communities economically and preserve the cultural and legal autonomy that is guaranteed by the treaties and has been upheld by the courts. The cultural, social, and economic vitality of tribal communities depends partly on other stakeholders reacting to climate change and other environmental challenges in ways that preserve their legal and moral rights to subsistence, income, and autonomy.

For tribal and non-tribal fishers and shellfish producers, climate change threatens both their way of life and the viability of their enterprises.

Research Process
Twenty interviews were conducted with 24 stakeholders in agriculture, fisheries, science, and conservation, concentrating on agriculture, as well as consulting relevant literature. The appendix to this report lists the people interviewed and the sources consulted. This is by no means a comprehensive account of the challenges and possible solutions facing food producers in the county, and a
thorough understanding of these issues will require coordination with the study now being conducted by the Whatcom County Food System Committee.\textsuperscript{136}

**Projected Effects of Climate Change on Agriculture**

Climate change consists of two primary aspects: rising temperatures and changes in patterns of precipitation. Both of these are likely to have important effects on agriculture. Secondary effects important in our area include freshwater and ocean water warming, sea level rise, and ocean acidification. Here we list the most important of these effects.

*Water shortages (also see Chapter 5 on Water Quantity & Quality).* Both rising temperatures and new rainfall patterns are likely to affect the availability of water for agriculture.\textsuperscript{137} Because winter temperatures will rise, there will be less water stored in the form of snowpack during the rainy months of fall, winter, and spring. This means that increasing amounts of winter precipitation will flow into streams and rivers, and out to the ocean, at times when crops are not in the field or do not need to be irrigated. It also means that dairy manure lagoons, where manure has to be stored during the winter when it cannot be applied to crops, may reach their maximum capacity, meaning farmers will either have to cut their herds or increase storage capacity.

In addition, with hotter temperatures and less precipitation during the summer months, the amount of water that farmers will require for irrigation will increase: the demand for irrigation water will increase at the same time as the supply decreases. Currently, groundwater supplies most of the need for irrigation in the summer, but with drier summers and increased groundwater use, this may no longer be the case (\textit{see Chapter 5 on water}). In addition, water needed for treaty-guaranteed fish passage, and for increasing municipal use as county population grows, will become an object of competition for farmers who need to irrigate crops or pastures.

*Plant diseases and pests.* Warmer winter temperatures and fewer freezing days have already brought northward movement of insect pests and fungal and bacterial diseases. An important case in point is the spotted-winged fruit fly (\textit{Drosophila suzukii}), which attacks our raspberry and blueberry crops. Before this pest appeared in 2009, farmers had instituted effective integrated pest management systems that allowed them to reduce chemical applications, and stimulated the growth of a small organic sector in berry farming. Since the fruit fly appeared, farmers have had to return to the intensive spraying practices of the early 2000s, and the organic berry sector has almost disappeared.\textsuperscript{138} In addition, two fungal pests, \textit{Botrytus} or gray mold and \textit{Monilinia} or mummy berry, affect small fruits such as our mainstay raspberries and blueberries, along with strawberries, wine grapes, and other crops.\textsuperscript{139}

*New crops and varieties.* Provided water is available, warmer temperatures may make it possible to develop new crops or new varieties of existing crops, but they may also challenge the viability of

\begin{itemize}
\item \textsuperscript{136} \url{http://www.co.whatcom.wa.us/2992/Food-System-Committee}
\item \textsuperscript{137} 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. For useful graphs of past trends and predictions, see Eric Hirst, “Whatcom Water Woes,” (pdf) 2018.
\item \textsuperscript{138} Interview with Henry Bierlink, Whatcom Raspberry Commission, 12 April 2019; Interview with Randy Honcoop, raspberry farmer, 30 May 2019.
\item \textsuperscript{139} Interview with Chris Benedict, WSU Extension Service, 9 July 2019.
\end{itemize}
currently planted varieties. For example, Washington vineyards have been able to increase the
number of varietals they grow themselves, adding several desirable varieties since the 1990s.\textsuperscript{140} 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. The small number of closely-
adapted crops currently grown in Whatcom County (in contrast to Skagit County, which boasts over
80 different field crops on smaller acreage)\textsuperscript{141} makes our agriculture especially vulnerable to major
changes in temperature and precipitation. In addition, all of our crops require specialized infra-
structure to produce and process, making it more difficult for farmers to switch crops if such a switch
became necessary. A final factor is that most of our crops, along with our livestock, are perennial
organisms, which only repay investment if they can be kept for several years, so farmers cannot
switch to new crops or animals on short notice, unlike farmers in other areas who grow primary
annual crops such as grain or vegetables.

\textit{Animal diseases}. Like plant pests, animal diseases migrate with changes in climate. The pigeon fe-
ver that affects horses, which previously did not exist in Whatcom County, is now here, spread by
an insect vector moving northward, and it may be only a matter of time until similar diseases affect
cattle, which are a mainstay of our agricultural economy, and import and export of cattle are normal
practices, with about 250,000 livestock coming into the county every year, and about 150,000 going
out.\textsuperscript{142}

\textit{Human health hazards}. Our local agricultural economy depends on hired labor, particularly in the
summer season when temperatures are hottest. Although heat stress is a problem at present only on
the hottest days, if temperatures continue to rise there may be more days when field workers are ex-
posed to dangerously hot conditions, precisely at the times when labor demands are greatest and
working days are longer.

Perhaps more serious for farm workers currently is the smoke from wildfires in increasingly hot and
dry summers, exposing farm workers to dangerous levels of particulate matter, especially during the
hottest days, when fires are most likely to take place.\textsuperscript{143}

\textit{Sea level rise}. Models predict up to three feet of sea level rise by the year 2100.\textsuperscript{144} If these predic-
tions are accurate, we face the loss of 5000 acres of farmland in coastal areas,\textsuperscript{145} particularly in
Ferndale and other areas close to the coast. As sea-level rises, saltwater intrusion of groundwater
may occur. Groundwater is the main source of potable water on the Lummi peninsula. In addition,
seawater incursion in low-lying areas will cause soil salinization. The flooding risk associated with
storm surge will further exacerbate the problem (\textit{see Chapter 5 on water}).

\textit{Corporate farming}. Currently most of our farms, small or medium-sized, are privately owned by
individuals and families, in contrast to California, where corporately owned- and managed farms are

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{140} Interview with Tom Thornton, Cloud Mountain Farm Center, 21 March 2019
\item \textsuperscript{141} See 2017 Census of Agriculture
\url{https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/1/state/WA/county/057}
\item \textsuperscript{142} Interview with Michael Anderson, DVM, 30 March 2019.
\item \textsuperscript{143} Interview with Edgar Franks, Community to Community, 4 April 2019.
\item \textsuperscript{144} According to IPCC,\textsuperscript{144} depending on the amount of global temperature change, sea level is projected to rise from 26 to
98mm (10 to 38 inches).
\item \textsuperscript{145} Interview with Chris Elder, Whatcom County Climate Action Advisory Committee, 23 May 2019.
\end{itemize}
\end{footnotesize}
the norm. As extreme heat and water shortages become more common in California, agricultural corporations with large amounts of capital and economies of scale may begin to covet farms in the cooler climates of the Northwest, including Whatcom County, and may bring their capital to our area, which could fundamentally change the economics and culture of Whatcom County agriculture in unpredictable ways.146 This could occur either as outright purchase of land or leasing of land and corporate management of farming operations.

**Possible effects of agriculture on climate change.** Agriculture is not a major contributor to climate change except in areas where forests are being converted to agricultural land. The Environmental Protection Agency estimates that agriculture contributes 9% in the US, of which about 4% of this amount is due to animal agriculture, two thirds of that from enteric fermentation and one-third from manure.147 In addition, agricultural operations consume energy, particularly by farm vehicles and trucks used to transport agricultural inputs and outputs, as well as by processing plants. Hence it would be worthwhile to find ways to reduce this impact.

Also important are the other connected effects of agriculture on ecological problems that might be exacerbated by climate change. Increased winter floods and stream runoff may affect the ability of dairy farmers to store manure, and agricultural use of water competes with water necessary for ecosystem services and fish passage. Recent approaches by renewable energy companies to lease agricultural land for solar farms present another tradeoff between continued agricultural productivity and measures taken in other spheres to mitigate climate change.

**Projected Effects of Climate Change on Fisheries**

Like fisheries everywhere, Whatcom County fisheries are threatened by climate change. This threat comes 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.148 Here we list the primary challenges posed.

*Less water and warmer water in rivers and creeks.* Salmon, the mainstay of our local finfish fisheries, needs not only sufficient water for passage, but also cold enough water, to reproduce and grow. A combination of hotter temperatures and lowered stream flows (due to both evaporation and changes in seasonal distribution) has raised the temperature of our creeks and rivers. As this happens, adult migrating salmon have increasingly been forced to take refuge in cool pools within the streams, which are fed by groundwater, which is generally cooler than stream water. If the water table is lowered by increased irrigation or municipal use, these cool pools may no longer provide this needed refuge.

Salmon hatcheries, including two operated by the Lummi Nation, 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.

146 Interview with Chad Kruger, WSU Extension, 13 May 2019.
Sea level rise. In addition to possibly inundating agricultural lands close to the coast, with 3 feet of sea level rise most of the Lummi Reservation would be an island. Also much of the current intertidal shellfish habitat would be permanently under water. Sea level rise may also affect estuarine habitat for juvenile salmon. Attempts to armor shorelines to protect coastline residences against sea level rise will cause waves to bounce off the bulkheads and wash away the shellfish. Armoring shorelines is not an approach supported by the Lummi Nation. It is possible that in some but not all areas of the coastline the shellfish beds would simply move inland to places two to three feet higher elevation, but this is not certain.

Ocean acidification. Lowering pH of ocean water is perhaps the most serious threat to our fisheries, particularly shellfish. Oysters, clams, and mussels with calcareous shells cannot “set” or form shells when the water becomes too acidic, and in fact 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 indirectly though declines in many of their prey species.

Ocean water temperature changes. There have been increased incidences of warmer ocean water in the Eastern Pacific over the past decades: the famous “blob” that formed in our waters from 2015 to 2018 was a dramatic instance, but El Niño events also bring warmer waters. This affects the distribution of the marine organisms that salmon feed on, and the distribution of salmon in the Pacific Northwest and Alaska, and can affect the migration routes of salmon returning to spawn, which has a direct effect on the number of fish available to local tribal and commercial fishers.

Ocean waters also become more stratified during warm water events, meaning that the warm surface layer mixes less with the colder layers underneath, and as a result conditions promote the growth of red tide organisms; red tides in recent years have lasted longer into the fall than previously, affecting the safety of our shellfish harvests. Toxic algal blooms are also more likely to happen with rising ocean temperatures, and these also affect the edibility of clams and other shellfish. A third worry are Vibrio and other bacteria, which increase when the water is warm and can release toxins rendering oysters toxic to human consumption.

A final challenge of ocean water warming is its effect on the molt cycle of Dungeness crabs. These changes have so far been erratic and unpredictable, which requires changes in open season and affects the timing of commercial sales. Other resources important to tribal subsistence, such as sea urchins and sea cucumbers, also have their reproductive cycles shifted in time with changes in ocean temperatures.

Potential Strategies for Agriculture and Fisheries
There are many measures we can take to make sure that agriculture and fisheries continue to flourish as parts of our local economy and society as the temperature rises, the summers get drier, and the winters get wetter and warmer. Whatcom County should strive to maintain agriculture and fisheries as a vital part of our economy. Farmers and fishers are aware of the dangers of environmental change and are very willing to do their part to mitigate its effects and adapt to changing circumstances, as long as they can continue to make a living.
It is important to maintain agricultural and fishing economies that are large enough to be viable. A minimum size for viability depends in part on preserving the infrastructure that supports farming and fishing. This includes infrastructure, field machinery, and transportation equipment, but it also includes markets for the products. The current mandated minimum of 100,000 acres of agricultural land is probably an adequate standard.

Finally, we must promote continued collaboration between a variety of organizations, including federal, tribal, state, and local government agencies, conservation and water districts, universities and research organizations, and representatives of the farming and fishing industries. This means, first and foremost, leadership from the County Council and agencies of the county government, which need to be proactive in promoting innovative, resilient, and adaptive agriculture and fisheries.

It will require both mitigation and adaptation strategies to maintain viable agriculture and fisheries economies in the county under a changing climate. Several specific and feasible strategies for addressing the problems outlined above are presented in Table 6.1 and discussed below.

*Water rights and other regulatory reform.* Although water rights are also addressed in Chapter 5 of this report, we wish to emphasize the importance of water rights for the continuing viability of agriculture and fisheries.

On the agricultural side, all stakeholders maintain that there is enough water to support agriculture in our county, in its current form or any projected modified form in the future. The problem is the distribution of water, and this has two aspects. First, there is adequate water in the wintertime but not enough in the summertime. Summer shortages create conflicts between competing demands. Second, the current system does not distribute water efficiently or fairly at the time of shortages. Several specific reforms could address this summertime maldistribution, making local agriculture more resilient to increasingly severe shortages in the future.\(^{149}\)

- Much of the irrigation now carried out in Whatcom County is technically illegal, in the sense that farmers do not have formal rights to the water they are using. The county should urge the State Department of Ecology to recognize applications for water rights in the order in which they were received, where appropriate, i.e. rights to water that is now being used responsibly but technically not legally.
- Current water rights holders operate under a “use it or lose it” provision—if they do not use all their water rights, they are subject to having the unused portion revoked. Hence, they object to metering water usage, because it might result in revocation of their rights. If the use it or lose it provision were eliminated, this might mitigate the objection to metering.
- Current water usage is not metered. If water usage were metered, it would facilitate various water trading schemes.
- Water trading schemes could lead to more efficient use of water. Several have been proposed, including leasing, sales, and water markets, to be administered by county or state agencies, by a non-profit corporation, or by the current Watershed Improvement Districts. Further study of these possibilities is warranted.

\(^{149}\) See the Water Quantity and Quality section of the current report for further analysis.
Table 6.1. Potential climate strategies, actions and measures in agriculture and fisheries.

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<th>Strategy</th>
<th>Actions</th>
<th>Measures</th>
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<tr>
<td>Maintain our rivers and coastal areas to permit continued sustainable food production</td>
<td>1. Develop plans to maintain Nooksack River flows 2. Require realistic stream buffers that effectively cool water but permit farming</td>
<td>- Plans in place, approved by all interested parties - Buffers in place and shown to cool water; farmers adequately compensated for land lost</td>
</tr>
<tr>
<td>Maintain agricultural land at a viable level</td>
<td>1. Incentivize retiring farmers to sell to new farmers 2. Subsidize new farmers’ land purchases, perhaps through low-interest loans</td>
<td>- Incentives in place and used in farm transfers - Subsidies in place and used by new farmers</td>
</tr>
<tr>
<td>Reform water rights to ensure efficient and equitable distribution of water for agriculture, streamflow, and municipal use</td>
<td>1. Actively promote negotiations between tribes, farmers, and municipal users 2. Urge Ecology to act on water rights applications to regularize and legalize rights 3. Eliminate the “use it or lose it” provision 4. Begin compulsory or voluntary metering of water use 5. Allow water spreading to adjacent plots 6. Experiment with water markets or other water trading schemes</td>
<td>- Negotiations ongoing; agreements in place - Water rights applications processed - Relinquishment abolished or used by fewer users - Meters in place, shown to reduce use - Water spreading in place and monitored to assure no overall increase in water use - Experiments in place and evaluated for efficiency and equity</td>
</tr>
<tr>
<td>Construct and maintain sustainable food production infrastructure</td>
<td>1. Encourage/subsidize nutrient treatment systems for manure 2. Advocate flexible processing facilities for new crops 3. Facilitate conversion of farms to renewable energy 4. Encourage local sales to reduce energy expenditures and dependence on foreign markets</td>
<td>- Larger amount of manure treated; more treatment systems in active use - Processing facilities planned &amp; constructed - Farm power supplied by renewable energy - Less energy used per crop volume and sales dollar; smaller percentage of products exported</td>
</tr>
<tr>
<td>Diversify the local food system</td>
<td>1. Provide subsidies to small-scale, intensive practitioner of diversified agriculture 2. Consider tax breaks or other incentives for farmers who sell products locally 3. Create connections between local food producers and sellers, including supermarket chains 4. Expand the farm-to-school food program</td>
<td>- Program of subsidies in place and used by significant number of small-scale farms - Tax breaks in place for farmers selling locally - Larger portion of locally produced foods sold locally - Farm-to-school program accounting for increased proportion of school lunches</td>
</tr>
<tr>
<td>Research key aspects of climate change mitigation and adaptation as they relate to food production</td>
<td>1. Develop methods shellfish culture that counter the effects of ocean acidification 2. Develop crop varieties that will use less water and thrive in warmer conditions 3. Introduce new crops conducive to a changing climate 4. Anticipate invasive pests and develop resistant varieties or other biological control methods 5. Research animal diseases that are likely to occur here 6. Develop more partnerships on the model of the raspberry research facility</td>
<td>- Methods developed tested, and implemented - New crop varieties developed &amp; planted - New crops introduced, planted, harvested, sold - Pest control methods effectively used at laboratory and field scales - Animal disease preventive and curative measures ready for implementation if necessary - Partnerships developed and active</td>
</tr>
<tr>
<td>Educate the public about the importance of food production to our economy, environment, and well-being</td>
<td>1. Encourage and expand efforts to connect urban consumers with fishers and farmers 2. Facilitate contacts between food producers and environmental and climate action groups 3. Publicize the farm pavilion at the county Fairgrounds in Lynden</td>
<td>- Active and regular education programs for urban residents - Regular meetings and agreements between food producers and environmentalists - Regular use of the farm pavilion by urban visitors</td>
</tr>
</tbody>
</table>

- Water spreading is currently illegal—water rights attach to specific parcels of land, and water from one parcel cannot be used on another, even if the same farmer owns both parcels. Water spreading should be allowed within reasonable and sustainable limits.
Western US water law is complex and not easily reformed, even by Congressional action. The county should thus ask Ecology for permission to try out some or all of the above reforms for a limited time to see how well they work, after which the ones judged to work best could be implemented permanently. Walla Walla and Douglas Counties have carried out similar programs.

Since according to Western Water Law, earlier rights have priority, the Lummi Nation could quantify its water right in order to protect surface flows sufficient for salmon; this would undoubtedly intensify competition for water between tribes and farmers, which emphasizes the necessity for good-faith negotiations between different stakeholders.

None of these reforms would eliminate the fact that there are competitive uses of water for ecology and fish passage, municipal and industrial use, and agriculture. However, greater flexibility in water allocation could lead to the ability of competing interests to negotiate creatively and reach mutually acceptable solutions. It is thus perhaps inevitable that conflicts would arise, and such conflicts must be addressed by negotiation with fair representation of all stakeholders.

Agricultural infrastructure. Aside from the suitability of climate and soils, one reason Whatcom County agriculture is confined to a few major crops is that infrastructure exists for those crops, in the form of machinery, transportation, and processing facilities. For example, Whatcom County once had thriving pea, carrot, and egg agriculture, which fed into processing facilities, but when the facilities went out of business, so did the chance to grow and market those foods. Currently, the infrastructure exists for berries, potatoes, and dairy products, but not for other potential crops. If agronomic research and market research indicate that other crops would do well here, the county should consider facilitating infrastructure construction and equipment purchase, through loan guarantees, assisting farmers and businesses in obtaining grants, or other ways to make purchase of necessary infrastructure affordable for farmers.

In addition, county regulations currently make it difficult to build alternative energy projects, such as wind turbines. These barriers should be removed, which would reduce the greenhouse gas emissions from agricultural processing and reduce long-term energy costs for farmers.

One form of technology that promises to reduce agricultural greenhouse gas emissions as well as alleviate the problems of poor distribution of water is nutrient treatment systems. Large dairies produce tens of thousands of gallons of manure every day, and that manure gives off methane, a potent greenhouse gas. Anaerobic digesters draw the methane off of manure, which can be burned to produce electric power. After the methane is burned, the 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 the power output and making the investment more attractive to the dairy farmer.150

Digesters not only capture methane, a greenhouse gas, but also lessen the problem of manure storage in the wintertime, which can contaminate waterways. This is an example of a technology that addresses local environmental problems at the same time as climate change, and thus is attractive to farmers whatever their views on climate change issues.

150 Interview with Craig Frear, Regenis, 18 March 2019.
At present, however, anaerobic digesters are not affordable without grants for construction or subsidized prices for the electricity generated, because electricity from other sources is much cheaper in the Northwest than in other parts of the country. Some of the cost of current digesters has been mitigated by collection of tipping fees from dumpers of food processing waste, but there is a limited amount of waste that needs to be dumped; most is recycled within agriculture. Hence there are only five currently operating digesters in the county, and one of these has suspended operations because one of the dairies that supplied the manure has gone out of business.

Another possible by-product of digesters is methane or biogas, which could be sold to natural gas suppliers and help make the digester technology affordable. These systems are in place in Oregon and California, and could be tried here if the price structure were attractive to farmers.\textsuperscript{151}

There are also other nutrient management technologies that address both climate change and other environmental issues: one of these is an innovative, processing system recently installed at Coldstream Farms near Deming, involving three stages of pressing to separate gross solids, chemical flocculation to remove nutrients, which can be used for fertilizer, and reverse osmosis to extract remaining dissolved nutrients, after which the end product, clean water, can be returned to a stream or injected as groundwater. In addition to limiting methane release, this system helps mitigate the problem of over-nutrification through runoff into streams.\textsuperscript{152}

\textit{Diversification and local markets.} One reason Whatcom County food production is both vulnerable to many aspects of climate change and contributes more to climate change than necessary is the lack of diversity mentioned above. A focus on monoculture crops causes vulnerability both to climate changes and other environmental disturbances, but also to changes in markets. Since so much of our agriculture is oriented to outside markets, both domestic and overseas, any change in those markets puts marketing of our products in jeopardy. In addition, over 95\% of the food we consume locally is produced elsewhere; there are only a few farms and fishers who sell most of their product locally.

Dependence of our agriculture on distant markets means higher fuel consumption to transport foods from here to where they are marketed, and also to transport food produced outside which is marketed here. Fisheries, producing a specialized product, are less amenable to being incorporated into a local food system on a large scale, but transport of fisheries products is a minor factor in our greenhouse gas production. Although much of the food produced here will continue to rely on sales to distant markets, and demand for foods not produced here will continue, it would be helpful to improve the diversity of local crops and products in our region in general.

The county should thus incentivize the construction of a local food system, which like many of the agricultural innovations mentioned above, would diminish our contribution to climate change at the same time that it would address problems of food security and market vulnerability of commodity agriculture. This would involve several steps:

- Facilitating the entry of small-scale farmers. Our farming workforce is aging, and many retiring farmers end up selling out to non-farming land users rather than passing on the farm within the

\textsuperscript{151} Interview with Craig Frear, 11 March 18; see also US Department of Energy, Alternative Fuels Data Center, “\textit{Renewable Natural Gas (Biomethane) Production}.”

\textsuperscript{152} Interview with Galen Smith, Coldstream Farms, 17 April 2019
family. The county should consider programs that provide access to small amounts of land for intensive, diversified vegetable, fruit, grain, and livestock farming.

- Encouraging local markets for the products we already farm here. A great majority of our dairy farmers sell to Darigold, which markets its products all over the Northwest or sells to foreign buyers as distant as China. The milk price they pay is set nationally, and because of the shrinking foreign markets in the past few years, the price has been low enough to cause hardship for dairy farmers, or even induce them to sell out. We do, however, have a growing number of independent producer-handlers who sell specialty products locally, and often at a much higher price than the national milk price. Such local enterprises should be encouraged, perhaps through tax breaks.

- Creating connections between local food producers and consumers, particularly through direct sales. This already happens at a small scale, 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 program in which local schools buy directly from farmers.

Research and Collaboration. Even though we can predict some of the changes in climate that are likely to occur in the near future, and even though we already have ideas (some of them contained in this report) about how to adapt, there is much we do not know about the best ways to adapt to climate change. How do we encourage installing irrigation systems that use water most efficiently? What kinds of water rights and water-exchange mechanisms can be used here to distribute water most efficiently and equitably within and beyond the agricultural systems? What methods of organic or other low-risk pest control are likely to work against pests that are likely to invade here? What new varieties and new crops will do best in our changed climate, given our soil and our land costs? What should we really be doing to preserve and restore our fish runs? What species of shellfish will do best under a changing climate?

All these questions can be solved by research, some of them definitively and others with a high probability. But research takes money, for personnel and equipment. Collaborations between WSU and the agricultural community, and between WWU, UW, and the tribal and commercial fishing communities, must be maintained and strengthened, participation of farmers and fishers in the research itself must be encouraged, and extension and application of research results are vital. Examples are the raspberry research facility recently established in Lynden as a collaboration between WSU and local farmers, and the Food Lab teaching and research kitchen that will be part of the Farm Pavilion now being built at the Northwest Fairgrounds. Insofar as it is feasible, the county should not only facilitate, but actively participate in all these research activities, including the dissemination of research results.

Education. Unfortunately, many Whatcom County residents are unaware of the dominant role that agriculture and fisheries play in our economy, unaware of the complexity of farms and fisheries as ecosystems, and unaware of the urgency of climate change and the nature of possible solutions. The new Farm Pavilion being built at the county fairgrounds is an example of the kind of efforts that will contribute to education about agriculture and the environment.

The county, along with local non-profits, educational institutions, and citizen groups, can play a part in educating the general populace about these important matters. Efforts to bring agricultural and
fisheries (tribal, commercial, and sport) producers together with urban residents to understand each other’s concerns, both environmental and economic, should work to find common ground toward implementing the solutions proposed here and other solutions that may emerge from further research and from the experience of the next few years. The Council or its committees should sponsor public forums to promote this mutual understanding before proposing specific programs or ordinances.
Over 60% of Whatcom County land is forested, or about 844 thousand acres. Most of this land, ~606 thousand acres is Federal (Mount Baker-Snoqualmie National Forest, North Cascades National Park, etc.), State and tribal. If managed well, these forests may substantially contribute to carbon mitigation and climate adaptation. Climate change; however, is a threat to the survival of forests and their viability as a carbon sink. Increasing temperatures, prolonged drought and extreme weather events associated with climate change are leading to more natural disasters, such as wildfires, flooding, landslides, and pest outbreaks, all of which impact forests and the ecosystem services they provide. Ecosystem services are goods (e.g., timber, food, bioproducts), ecological functions (e.g., carbon storage, nutrient cycling, water and air purification), and social/cultural functions (e.g., recreation, traditional resource uses). Ecosystem services are discussed in more detail in Chapter 8 of this report.

Climate disruption is rapidly changing forest ecosystems, faster than traditional forest species can adapt to prolonged drought and heat. These changing ecosystems are also a challenge for managed/commercial forest operations that need to plan over timeframes up to 50 years or more depending on the rotation age for harvest. Which tree species and management practices will result in healthy forests over these long time periods? Will the commercial forestry industry be able to assume this economic risk?

Carbon mitigation in forestry refers to the sequestration of atmospheric CO$_2$ through photosynthesis, where carbon is stored in tree stems, branches and roots. A large proportion of this stored carbon can end up in forest soils. Trees release carbon back into the atmosphere at a lower rate during respiration, when they die and decay, and when they burn. Forests are carbon sinks when they absorb more carbon than they release, or carbon sources when they release more carbon than they absorb. This balance is influenced by how humans manage forests. Carbon mitigation is achieved by reforestation and promoting healthy forests, wetlands and riparian areas.

In contrast, climate adaptation refers to adjustments in natural or human systems in response to actual or expected climate change, including increases in the frequency or severity of weather-related disasters. Adaptation in forestry can refer to planting more drought and heat-tolerant species or to genetic alterations of species that improve their ability to survive in a changing climate. Different forest management strategies may also support adaptation effectiveness, since forests provide substantial ecosystem services that benefit other sectors.

This summary for forestry is based on multiple interviews of experts in Whatcom County and Washington State. The detailed interview information is located in the Appendix. We recognize that

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153 This acreage is from an assessment of GHG mitigation potential of Whatcom County forests conducted in a study sponsored by ICLEI in 2019. The acreage is lower than the total forested land acreage listed at [http://data.workingforests.org/#Whatcom](http://data.workingforests.org/#Whatcom)
there is considerable overlap among forestry and other areas in this report, including water quantity and quality, land use planning, recreation, wildlife and habitat, and public safety and preparedness. As a result, some of the climate change strategies we suggest for forestry may overlap and appear in these other categories. Strategies that cross-cut multiple categories will need to be refined to meet the needs of those areas.

**Past and Present Climate Efforts**

Protecting forests, modifying forest management practices, and expanding forest acreage, represent current major carbon mitigation strategies for the county. Forests as a carbon sink were recently quantified for Whatcom County in a jointly sponsored project. Whatcom County was selected as one of three pilot jurisdictions in the United States. The protocols developed in this project will be used to assess the greenhouse gas inventory of forests and trees and will be adopted as part of ICLEI’s Clear Path greenhouse gas emissions inventory software that is widely used by local, regional, and state governments to calculate their GHG footprint.

This study found that during a 10-year timeframe (2001-2011), there was a net conversion of ~5,300 acres of forestland to primarily grassland, and most of this loss occurred in lands zoned commercial or rural forestry. Over this same inventory period, forest disturbances were significant, mostly due to harvesting, but also infestations and weather. Harvesting occurred almost entirely on non-federal forest land. There were no significant fires during this 10-year timeframe. During the study period, Whatcom County forests and trees store ~112 million metric tons of carbon (equivalent to 400 million tCO₂). This amount of carbon storage will vary over time with harvesting, wildfires, and other major disturbances.

Overall, this study found that forests and trees in Whatcom County are a net sink for CO₂, pulling significantly more carbon from the atmosphere than they emit. Forest GHG emissions occur during harvest, decay, fire, and other disturbances. Taking into account both emissions and removals of atmospheric CO₂, Whatcom County’s forests and trees provided a net removal of ~4 million tCO2/year over the study period. Although this estimate represents a relatively short period of time, policy decisions and land management actions that convert forests to developed lands will have a major long-term impact on carbon removal capacity. Furthermore, uncertainties identified in the analysis should be reduced in the future with advances in remote-sensing capabilities.

Approximately 223,613 acres in Whatcom County (or 17% of land) are zoned rural forestry and commercial forestry. *Rural Forestry* lands are 20 acres or larger and are mostly devoted to growing trees for commercial timber production with low density (limited) residential development (no more than 20% of total acreage). *Commercial Forestry* lands are primarily devoted to growing trees for long-term commercial timber production, and generally the parcels are 40 acres or greater in size.

The rural and commercial forestry land base supports one sawmill in the county, Great Western Lumber in Everson, WA, which produces ~25 million board feet annually. Although old growth

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154 Sponsored by ICLEI Local Governments for Sustainability, World Resource Institute, Climate and Land Use Alliance and Woods Hole Research Center (Chris Elder is the County’s point of contact).
155 ICLEI is the International Council for Local Environmental Initiatives. Also referred to as Local Governments for Sustainability.
156 Draft project report, “Whatcom County: GHG Inventory for Forests and Trees Outside Forests.”
forests contain more sequestered carbon than younger forests, it is very important to maintain the forest industry in Whatcom County for carbon mitigation: 1) the major forest product in Whatcom County is lumber, which, unlike pulp for paper, sequesters carbon in buildings for decades, 2) our forests provide locally-sourced lumber for the building industry and jobs, 3) fast growing forests sequester carbon at a higher rate than mature forests, and 4) forests can be managed to reduce their vulnerability to wildfires.

Young, fast-growing trees do sequester carbon at a higher rate; however, mature forests store more carbon on a mass basis (Fig. 7.1). The rotation age in commercial forestry is driven by economic return and risk. The longer the rotation age, the greater the risk of losing the timber to wildfires, disease, etc., events that ultimately release carbon back into the atmosphere. In Whatcom County most logging produces timber for the building industry which can effectively sequester the carbon for an additional 50-100 years in addition to the rotation age.

A rural forestry designation in county zoning requires the owner to submit a land management plan to receive this tax break, but the county typically only monitors for compliance at the time of change in ownership. The county could take a more active role jointly with the Whatcom Farm Forestry Association to educate rural forest owners on active management to maximize carbon sequestration.

Actively managed forests are usually pre-thinned at 10-15 years to reduce competition for nutrients and water (by increasing spacing) and to reduce fuel load. Invasive species can also be removed during thinning. The slash that is produced during thinning presents a temporary fire hazard but decomposes after a few years. If slash removal is feasible (physically and economically), which usually happens after clearcutting, then it may be utilized. For example, the Department of Natural Resources (DNR) in Washington has tested pyrolysis units to create jet fuel from slash. The Northwest Advanced Renewables Alliance, a university consortium led by Washington State University, produced biofuel from forest residuals to power an Alaska Airlines flight from Seattle to Washington D.C. in 2016. The lumber mill in Darrington is considering using slash or small diameter logs for wood composites. Sustainability in building construction will lead to increasing use of various types of engineered wood. Engineered wood is not only used in flooring, but also can replace studs and other building materials. New engineered wood products, also known as mass

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157 The rate of carbon sequestration is species dependent, but in Douglas Fir the highest rate occurs between ~15 to ~60 years of age.
159 https://news.wsu.edu/2016/11/14/forest-powered-biofuel-flight/
160 Interview with Chris Hankey and Dan Siemann, Washington Department of Natural Resources.
timber or cross laminated timber, are in some cases even able to replace carbon-intensive steel beams in construction. Therefore, increased production of engineered wood products may represent an opportunity to diversify and grow Whatcom County’s forest products industry.

The risk of wildfires in western Washington is higher than most people realize and will continue to increase with climate change and population growth.\footnote{National Interagency Fire Center \url{www.nifc.gov}} Although fires can serve an important ecological function, wildfires release a tremendous amount of carbon dioxide. The DNR was instructed by the State Legislature (Bill 6109 in 2018) to map wildland/urban interfaces (WUIs) by county with the stated purpose of mitigating wildfire hazard. It is known that 70 to 90% of all wildfires are human caused. In critical areas, the International WUI code will be applied by county to the construction, alteration, movement, repair, maintenance, and use of any building structure within the WUI areas of a jurisdiction.

Whatcom County is fortunate to have been a part of the joint national project by ICLEI to assess the carbon mitigation by forests. Other natural systems that are important for carbon mitigation; however, should also be considered. For example, wetlands are a major natural system for removing and storing carbon and are often overlooked. Protection and restoration of wetlands are necessary to preserve the critical ecosystem services they perform, such as clean water and flood control. The county could partner with the various organizations that are restoring riparian and wetland areas. In the future, as research and techniques advance, these areas will also become important carbon sinks in the GHG analyses.

**Potential Climate Strategies**

The potential strategies in Table 7.1 represent a culmination of numerous interviews, reports, and research articles. The Whatcom County Climate Impact Advisory Committee (CIAC) will determine which strategies will ultimately be included in a future climate action plan. Although many of the strategies and actions may not be viewed as responsibilities of the county, the potential impact of no action (e.g., economic loss of wildfires and other weather-related disasters) will have a direct negative impact on county budgets and services.\footnote{Gregory J Ettl, Associate Professor, School of Environmental and Forest Sciences, University of Washington.}

This community outreach project has been an important step in understanding whether scientific approaches to mitigating and/or adapting to climate change have translated into actual changes to forest management practices in the field. For the most part, they have not been incorporated into forest management practices in the Pacific Northwest.\footnote{Gregory J Ettl, Associate Professor, School of Environmental and Forest Sciences, University of Washington.}

It is encouraging; however, that many agencies are actively trying to understand the risk that climate change poses to their missions. For example, the DNR, Native American tribes, and the USFS have initiated progressive programs to understand this risk and are conducting research that may inform new or modified regulations. The Washington Farm Forestry Association has also been conducting research and is a leader in educating forest land owners on sustainable forest practices. In all cases, our interviews have, at the very least, started a conversation on how a changing climate may impact forestry in Whatcom County.
Building resilience in the county’s next generation of forests will require both mitigation and adaptation to climate change. These may include rapid identification of hot spots where trees are dying or rethinking how rural forest owners design the size and shape of clearcuts to reduce the spread of wildfires, insects and disease, flooding and sediment load in creeks, and landslides. Forest resilience may also be part of reforestation management by changing tree spacing in areas where drought may be a problem, or even planting stock from southern seed zones that have adapted to higher heat and drought conditions. Large disturbances may present an opportunity to establish new genotypes and forest heterogeneity and diversity.

Table 7.1. Preliminary thoughts on strategies based on interviews.

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Actions</th>
<th>Measures (at X yr intervals)</th>
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</table>
| Promote a healthy forest industry in the county. | 1. Use locally-sourced lumber for all county building projects as available.  
2. Assess management plans for rural forestry lands and revisit zoning designations where needed.  
3. Discourage conversion of forest lands to other uses to maintain a viable forest industry. | 1. Update county codes to encourage/require locally sourced lumber for county building projects.  
2. Assess a portion (TBD) of rural forestry management plans against progress every year.  
3. Develop a biannual report on how commercial and rural forest lands are supporting the local forest industry. |
| Assess natural carbon sinks in the county | 1. Quantify carbon sink potential of forests based on descriptors such as tree type, age and type of management.  
2. Assess, quantify and map wetlands, carbon sink potential, and restoration needs.  
3. Associate carbon storage potential with soil type | 1. GHG mitigation achieved in Clear Path model for forests.  
2. Revise regulations to promote & protect healthy forests & wetlands  
3. Use of forest ecosystem inventory system to look at carbon stocks and trends. |
| Reduce wildfire risk and build resilience in forests | 1. Promote and educate landowners about active forest management practices to reduce wildfires  
3. Review/change codes & regulations to meet International WUI Codes | 1. Communication events (workshops, mailings, etc.) to target audience.  
2. Number/severity of fires on areas zoned rural or commercial forestry  
3. Number of certified FireWise communities in county and Washington Fire Adapted Communities Learning Network.  
4. Conduct local risk assessments to evaluate wildland fire hazards to valued resources.  
5. Number/severity of fires in areas designated as WUI |
| Prepare for weather-related disasters. | 1. Incorporate climate change risk into county planning activities and permitting when considering forest zoning or new roads and developments.  
2. Take a more active role in coordinating various agencies/organizations to conduct surveys to better understand the impacts of climate change on forests. | 1. Regulations and permitting takes into account the cost of climate change.  
2. Establish more NLCD plots on rural/ commercial forestry zoned areas & establish regular monitoring. |
| Communicate to forest landowners in the county. | Educate and encourage forestry landowners to build resilience into their forest management practices. | 1. Work with other organizations in the County to sponsor workshops.  
2. Promote site-specific evaluations of climate change vulnerabilities when devising reforestation plans. |
The Nooksack Salmon Enhancement Association (NSEA) adopted several strategies for healthy forests in their climate adaptation plan for Whatcom County in 2010. They recommended that forests should incorporate mixed landscape structure for greater diversity that allows shifts in species distribution. This may 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.

Douglas fir is one of the most drought-tolerant commercial species in the Pacific Northwest and is routinely used in monocultures. Small rural landowners in the county and county parks might be more willing to experiment with a wider selection of species and more diversity.

The North Cascadia Adaptation Partnership, which includes the Mount Baker-Snoqualmie and Okanogan-Wenatchee national forests and Mount Rainier and North Cascades Complex national parks, was created in 2010 to assess vulnerability and develop science-based adaptation strategies to reduce vulnerability to climate change. Among many recommendations, they suggest planting species that will be more robust to warmer temperatures and lower soil moisture, including species from hotter and drier seed zones, more diversity in tree species rather than monocultures, and more pest-resistant and fire-resistant species.

The DNR recognizes that multiple agencies will need to come together to monitor forest ecosystem health. The very concept of ecosystem health is difficult to define since it varies from site to site. Monitoring or tracking shifts in ecological systems is difficult and expensive because the conditions are changing so rapidly with climate change. The National Land Cover Database (NLCD) sponsored by the U.S. Geological Survey in partnership with several federal agencies has developed methodologies and a database to monitor changes in local ecosystems. There are 212 permanent forest inventory plots in Whatcom County: 126 in National Forests, 28 in other federal lands, 23 in state lands, 3 in county land and 36 in private lands. Only about half of these sample plots have been measured twice since 2002. The county could take an active role in coordinating the various organizations and entities to provide more frequent evaluation of sample plots as they relate to forest health.

**Barriers to Implementation**

The county government needs to take a more active role in coordinating and providing leadership for public and private efforts to address the challenge posed by climate change. Many of the issues are complex and cross-cutting such as the competing interests between the timber industry, watershed management and preservation of important ecosystem functions. Issues associated with water and natural resources will require strong leadership and authority to resolve. Funding will always be an issue, whether to pay now or incur much higher costs in the future.

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163 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.
Conclusions

Whatcom County has a large financial stake in promoting a strong and health forest industry as well as healthy forests on protected lands. According to the State Department of Commerce,\textsuperscript{166} forestry contributed 1,889 direct jobs and 4,965 direct, indirect and induced jobs\textsuperscript{167} in Whatcom County in 2017. These jobs translated into $220,530,864 in wages and $5,755,079 in taxes and fees.

The forest industry needs to plan over time-frames of fifty years or more. 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. 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.

\textsuperscript{166} Washington State Department of Commerce, \url{http://data.workingforests.org/#Whatcom}

\textsuperscript{167} Economists define indirect as those jobs created as a result of the direct jobs, while induced are jobs within the supply chain.
Chapter 8

Land Use, Recreation, and Wildlife and Habitat

David Kershner

"When we try to pick out anything by itself, we find it hitched to everything else in the Universe."—John Muir, naturalist, philosopher

Land use decisions the county makes today will either mitigate the worst 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 the harm to our economy and our quality of life.

Although the 2007 Climate Protection and Energy Conservation Action Plan does not have a section addressing land use, recreation, or habitat, we have chosen to group these planning issues because they are inter-connected. Residential, commercial, or industrial development often eliminates, degrades, or fragments habitat and forecloses future recreational opportunities. At the same time, 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 wood products, fish, clean drinking water, flood control, and natural pollination of crops.

There are four broad categories of ecosystem services: 1) provisioning, such as food products or water resources; 2) regulating, such as stabilizing climate and limiting disease; 3) supporting, such as nutrient cycling and oxygen production to maintain life; and 4) offering cultural services, such as spiritual benefits and recreational opportunities. As many ecosystem services are already adversely impacted by human activities, there is growing concern that climate change will further compromise the benefits we enjoy from intact ecosystems. At the same time, there is growing evidence that restoration of habitat can help us mitigate the effects of climate change and in the end help avoid significantly greater costs of climate impacts.

Ecosystem-based strategies can help us address climate change. At the same time, climate change is in many cases compromising ecosystem services. To maintain the provisioning and regulating services provided by healthy ecosystems, we may need to adapt our land management to help reduce negative impacts on ecosystem structure and functions.

Based on our interviews, it is clear that a meaningful response to climate change will require changes in the land use code. It is also clear that 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 forestlands, shorelines, and riparian corridors and to restoring habitat.
**Land Use**

Low-density development is one of the key contributors to carbon emissions. Although the Growth Management Act was intended to protect resource lands, open space, and habitat from sprawl, low-density residential development continues to reduce, degrade, or fragment high quality fish and wildlife habitat, while also reducing available farmland and forestland. Conversion of farmland and forestland not only reduces the availability of agricultural and forest products, it also reduces carbon sequestration. Low-density development, or urban sprawl, increases energy consumption of residential structures (a multi-family building uses less energy per capita than a single-family residence, for example) and increases conversion of land for roadways. In turn, low-density housing increases energy consumption by increasing vehicle miles traveled.

The county is now in compliance with the Growth Management Act, but it is failing to meet its goal to concentrate development in Urban Growth Areas (UGAs).\(^{168}\) According to the June 2019 Buildable Lands Program report, population growth between 2013 and 2018 outside UGAs exceeded the desired allocation by 57 percent.\(^{169}\) Lynden was the only city for which growth met the City’s projected allocation. Bellingham fell short of its goal by about 9 percent. If we are going to reduce our carbon emissions and protect ecosystem services, the county and cities need to work together to more effectively limit development outside UGAs.

According to planning staff, land use planning tools that could help reduce sprawl and preserve land with high value ecosystem services are: development of a “green infrastructure” plan (see next paragraph), a rezone to reduce development pressure, a compensatory rezone (where landowners subject to a rezone receive a portion of the estimated value of rights removed),\(^{170}\) and purchase of development rights (where landowners sell development rights/conservation easements to the county).

Green infrastructure plans identify, protect, connect, and re-green the landscape, promoting climate resilience while in some cases significantly reducing carbon emissions. Examples of green infrastructure on the landscape scale are parks and nature preserves. On the scale of individual development projects, green infrastructure can include bioswales, permeable pavements, and green roofs. The U.S. Environmental Protection Agency notes on the agency’s website: “Climate change is affecting us now. As different parts of the country become drier, wetter or hotter, green infrastructure can help improve community resiliency today and into the future.”\(^{171}\) Figure 8.1 highlights some of the benefits of green infrastructure planning.

The transfer of development rights from sensitive areas (known as “sending areas”) to areas more appropriate for urban-scale development (known as “receiving areas”) is another tool to mitigate climate change impacts. The county has a Transfer of Development Rights (TDR) program to allow

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168 Under the Growth Management Act, Urban Growth Areas are defined as those areas of certain counties in the State (including Whatcom County) “within which urban growth shall be encouraged and outside of which growth can occur only if it is not urban in nature.” RCW 36.70A.110

169 Community Attributes Inc., Background Information and Key Issues Report, Whatcom County Review and Evaluation Program, Prepared for Whatcom County, June 11, 2019

170 There is no legal requirement that landowners be compensated for a rezone, unless the regulatory change diminishes the value of the property to the extent that it is as if the government entity has condemned the property. See: Pascoag Reservoir & Dam, LLC v. Rhode Island, 217 F. Supp. 2d 206 (D.R.I. 2002).

171 Accessed September 17, 2019 at: https://www.epa.gov/green-infrastructure/green-infrastructure-climate-resiliency
density units in the Lake Whatcom Watershed to be transferred to an unincorporated zoning district on the urban fringe of Bellingham and to Birch Bay. While density allowances have typically been high enough in the receiving areas that developers have not been interested in buying rights from sending areas, a county working group recently recommended additional incentives that could improve the success of the county’s TDR program.\footnote{Exchanging a development right in a sending area for the right to build additional commercial floor area in a receiving zone is one promising example. See: Whatcom County Multi-Stakeholder Working Group, Final Report, October 3, 2018} In addition, planning staff noted that there could be demand for increased density in what are known as Limited Areas of More Intensive Residential Development (LAMIRDs); such a policy would require more analysis to determine if it would have a net positive impact on sprawl and climate change.

Planning staff noted that clustering could also be required where there is conversion in the Rural Forestry zone, as is already required in the Agricultural Protection Overlay zone. For example, the county could require a reserve tract for any conversion of parcels that are larger than 20 acres.

Figure 8.1. Benefits of green infrastructure.\footnote{https://www.epa.gov/file/green-infrastructure-climate-resiliency-infographic}
According to Building Industry Association staff, demand for housing in the UGAs relative to non-UGAs would increase if the cost of development were lower in urban areas. One strategy for accomplishing that is to reduce the cost of permitting in UGAs relative to rural areas.

Climate change adaptation will also require changes in land use planning. According to staff of the Nooksack Indian Tribe, the county administers the National Flood Insurance Program and implements regulations that restrict development in the floodplain, but updating FEMA flood insurance maps is a long and burdensome process and FEMA guidelines do not incorporate climate change. The county is starting to incorporate climate change into floodplain management planning, but future climate scenarios need to be more explicitly incorporated into flood hazard assessment. Reconnecting and restoring floodplains will be critical to building resilience to larger, more frequent floods expected in the future. As a result, Nooksack Indian Tribe staff recommends scoping of floodplain management actions that consider floodplain reconnection to the extent possible.

As sea level rises, the cost of providing county services to developments in the floodplain and along the shoreline will increase. Representatives of North Cascades Audubon Society stated that new development should pay the true cost to the county of future damage associated with climate change. For example, the county’s added cost of repairing roads to access developments such as Sandy Point, which are already being impacted by storm surge.

Thurston County has been at the forefront of quantifying the climate adaptation benefits, as well as economic benefits, of concentrating development in existing urban areas. A recent study commissioned by Thurston County estimates that the value of ecosystem services, focusing development and redevelopment in urban areas through tax incentives and permit fee waivers could prevent ecosystem service losses of $343 million to $542 million over 50 years. Avoided costs to homes and infrastructure from reduced flooding are among the estimated economic benefits, along with avoided costs of water treatment. In addition, the study found that by avoiding provision of city services to 6,175 acres of unincorporated rural areas, public entities could save $700 million in public service costs over a 50-year time frame, while reducing city, county, and state revenue by only about $71 million over the same period. The study assumed growth was focused in urban cores and that less than 5 percent of new growth through 2040 would be located outside designated existing cities and Urban Growth Areas.

While industrial and commercial uses in Whatcom County (excluding forestry and agriculture) are generally concentrated in urban areas, these sectors together represented almost 40% of overall greenhouse gas emissions in 2005. Of that total, industrial uses accounted for 24% of emissions.

The Whatcom County Council has proposed development permitting changes for the Cherry Point Industrial District that would limit future emissions from industrial land uses by requiring offsetting

174 Earth Economics, Benefit Cost Analysis of Selected Actions from the Thurston Climate Adaptation Plan, October 2017
176 Industrial emissions were in fact a higher percentage of total emissions, given that electricity and/or natural gas usage information was unavailable for at least three industrial facilities.
of greenhouse gas emissions for new major projects. These proposed amendments will likely be voted on in December of 2019.

Recreation and Habitat
Whatcom County government, tribes, NGOs, and business partners, have worked together on many projects to protect habitat and create recreational opportunities. Since 1984, Whatcom Land Trust has been involved in protecting over 25,000 acres of land in the county. Some of this land has been transferred to the Whatcom County Parks & Recreation Department, which managed 69 properties comprising over 16,000 acres, as of 2016. While the county has been proactive in protecting open space and farmland, climate mitigation and adaptation is not a stated goal of the county’s open space plan. In fact, there is no mention of climate change or carbon sequestration in the 2016 plan.\(^{177}\)

Although recreation lands contribute substantially to the Whatcom County economy,\(^ {178}\) climate change will require adaptation to keep them accessible to the public. The North Cascades Adaptation Partnership, a collaboration of the U.S. Forest Service and the U.S. National Park Service, has identified opportunities to adapt to climate change on recreation lands in the North Cascades. Among the agencies’ recommendations are: designing culverts for projected rather than existing peak flows and educating the public about the need for water conservation due to predicted lower water availability in summer months.\(^ {179}\)

To address wildlife’s vulnerability to climate change, the Washington Department of Fish and Wildlife has developed a State Wildlife Action Plan. In it, the agency lists “Climate Watch Species,” that are considered especially vulnerable to climate change. These species are a subset of those listed as Species of Greatest Conservation Need (SGCN). The 2015 report states that “habitat loss and degradation as well as a lack of baseline and monitoring data were most frequently cited as the primary stressors or needs for SGCN species.”\(^ {180}\) The county’s Wildlife Advisory Committee also highlighted the need for establishing better baseline information in its 2017 Ecosystem Report,\(^ {181}\) recommending that the county commit resources to baseline analysis of wildlife conditions. The Ecosystem Report also calls for incorporating climate change projections into the development of an ecosystem plan and the Critical Areas Ordinance to determine if there are locally important species and habitats that require extra protection under the CAO.


\(^{178}\) Economists at Earth Economics estimate that consumer outdoor recreation spending in Whatcom County supports over 6,500 jobs and recreation-related businesses generate over $500 million annually. See: Flores, L., Schwartz, A. 2015. Economic Contribution of Outdoor Recreation to Whatcom County, WA, Earth Economics, Tacoma, WA.


Puget Sound Chinook and Southern Resident Orca (Killer Whales) are both listed as Climate Watch Species in the State Wildlife Action Plan. In the Nooksack River, increased temperatures, higher peak flows and lower summer flows associated with climate change will further impact salmon, exacerbating the habitat loss and degradation that have already led to dramatic declines in salmon populations. According to Treva Coe, a fisheries biologist with the Nooksack Indian Tribe who co-authored a climate change vulnerability assessment for endangered salmon species in the Nooksack River’s South Fork, accelerating the pace and expanding the scale of instream, riparian and wetland restoration and floodplain reconnection may offset projected climate impacts and help Chinook adapt to a changing climate. These activities, including tree planting, will not only improve habitat, but also help slow climate change by sequestering more carbon.

According to representatives of the North Cascades Audubon Society, the Critical Areas Ordinance provides significant protection of critical areas, but planning staff is not implementing the ordinance and other land use regulations consistent with the intent of the Comprehensive Plan. Audubon representatives also pointed to studies that wetland mitigation projects are not providing ecosystem services equal to what is being lost to permitted development.

As the climate changes, Whatcom County will need to accelerate investment in protection and enhancement of ecosystem services. The longer we wait, the more costly the damage is likely to be from impacts such as flooding and damage to commercial and sport fisheries. For example, the county could better protect areas that provide essential ecosystem services by conducting a comprehensive inventory of critical areas, the state of their degradation, and evaluation of opportunities to protect or restore these natural assets. This was a recommendation of the consultants who worked with the county on the last Critical Areas Ordinance update.

Both the Critical Areas Ordinance and the Shoreline Management Program have no net loss of ecological function standards, but Nooksack Indian Tribe staff note that the county is not directly monitoring ecological function over time. Tribal staff recommends a monitoring program that incorporates climate-related ecological functions such as carbon sequestration, flood regulation, and water quality maintenance.

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 change.

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

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183 The commercial fishing industry contributes over 1,700 direct jobs to the Whatcom County economy. See: Martin Associates, The Economic Impacts of the Commercial Fishing Fleet at the Port of Bellingham 2013, December 2014.

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.185

In the fall of 2018, the PDR Oversight Committee recommended that the County Council approve revised PDR program guidelines to expand the PDR program to include working forestland and important ecological areas. The Council approved broadening the scope of the program to also purchase development rights and conservation easements on working forestlands and important ecosystem areas. According to Planning Staff, there is significant property owner interest but local, state, and federal matching funds are limited and can be challenging to utilize.

Frank Bob of the Lummi Nation observed that the county needs to protect remaining natural habitats as its top priority. He said that restoration needs to be the second priority, pointing out that it is cheaper to prevent damage than to try to fix it.

According to Bob, the county needs to invest more in re-creating habitat connectivity, so that wildlife can adapt to climate change. The county needs to identify the species that are not listed now but are going to be made vulnerable by climate change, so we can preserve habitat and avoid more listings.

The county has so far not considered climate change in its Shoreline Management Program rules. Yet, rising sea level is going to increase shoreline impacts, including enhancing the rate of shoreline erosion, migration, and change.186

Whatcom County will be in a better position to achieve the policy goal of no net loss of habitat function by integrating the best available science into the Shoreline Management Program as soon as possible. This will limit adverse impacts of shoreline armoring and avoid additional costs of repairing, restoring, and enhancing shoreline functions for habitat, hazard mitigation, and general access.

As the climate changes, Bob said that we need to answer the question: “How many people [living in the watershed] is too many?” He argues that we need to determine the ecological carrying capacity of the county as part of our climate adaptation planning.

Potential Climate Strategies
The potential strategies in Table 1 (next page) represent a culmination of numerous interviews, reports, and research articles. Any strategy that is considered for inclusion in a future climate action plan needs to be evaluated through a vulnerability assessment process that is based on a set of criteria established by the Whatcom County Climate Impact Advisory Committee (CIAC). Although many of the strategies and actions may not be viewed as responsibilities of the county, the potential impact of no action (e.g., economic loss to fisheries and increased costs of flooding) will have a direct negative impact on county budgets and services.

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185 Grace-Sanders, Julie, “A saltwater marsh in recovery is gobbling carbon, gaining ground,” Seattle Weekly, August 29, 2019

186 The scope of the current update to the Shoreline Management Program has yet to be determined. Planning staff has said that climate change could be addressed as part of the SMP, though it is not required by the state.
Table 8.1. Preliminary thoughts on strategies based on interviews.

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Actions</th>
<th>Measures</th>
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<tbody>
<tr>
<td>Limit development in sensitive rural areas to protect ecosystem services and reduce vehicle miles traveled</td>
<td>4. Concentrate development in urban growth areas</td>
<td>4. Modify zoning code and permit fee structure to create higher financial incentives for infill development; consider impact fees in rural areas that factor in the climate-change related costs to the county</td>
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<td>5. Discourage residential development in riparian corridors, floodplains, on shoreline bluffs, in forests and productive agricultural land</td>
<td>5. Increase funding for acquisition of rural lands with high ecosystem services; consider zoning changes based on water availability</td>
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<td>6. Inform landowners, developers, and contractors about the climate change risks of developing in the floodplain</td>
<td>6. Explicitly incorporate future climate scenarios into flood risk assessment</td>
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<td>7. Encourage clustering when residential development is permitted in Rural Forestry zones</td>
<td>7. Consider requiring clustering for subdivisions in the Rural Forestry zone to minimize road building and clearing of forest</td>
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<td>5. Encourage use of green infrastructure in development projects (including bioswales, rain gardens, permeable pavements, and green roofs)</td>
<td>8. Use cost-benefit analysis that includes ecosystem service benefits and social costs when evaluating climate adaptation strategies</td>
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<td>Limit new emissions from residential, commercial, and industrial sources</td>
<td>4. Approve revisions to Comprehensive Plan to require lifecycle analysis of greenhouse gas emissions associated with new projects in the Cherry Point Industrial District</td>
<td>9. Develop a Green Infrastructure Plan for promoting climate resilience</td>
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<td>5. Consider requiring carbon offsets for all new carbon-intensive commercial and industrial uses</td>
<td>10. Create an annual innovation award for developments that exemplify creativity in instituting and maximizing the use of low impact development strategies 187</td>
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<td>Protect migration routes of climate-vulnerable species</td>
<td>4. Increase the pace and scale of restoration activities along salmon-bearing streams to keep water temperatures from rising</td>
<td>4. Quantify lifecycle gas emissions for new projects</td>
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<td>5. Preserve habitat connectivity between lowland and upland areas so vulnerable species can migrate to suitable habitat</td>
<td>5. Mitigate all greenhouse gas emissions with local renewable energy offsets</td>
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<td>6. Limit emissions from new natural gas and propane sources by incentivizing energy efficient appliances</td>
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<td>6. Quantify acres of trees planted in riparian corridors per year and report in annual climate updates</td>
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<td>7. Develop an Ecosystem Conservation Plan or Program that prioritizes protection of habitat corridors connecting core habitats of vulnerable species</td>
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<td>8. Preserve habitat quality by preventing invasive species establishment after disturbance and by removal of established non-native species</td>
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187 This type of innovation award is an objective set forth in the City of Norfolk, Virginia’s Green Infrastructure Plan released in July 2018. For more examples of green infrastructure tools, see: http://www.gicinc.org/PDFs/GreenPlan-CityofNorfolk-FinalReport%202018.pdf