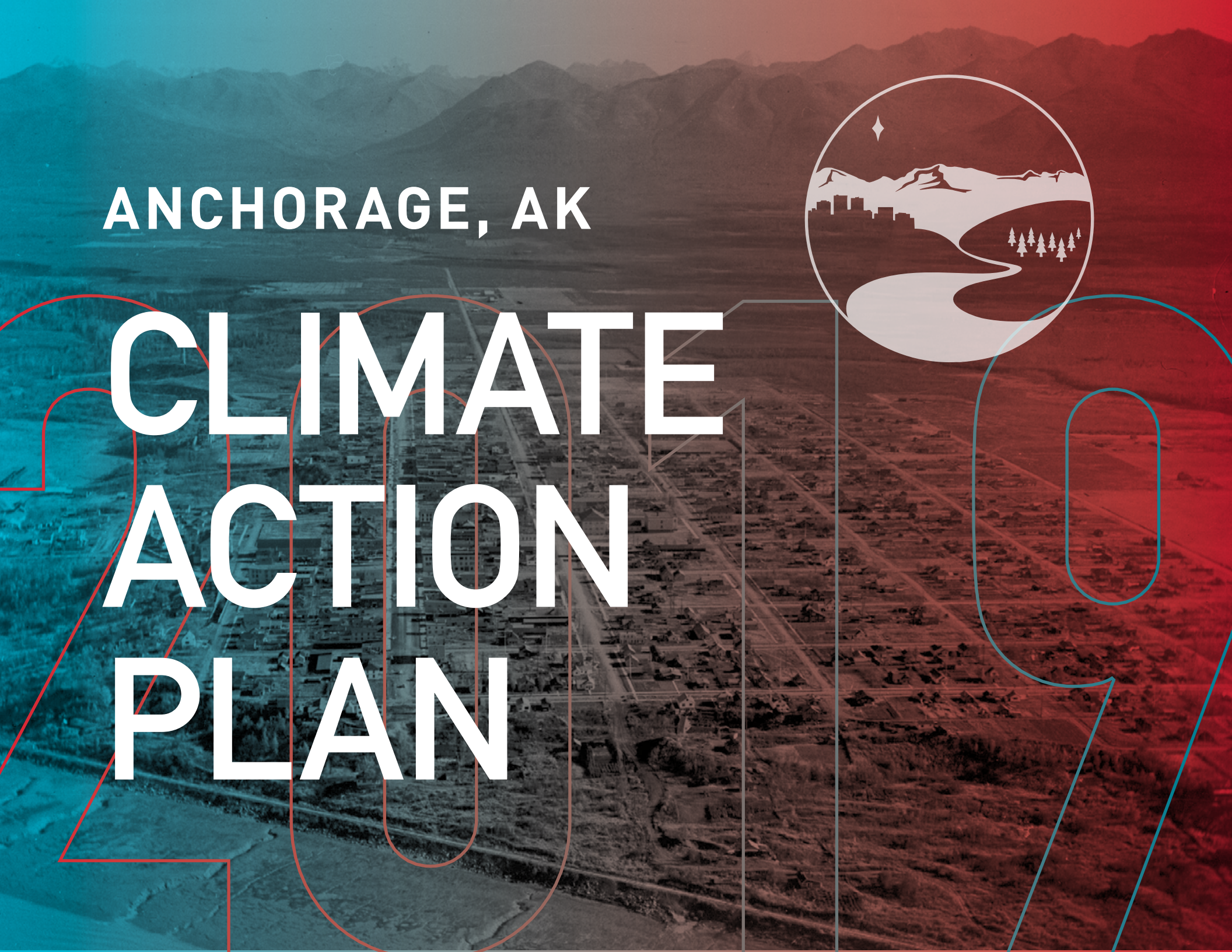

ANCHORAGE, AK
CLIMATE
ACTION
PLAN
2020

ANCHORAGE
Climate Action Plan

ADOPTED MAY 21, 2019
ANCHORAGE ASSEMBLY RESOLUTION 2019-158

Cover photo: Lu Liston Collection; Anchorage Museum, B1989.016.292

Neighbors,

Anchorage, Alaska is the biggest city in the biggest state and the gateway to America's Arctic. We are a one-hundred year old city of 300,000 people, and our First People have lived with the land and waters for 10,000 years. We are a community where more than 100 languages from around the world are spoken in our homes, our schools, our businesses, our parks, our wildlands, and on our streets – Anchorage is proud to be uniquely global and distinctly Alaskan.

In the North, the climate is changing twice as fast as the rest of the United States. Rural Alaska has witnessed eroding shorelines, changing terrains and habitats, melting permafrost, and receding glaciers. Anchorage is living with more freeze-thaw events, more rain-on-snow events, more insect infestations, and a longer fire season, all of which threaten public health, infrastructure, and the wellbeing of our city's residents. These fast-moving challenges compel responses and initiatives to adapt to and mitigate the effects of climate change.

This Climate Action Plan expands on Anchorage's tradition as a welcoming and resilient city. Equity and inclusion are the wellspring values at the heart of our social, economic, environmental, and economic policies and practices. Those values make us stronger and more resilient, and they help ensure that our residents, our communities, and our businesses have the capacity to thrive as we navigate a changing climate and an evolving economy. This Climate Action Plan highlights deeply-rooted Alaskan traditions of collaboration and innovation. We are grateful to the many partners and participants who contributed to its deliberation and creation.

Please join us as we work together to reduce energy use, improve public health, promote energy independence, strengthen our economy, and build a more livable and resilient community. We have the opportunity to show others that there is an Anchorage Way, and that our community can be a model of good stewardship, good management, and preparation that will leave us more efficient and more self-sufficient.

Sincerely,

MAYOR ETHAN BERKOWITZ

The Municipality of Anchorage acknowledges that our city sits on the traditional homelands of the Dena'ina Athabascan peoples.

The Municipality recognizes the governmental status of the Native Village of Eklutna and is committed to working with the Native Village of Eklutna as a government partner. The Municipality also acknowledges the vital role that the Eklutna Corporation has as the largest landowner in the Municipality. This Climate Action Plan is built on the recognition that Indigenous values and knowledge are foundational to our efforts to build community resilience.

2050 VISION FOR ANCHORAGE

In 2050, Anchorage is a resilient, equitable, and inclusive community prepared for the impacts of a changing climate. Winter cities around the world look to Anchorage as a leader in stewardship and energy innovation. Anchorage is self-sufficient and the heart of our state's globally competitive economy.

TABLE OF CONTENTS

Acknowledgments 6

Anchorage Climate Action Plan at a Glance 9

Why create a climate action plan? 12

Climate change in Anchorage 17

Understanding Anchorage's greenhouse gas emissions 25

Key terms in the Anchorage Climate Action Plan 29

Embedding equity in climate action 30

Co-benefits of climate action 32

Climate Action Plan sectors 34

- Buildings and Energy 36
- Land Use and Transportation 44
- Consumption and Solid Waste 52
- Health and Emergency Preparedness 58
- Food Systems 68
- Urban Forest and Watersheds 74
- Outreach and Education 82

Implementation and monitoring 88

How was the Climate Action Plan developed? 90

Appendices 93

- Community Engagement Strategy 93
- Municipal Liaisons and Potential Partners 95
- Related Municipal and Community Plans and Reports 97
- References 99

ACKNOWLEDGMENTS

ANCHORAGE ASSEMBLY

Christopher Constant

Forrest Dunbar

Fred Dyson

Crystal Kennedy
Suzanne LaFrance

Austin Quinn-Davidson

Kameron Perez-Verdia

Pete Petersen

Felix Rivera

John Weddleton

Meg Zaletel

CLIMATE ACTION PLAN STEERING COMMITTEE AND LEAD AUTHORS

Micah Hahn, University of Alaska Anchorage, Institute for Circumpolar Health Studies

Shaina Kilcoyne, Municipality of Anchorage, Solid Waste Services

Catherine Kemp, Municipality of Anchorage, Office of the Mayor

Chelsea Ward-Waller, University of Alaska Anchorage

Alexandra Long, Municipality of Anchorage

Shannon Donovan, University of Alaska Anchorage, Department of Geography and Environmental Studies

Brian Brettschneider, University of Alaska Fairbanks, International Arctic Research Center

Libby Roderick, University of Alaska Anchorage, Difficult Dialogues Initiative

ADVISORY COMMITTEE

Mara Kimmel, Anchorage Museum, *Advisory Committee Co-Chair*

Besse Odom, NAACP, *Advisory Committee Co-Chair*

Jon Bittner, Alaska Small Business Development Center

Robin Bronen, Alaska Institute for Justice

Polly Carr, The Alaska Center

Michael Fredericks, RIM Architects

Hilton Hallock, Alaska Pacific University, Provost

Stephanie Holthaus, The Nature Conservancy

Radhika Krishna, Anchorage Community Land Trust

Wendy Lindskoog, BP Exploration (Alaska) Inc.

Curtis McQueen, Eklutna, Inc.

Liz Medicine Crow, First Alaskans Institute

Danielle Meeker, Office of Governor Bill Walker

Jackie Qatalina Schaeffer, Alaska Native Tribal Health Consortium

Chris Rose, Renewable Energy Alaska Project (REAP)

Alliana Salanguit, University of Alaska Anchorage

Cathy Sandeen, University of Alaska Anchorage, Chancellor

Jasmin Smith, The Business Boutique and Mountain View Community Council President

CHAPTER AUTHORS AND WORKING GROUP LEADS

Raymond Anthony, University of Alaska Anchorage, Ethics Center and Department of Philosophy

Stephanie Bauer, University of Alaska Anchorage

Brian Brettschneider, University of Alaska Fairbanks, International Arctic Research Center

Shannon Donovan, University of Alaska Anchorage, Department of Geography and Environmental Studies

Aaron Dotson, University of Alaska Anchorage, Civil Engineering Department

Micah Hahn, University of Alaska Anchorage, Institute for Circumpolar Health Studies

Shaina Kilcoyne, Municipality of Anchorage, Solid Waste Services

Rachael E. Miller, Alaska Pacific University, Institute of Business and Public Policy

Jennifer Schmidt, University of Alaska Anchorage, Institute of Social and Economic Research

Erin Whitney, University of Alaska Fairbanks, Alaska Center for Energy and Power

WORKING GROUP MEMBERS

Jim Amundsen, Alaska Department of Transportation and Public Facilities

Barry Andres, RurAL CAP

Andres Benitez Ospina, Anchorage School District

James Benzschawel, Alaska Division of Homeland Security and Emergency Management

Brooke Blessing, Municipality of Anchorage, Project Management and Engineering

Angela M. Bolton, Anchorage Water and Wastewater Utility

Charles Boyle, Municipality of Anchorage, Project Management and Engineering

Mike Brubaker, Alaska Native Tribal Health Consortium

Ryan Buchholdt, University of Alaska Anchorage

Kyla Byers, Arctic Harvest Deliveries

Suzanna Caldwell, Municipality of Anchorage, Solid Waste Services

Steve Cleary, Alaska Trails

Kristen Collins, The Alaska Center

Steve Colt, Alaska Pacific University

Kyle Cunningham, Municipality of Anchorage, Watershed Management Services

Julia Ditto, Alaska Pacific University

Cara Durr, Food Bank of Alaska

Gary Ferguson, Independent Consultant

Mary Fischer, Alaskans for Litter Prevention and Recycling

Nancy Fresco, University of Alaska Fairbanks, Scenarios Network for Alaska + Arctic Planning

Mark Gingrich, Alaska Waste

Johanna Grasso, Anchorage Faith and Action Congregations Together

Scott Gruhn, Alaska Climate Action Network (AK CAN!)

Kelly Harrell, Ecotrust/Sitka Salmon Shares

Julie Harris, Municipal Power and Light

Johanna Herron, Alaska Department of Natural Resources, Division of Agriculture

Melissa Heuer, SPORK - Food Systems Consultant

Amy Holman, National Oceanic and Atmospheric Administration

Meghan Holtan, Agnew Beck Consulting

Tricia Howe, University of Alaska Anchorage

Celia Jackson, American Red Cross of Alaska

Leslie Jones, University Alaska Anchorage, Alaska Center for Conservation Science

Shannon Kuhn, Municipality of Anchorage, Anchorage Health Department

Tim Leach, Vermont Law School

Cady Lister, Alaska Energy Authority

Dustin Madden, Cold Climate Housing Research Center

Mark Masteller, University of Alaska Mat-Su

Chris McConnell, Renewable Energy Alaska Project

Christopher C. McConnell, University of Alaska Anchorage

Donna Mears, Central Recycling Services

Andy Mergens, Anchorage School District

Minoo Minaei, Anchorage School District, Bridge Builders, Welcoming Anchorage

Brad Muir, Municipality of Anchorage, Parks and Recreation

Allison Natcher, Alaska Department of Health and Social Services, Section of Rural and Community Health Systems

Stephen Nickel, Alaska Division of Forestry Community Forestry Program

Nancy A. Nix, University of Alaska Anchorage

Lynae Padilla, University of Alaska Anchorage

Chris Pike, University of Alaska Fairbanks, Alaska Center for Energy and Power

Jim Renkert, Alaska Department of Natural Resources, Division of Forestry Community Forestry Program

Sue Rodman, Alaska Department of Fish and Game

Bart Rudolph, Municipality of Anchorage, Public Transportation Department

Sally Russell Cox, Alaska Community Resilience and Climate Adaptation Programs

Paul Schuette, University of Alaska Anchorage, Alaska Center for Conservation Science

Pierce Schwalb, Bike Anchorage

Kathy Shea, Alaska Department of Environmental Conservation

A'Lena Sorenson, University of Alaska Anchorage

Mark Spafford, Municipality of Anchorage, Department of Solid Waste Services

Yaso Thiru, Alaska Pacific University

Jessica Thornton, Cook Inletkeeper

Sophie Tidler, Volunteer

Ryan Toohey, United States Geological Survey, Alaska Climate Adaptation Science Center

Lexi Trainer, Municipality of Anchorage, Office of Emergency Management

Eve Van Dommelen, Food Bank of Alaska

Scott Waterman, Alaska Housing Finance Corporation

Jennifer Witter, Anchorage School District

Sarah Yoder, Alaska Department of Health and Social Services

STUDENT CONTRIBUTORS

Alexandra Anthony

Thomas Baye

Samantha Beaman

James Christopher

Brooks Furlong

Kyla Gongora

Leigh Honig

Yemi Knight

Richard McElmurry

Klaire Rhodes

Courtney Schuman

Skylar Shaw

Maddie Smith

Melissa Tuttle

OTHER CONTRIBUTORS

MUNICIPALITY OF ANCHORAGE

Jamie Acton, Director, Public Transportation

Jason Bockenstedt, Deputy Chief of Staff, Office of the Mayor

Ona Brause, Chief of Staff, Office of the Mayor

Jon Cecil, Senior Transportation Planner, Planning Department

Joshua Durand, Parks Superintendent, Parks and Recreation

Jim Jager, External Affairs Director, Port of Alaska

Michelle McNulty, Planning Director, Planning Department

Stephanie Mormillo, Municipal Traffic Engineer, Traffic Department

Craig Lyon, Transportation Manager/AMATS Coordinator, AMATS

Natasha Pineda, Director, Anchorage Health Department

Mackenzie Pope, AmeriCorps VISTA, Office of the Mayor

Steve Ribuffo, Director, Port of Alaska

Kevin Spillers, Director, Office of Emergency Management

Carol Wong, Long Range Planning Manager, Planning Department

GRAPHIC DESIGN, PHOTOGRAPHY, AND FILM

Nora Gecan, Lead Graphic Design

Grant Deussing, Logo Design

Chidiebere Iwuoha, Film

Johanna Grasso, Paxson Woelber, Carl Battreal, Photography

EXTERNAL CONTRIBUTORS

Kate Ayers, Chugach Electric Association

Katie Conway, Alaska Energy Authority

Julie Estey, Matanuska Electric Association

Brian Hirsch, Deerstone Consulting

Amber McDonough, Siemens

Sean Skaling, Chugach Electric Association

The Anchorage Climate Action Plan is the result of a huge community effort. Many thanks to the Anchorage community and volunteers for their time and thoughtful contributions to the development of the plan.

ANCHORAGE CLIMATE ACTION PLAN AT A GLANCE

The Anchorage Climate Action Plan puts Anchorage on a path to reduce greenhouse gas emissions 80% from 2008 levels by 2050, with an interim goal of 40% by 2030.[*,1,2] Many of the actions in this plan are focused on addressing the primary cause of climate change by reducing greenhouse gas emissions. However, Anchorage residents are already experiencing many initial impacts of climate change, including warmer winters, icier roads, and more winter rain. The Climate Action Plan includes actions that will help Anchorage prepare for these and future impacts.

Anchorage is joining a community of cities, states, and organizations around the world in the effort to lower human contributions to climate change and build capacity to combat the environmental changes the world is facing. The actions in the Anchorage Climate Action Plan have been developed so that our efforts to confront climate change also support local jobs, economic development, improved public health, more transportation options, and community self-sufficiency.

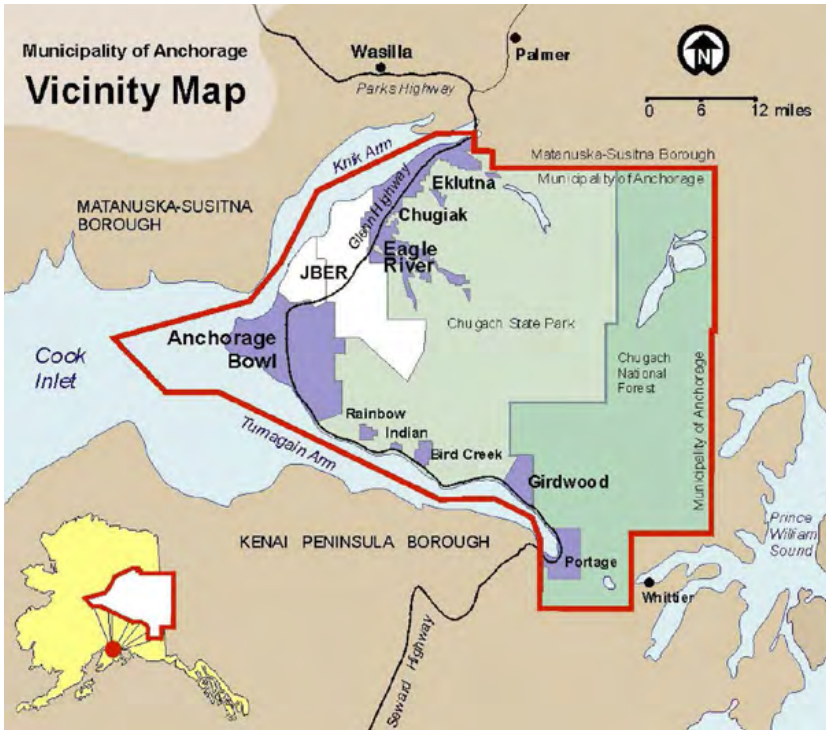
In addition to the objectives and actions laid out in each of the sectors, the Climate Action Plan has two overarching actions:

1. **Complete a greenhouse gas inventory and update annually to measure progress towards climate goals.**
2. **Develop a framework for selecting, monitoring, and sharing indicators that track 1) environmental changes associated with climate change, 2) impacts of climate change at a neighborhood-level, and 3) adaptation measures and their effectiveness in Anchorage.**

*These goals are necessary, and while this plan puts us on the right path, alone and in its current state, it will not ensure they are met. The implementation steps at the end of the plan aim to institutionalize ongoing community dialogue and action and help us secure additional resources to allow us to reach these goals.

WHICH COMMUNITIES ARE INCLUDED IN THE ANCHORAGE CLIMATE ACTION PLAN?

The recommendations included in the Anchorage Climate Action Plan apply to all communities within the Municipality boundary, including the Native Village of Eklutna, Chugiak, Eagle River, Anchorage, Girdwood, and Portage.



HOW IS THE ANCHORAGE CLIMATE ACTION PLAN ORGANIZED?

Highlights from each of the seven sectors are listed on the next two pages with page numbers to direct you to the full chapter. In each sector chapter, you'll find a 2050 vision, objectives for 2030, and the action steps to achieve these objectives.

BUILDINGS AND ENERGY

- Expand local renewable energy generation and use
- Reduce energy use in existing and new buildings
- Use existing and innovative financing mechanisms and incentives to encourage renewable energy and energy efficiency
- Integrate long-term clean energy solutions into regional energy policy and planning

Read more on pages 36-43

LAND USE AND TRANSPORTATION

- Improve transit options and non-motorized accessibility to major centers
- Encourage land use planning that reduces the distance people have to travel by car and increases community resiliency
- Transition to vehicles that are highly efficient and run on low-carbon and renewable energy fuels

Read more on pages 44-51

CONSUMPTION AND SOLID WASTE

- Divert and reduce waste, extending the life of the landfill
- Capture more wasted energy in collected refuse
- Further educate and engage residents and businesses about waste reduction and diversion
- Create waste reduction targets across both Municipal operations and the Anchorage community
- Optimize refuse collection and disposal systems

Read more on pages 52-57

HEALTH AND EMERGENCY PREPAREDNESS

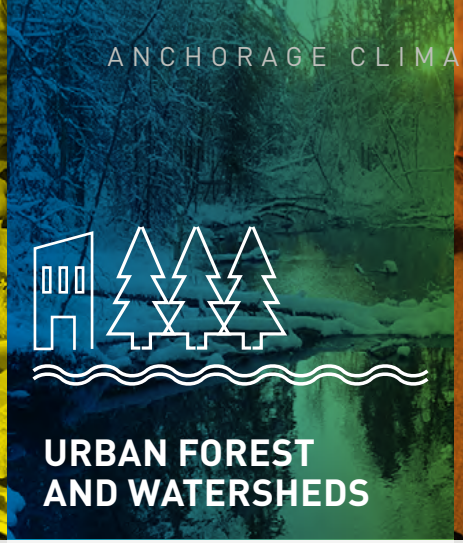
- Develop strategies to enhance the health and safety of all Anchorage residents
- Collaborate and engage diverse groups of people across Anchorage in health and safety planning
- Build household, neighborhood, and community resilience and self-sufficiency for emergency situations
- Support creative and collaborative research to understand how climate change is impacting the health and safety of Anchorage residents

Read more on pages 58-66

FOOD SYSTEMS

- Expand opportunities and markets for Alaska Grown products
- Ensure that all Anchorage residents can access healthy, local foods
- Create opportunities for residents and businesses to reduce food waste

Read more on pages 58-73



URBAN FOREST AND WATERSHEDS

- Support wildfire mitigation and improve forest management to prepare for increased risk of wildfire
- Improve stormwater management to mitigate flooding and promote better water quality
- Increase capacity to respond to invasive species outbreaks
- Monitor Eklutna watershed to ensure a resilient drinking water supply

Read more on pages 74-81

OUTREACH AND EDUCATION

- Use effective and inclusive outreach methods to ensure that all Anchorage residents benefit throughout the implementation of the Climate Action Plan
- Motivate Anchorage residents, schools, businesses, community councils, and agencies to reduce their carbon footprint

Read more on pages 82-87

WHY CREATE A CLIMATE ACTION PLAN?


Photo credit: Paxson Woelber

Nestled between Cook Inlet and the Chugach Mountains, Anchorage is the gateway to Alaska and the Arctic. Almost half of Alaska's population lives in Anchorage. The city is among the most ethnically diverse communities in the United States. Anchorage sits on the traditional homelands of the Dena'ina Athabascans, where people have thrived and survived for thousands of years.[3] Over 100 languages are spoken in the city's streets and schools, representing cultures from around the globe and from across the North.

Alaska's climate is changing faster than the rest of the United States. The scientific community agrees that the world is warming due to the human emissions of greenhouse gases.[4] Over the last 50 years, Alaska has warmed twice as fast as the global average.[5] The impacts of climate change are felt throughout the state. Thawing permafrost and receding sea ice threaten communities in the western, northern and interior regions of the state. In Southcentral Alaska, the impacts include increased wildfire risk, threats to human health and infrastructure, and less predictable freeze-thaw patterns. Communities and Alaska Native tribes throughout Alaska are creating climate action plans to cut emissions and adapt to these environmental changes. [6]

In the absence of adaptation efforts, damage to public infrastructure caused by climate change could cost Alaska $142 to $181 million per year and a cumulative $4.2 to $5.5 billion by the end of the century.[7] This burden will be heavily shouldered by the Municipality of Anchorage, which serves as the commercial hub of the state. Much of the economic activity and supply chain infrastructure that serves the state is based in Anchorage. The Port of Alaska is owned and maintained by the Municipality of Anchorage and links Alaska's primary marine, road, rail, pipeline, and air cargo systems. The Port handles half of all Alaska inbound cargo, almost 90% of all liquid fuel, and 90% of all cement used in Alaska.[8] The port's aging infrastructure is easily affected by extreme storms.[9] Transportation and shipping disruptions in Anchorage ripple throughout the state.

The actions outlined in this plan will help prepare our community for the impacts of a changing climate. Anchorage residents save money by preventing costly emergency responses (See Box 1). The transition to a low-carbon economy creates jobs and decreases operating costs of businesses and public utilities, saving local businesses and consumers money. The clean energy sector is growing worldwide, and this plan identifies opportunities for Anchorage to incentivize clean energy business investment.

THE CLIMATE IS CHANGING IN ANCHORAGE

GREATER RISK OF WILDFIRES

McHugh Lake Trail two years after the McHugh fire burned hundreds of acres south of the Anchorage Bowl.

Photo credit: Paxson Woelber

MORE WINTER FREEZE-THAW

Parks and Recreation used Street Maintenance equipment to scrape the Chester Creek Trail due to icy conditions in early December 2018.

Photo credit: Parks and Recreation

UNPREDICTABLE FISHERIES

Salmon in a commercial fishing boat.

Photo credit: Micah Hahn

BOX 1. COST OF WILDFIRE RESPONSE

Insect infestations, earlier snowmelt, and dry vegetation will make Anchorage's forests more susceptible to wildfires. Adapting our forest management strategies to account for these changes will help prevent catastrophic wildfires that threaten our homes and forests and will avoid the cost of wildfire response and recovery. Estimated costs due to increased wildfires across Alaska are $1.1 to $2.1 billion annually from 2006 through the end of the century.[10]

Photo credit: Anchorage Wildfire Mitigation

THE "ANCHORAGE WAY": ONGOING CLIMATE ACTIONS

BUILDINGS AND ENERGY

The Energy Smart Lighting Initiative is retrofitting Anchorage streetlights with LED fixtures. Municipal Maintenance and Operations (M&O) converted 12,000 lights with an estimated annual cost savings of $780,000. [11]

LAND USE AND TRANSPORTATION

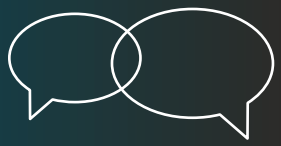
Over 500 Anchorage residents drive partial or fully electric vehicles.

The Anchorage Planning Department recently adopted a "Complete Streets" approach to planning and engineering stand for road that considers all road users - people who walk, bike, drive, and take the bus. The first Complete Streets project on Spenard Road features colored bike lanes, wider sidewalks, and additional pedestrian crossings.[12]

CONSUMPTION AND SOLID WASTE

Collection of compostable material has more than doubled in two years with curbside composting and additional drop off sites.

The Municipality produces enough energy to power the equivalent of 6,400 homes through its landfill gas to energy project.



HEALTH AND EMERGENCY PREPAREDNESS

Management translates key emergency preparedness documents into Anchorage's most spoken languages. The Anchorage Health Department is expanding outreach into limited English proficient communities to increase access to health care.[13]

FOOD SYSTEMS

Anchorage Parks and Recreation Department operates four community gardens with plans to add 54 new garden plots in Muldoon.

Edible planting projects are taking place throughout the Municipality, including at Fairview Park. Food forest and orchard projects are also underway at Gardens at Bragaw, Chanshtnu Muldoon Park, and Government Hill Commons.

URBAN FOREST AND WATERSHEDS

The Municipality's Firewise Home Assessment Program provides home visits to offer specific recommendations for vegetation management, home maintenance, and fire prevention through federal funding assistance.[14]

OUTREACH AND EDUCATION

Rider participation in Anchorage's annual Bike to Work Day has increased by 260% since 2007; in 2017, over 4,000 people participated in the local event.[15]

COMMUNITY ACTION IS THE KEY TO SUCCESS

This plan was written by the Anchorage community, for the Anchorage community. A team of over a hundred Anchorage residents helped draft this plan, including municipal staff, university faculty, staff, and students, agency representatives, and community members. Together, they identified the near-term actions most likely to result in the long-term changes necessary to achieve these ambitious climate action goals. Over 1,300 Anchorage residents participated in community events and provided important ideas and feedback throughout the development of the plan.

UNIVERSITY-MUNICIPALITY COLLABORATION

The Anchorage Climate Action Plan was developed through a collaboration between the University of Alaska Anchorage (UAA) and the Municipality of Anchorage. University faculty received a grant through the Faculty Initiative Fund to write this plan. They led the working groups, providing expertise for each of the sectors in this plan. The continued collaboration leverages resources and expertise, creating local data and knowledge to drive policy decisions.

Collaborative development of the Climate Action Plan created the opportunity for university students to participate in the municipal planning process. Several students were part of the working groups and participated in discussions about the most effective actions for climate mitigation and adaptation in Anchorage.

Bike to Work Day 2018. Photo credit: Anchorage Health Department

SUCCESS REQUIRES ACTION AT ALL LEVELS

Moving the needle on global greenhouse gas emissions and protecting communities from climate impacts requires action at the individual, household, neighborhood, and community levels. Coordination is needed across local, state, and federal governments. Many of the actions in the Climate Action Plan cross boundaries between traditional municipal departments or require collaboration between many groups. Implementation of the actions in this plan requires effective communication and creativity to meet the needs and goals of all partners.

At the Mountain View Boys & Girls Club, the gardening club is harvesting lettuce and learning about healthy eating and food security. Photo credit: Mayor's Officez

THE ROLE OF RESEARCH AND MONITORING

Research and monitoring are critical to effectively addressing the impacts of climate change in Anchorage. The development of key indicators of climate change in Anchorage will be an important first step to establish a baseline to monitor change. Establishing monitoring systems will allow the Municipality of Anchorage and other local organizations to rapidly respond to the evolving impacts of climate change. Such systems could include air quality monitoring stations to assess smoke exposure from wildfires or pollen levels, monitoring Eklutna Glacier, or ecological monitoring to aid in early identification of non-native plant and animal species.

Photo credit: Johanna Grasso

CLIMATE CHANGE IN ANCHORAGE

WHAT CHANGES HAVE ALREADY BEEN OBSERVED?

Temperatures have been increasing in Anchorage. In addition to normal year-to-year variability, scientists have observed a trend of increasing average seasonal and annual temperatures since 1949, when reliable meteorological data first became available (Figure 1). Looking more closely at seasonal trends, scientists have observed increases in temperatures across all seasons, but winter changes are most extreme. The average winter temperature has increased 6.7°F over this time period.[16] There has been notable warming in the spring, but warming has been more moderate in summer and fall.

The observed trend in precipitation is harder to see than the change in temperature, partly due to the extreme variability of precipitation. Moreover, tracking changes in precipitation is complicated because temperature plays a role. If more precipitation arrives as rain rather than snow, the impacts of precipitation will be different, even if the totals are the same.

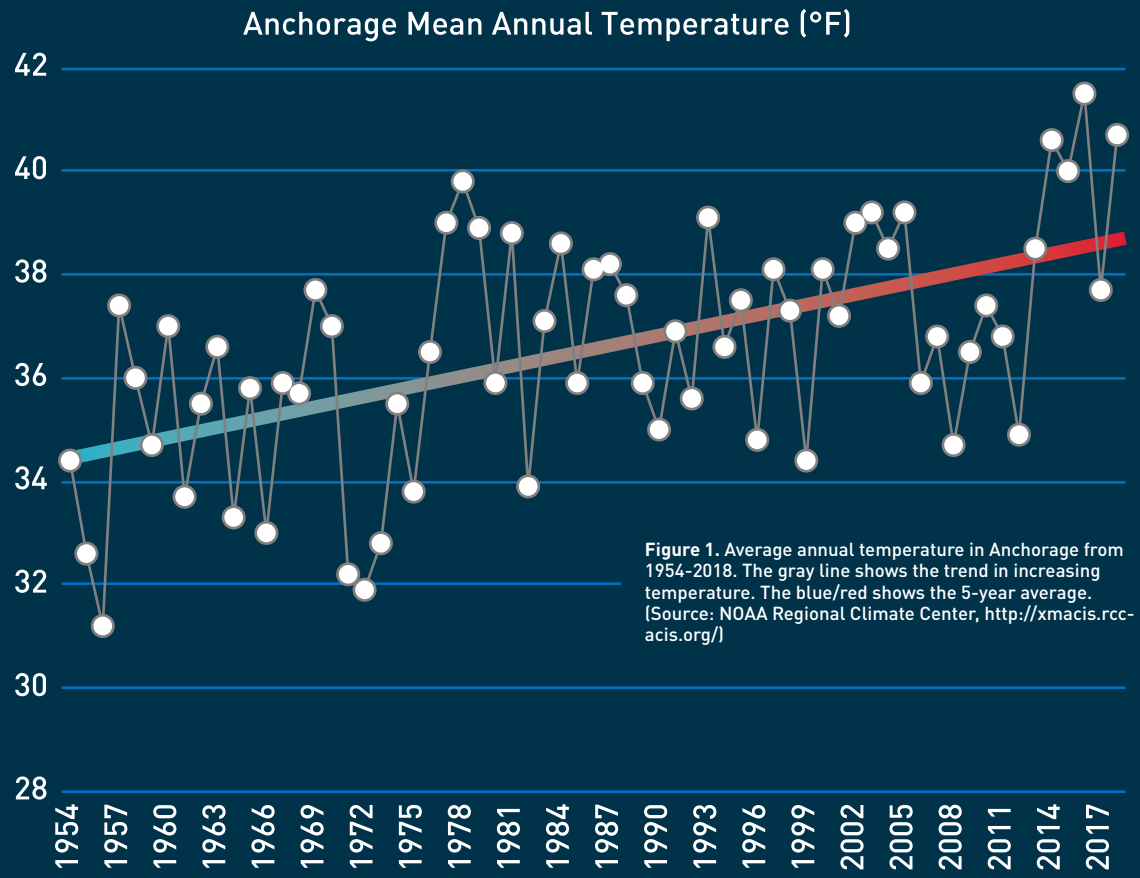


Figure 1. Average annual temperature in Anchorage from 1954-2018. The gray line shows the trend in increasing temperature. The blue/red shows the 5-year average. (Source: NOAA Regional Climate Center, http://xmacis.rcc-acis.org/)

The amount of snow on the ground is one of the most difficult daily weather variables to collect, and the location and method of measuring snow can substantially impact our historical weather records. One thing that is clear from historical snow monitoring in Anchorage is that the date of the first snowfall of the year is getting later, and the date of the last snowfall is getting earlier. Compared to 1958-1987, the average date of the first snowfall in Anchorage is a week later than it used to be.[17]

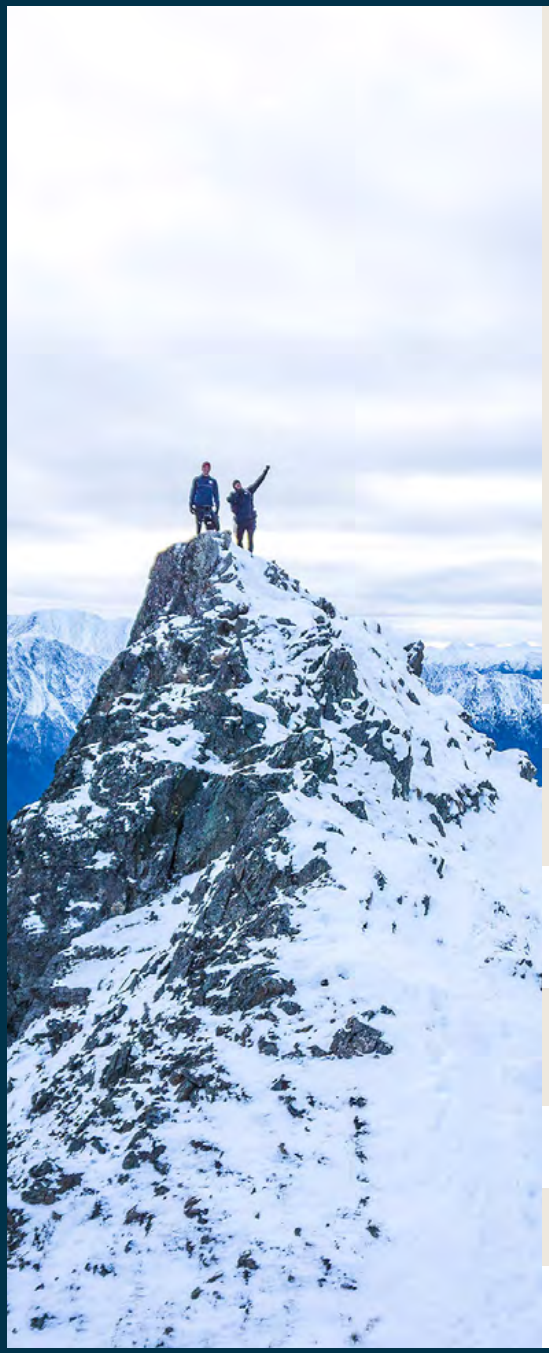


Photo credit: Matt Waliszek

WHAT DO YOU THINK ANCHORAGE'S "CLIMATE NORMAL" IS?

Climate scientists use the concept of *Climate Normals* as a way to describe the typical, expected climate pattern in a given area. Looking at these average values can provide context for understanding what it means when scientists say that our annual average temperature will be 4 to 5°F warmer by 2040 (compared to historical baselines).

Many people also have a concept of the type of climate pattern they expect to experience in the place they live. The chart below shows the normal monthly values for Anchorage for daily highs, lows, mean temperatures, rain, snow, and snowpack. These "normal" values are calculated using data from 1981 to 2010.

Before looking through the numbers in the chart, think about the type of climate you expect in Anchorage. What do you think the average temperature is in January? What months typically get snow? How long does that snow stay around? How hot does it get in the summer? Do these data support your perceptions about a "normal" Anchorage climate, or are there any surprises?

Normals (1981-2010)

Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Mean Temperature (°F)	17.1	20.2	26.5	36.8	47.8	55.2	58.8	56.7	48.5	34.8	22.2	19.0
Mean Maximum Temperature (°F)	23.1	26.6	33.9	44.5	56.0	62.8	65.4	63.5	55.1	40.5	27.8	24.8
Mean Minimum Temperature (°F)	11.1	13.8	19.2	29.1	39.6	47.7	52.2	50.0	42.0	29.1	16.6	13.2
Precipitation (in)	0.7	0.7	0.6	0.5	0.7	1.0	1.8	3.3	3.0	2.0	1.2	1.1
Snowfall (in)	11.3	10.9	9.9	4.0	0.3	0.0	0.0	0.0	0.4	7.9	13.1	16.7
Snow Depth (in)	10.9	12.4	11.9	3.8	0.0	0.0	0.0	0.0	0.0	1.0	4.3	9.1

"Climate normals" based on records from 1981-2010. (Source: NOAA National Centers for Environmental Information, https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals/1981-2010-normals-data).

ANCHORAGE'S FUTURE CLIMATE

Models give a glimpse of the future climate in Anchorage. These take into account important global drivers of climate – the atmosphere, oceans, and land and ice cover. By the 2040s, **the average annual temperature in Anchorage is expected to increase by 4 to 5°F, as compared to the historical baseline.**

The average monthly temperature is expected to increase in all months (Figure 2). Increases are expected to be greatest in the winter. Changes in shoulder seasons have large impacts on residents. For example, now, the average March temperature in Anchorage is below freezing. By 2040, the average temperature in March is expected to hover around the freezing point. In 2060, freezing temperatures in March may become rare.

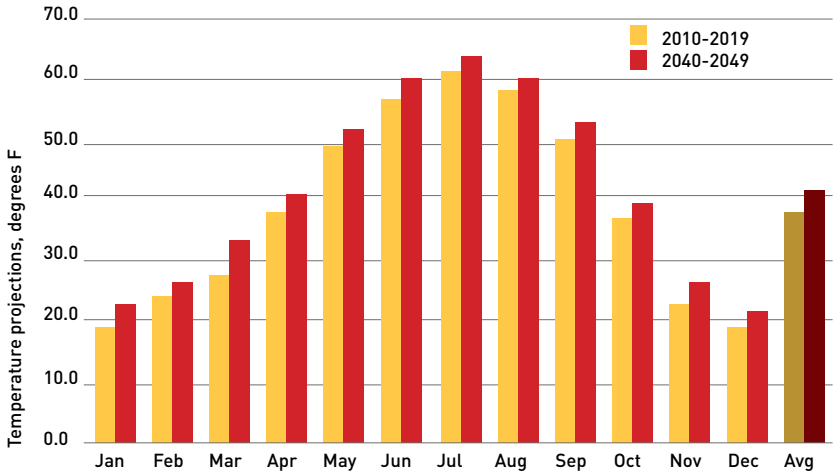


Figure 2. Modeled data for current and future temperatures in Anchorage. Graph shows mean monthly and mean annual projections. (Source: Scenarios Network for Alaska and Arctic Planning, www.snap.uaf.edu).

Climate extremes in Anchorage, especially the highest daily maximum temperature, are expected to increase in a changing climate. Anchorage is known for mild summer temperatures. Historically, temperatures over 80°F have been almost unheard of, standing as all-time records. But in the last several years, the number of warm summer days has been increasing. Daily summer highs tend to be about 7°F hotter than daily averages, with typical daily highs in July at 65 or 66 °F.[18] Average daily highs will likely reach 70 °F by 2040. Additionally, highs over 80 °F and even as high as 85 °F will become much more common.

In the same time period, **winters are expected to become milder.** The lowest daily minimum temperatures during the coldest months are expected to increase by about 7 °F. The typical number of days in January with a mean temperature below freezing is expected to decrease from about 20 days to only about 10 days by 2040.[19]

The projected trend in precipitation in Anchorage in the coming decades is considerably more complex than temperature. On average, the amount of precipitation Anchorage receives each month is expected to increase by the end of the century (Figure 3). Anchorage is expected to experience more "rain on snow events" as the number of winter days below freezing decreases. Although snowfall is difficult to predict, as seen in Southeast Alaska, warming winter temperatures dramatically decrease winter snowfall totals.[17]

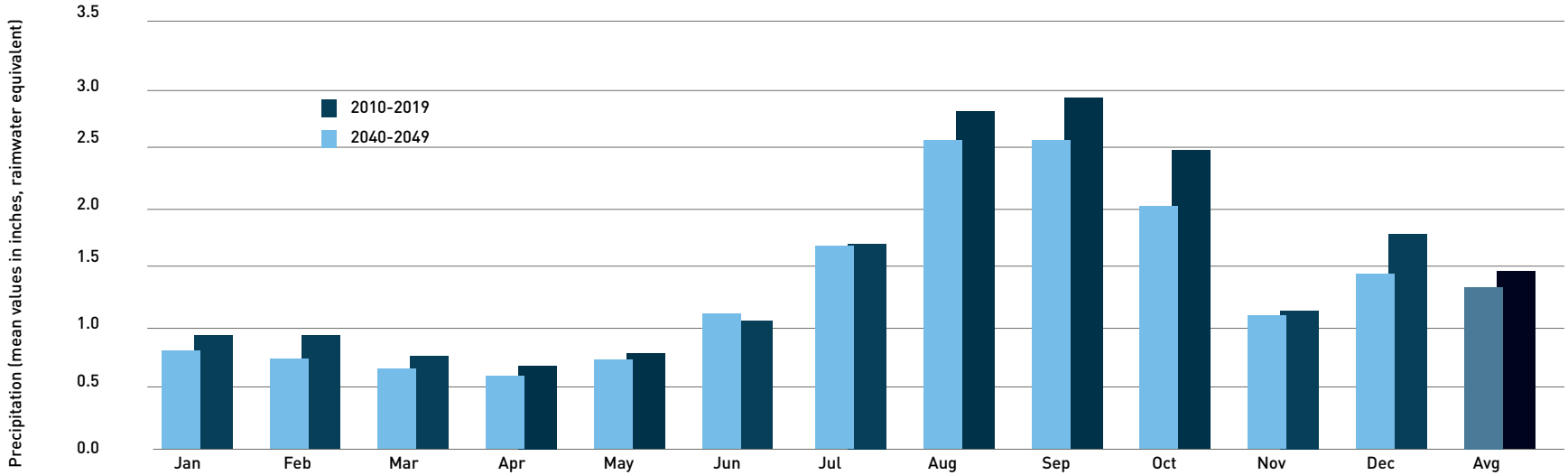
MEASURING SNOW IN ANCHORAGE

Anchorage is a snowy city, with more snow some years than others. The long-term average is 70" to 75" per winter. As little as 30" and as much as 135" have fallen in extreme years.

As the climate has warmed, the snow total has not changed significantly since the vast majority of winter days are still below freezing. As winter temperatures continue to warm and more days exceed the freezing mark, however, the snow totals are expected to drop dramatically.[17]

Photo credit:
Matt Waliszek

Figure 3. Modeled data for current and future precipitation in Anchorage. Graph shows mean monthly projections and annual projections. Note that more precipitation is likely to arrive as rain than in the past, and warmer temperatures tend to have a drying effect, so overall projections for seasonable water availability are difficult to derive. (Source: Scenarios Network for Alaska and Arctic Planning, www.snap.uaf.edu).



CLIMATE CHANGE IMPACTS IN ANCHORAGE

Eklutna Lake.
(Photo credit: Anchorage Water and Wastewater Utility)

Anchorage residents experience the impacts of climate change in our daily lives. Icy roads create hazards for people in cars, on bikes, and walking. Extreme precipitation events or sudden melting of ice and snow due to a warm event increase the risk of erosion and flooding. Less snow limits winter recreation. There will be fewer days to cross country ski on the trail system, a favorite way for many to get outdoors during the dark winter months.

Many other potential climate impacts are more difficult to predict. Runoff from Eklutna Glacier provides 86% of Anchorage's drinking water and generates hydroelectric power.[20] Other water sources include the Ship Creek watershed and ten high production groundwater wells which are an important part of a sustainable water supply. The glacier is retreating as a result of climate change. At the current rate of warming, scientists expect Eklutna Glacier to disappear in about 100 years, but this timeline could be cut in half with a higher warming rate. Between 2010 and 2015, 7-13% of the water volume in Eklutna Reservoir was from the annual net loss of the glacier.[21] The impacts of coastal erosion, extreme storms, and other large scale environmental changes on the loss of important cultural heritage sites in the Anchorage area are largely unexplored.[22]

Warmer temperatures throughout the year will have a range of impacts in Anchorage. The length of the growing season will expand with fewer days below freezing. By 2040, there could be five to 15 more days each year when the temperature is above freezing (Figure 4). This change creates an opportunity to grow new fruit and vegetable varieties that require more time in the ground.

Warmer temperatures also have negative impacts. Climate change puts local forests at risk. A massive spruce bark beetle outbreak began in Southcentral Alaska in 2016, aided by warmer temperatures (See Box 2). Warm summers combined with the many dead trees increase the risk of wildfire. Beyond the human health impacts of wildfire, wildfire events put stress on limited municipal resources.

POTENTIAL IMPACTS OF CLIMATE CHANGE IN ANCHORAGE

NATURAL SYSTEMS

- Increased risk of wildfires
- Changes in location and quality of available habitat for fish and wildlife
- Unpredictable salmon returns
- Changes to water availability
- Changes to the length of the growing season

INFRASTRUCTURE AND THE BUILT ENVIRONMENT

- Increased wear and maintenance costs of pavement due to increased frequency of freeze-thaw cycles
- Increased erosion
- Increased risk of flooding

HUMAN HEALTH

- Increased respiratory illness due to an increase in allergens, mold spores, dust events, or wildfire smoke
- Increased exposure to vector-borne diseases
- Decreased reliability of wild food sources
- Heat-related illness
- Mental health impacts
- Decreased winter recreational and exercise opportunities

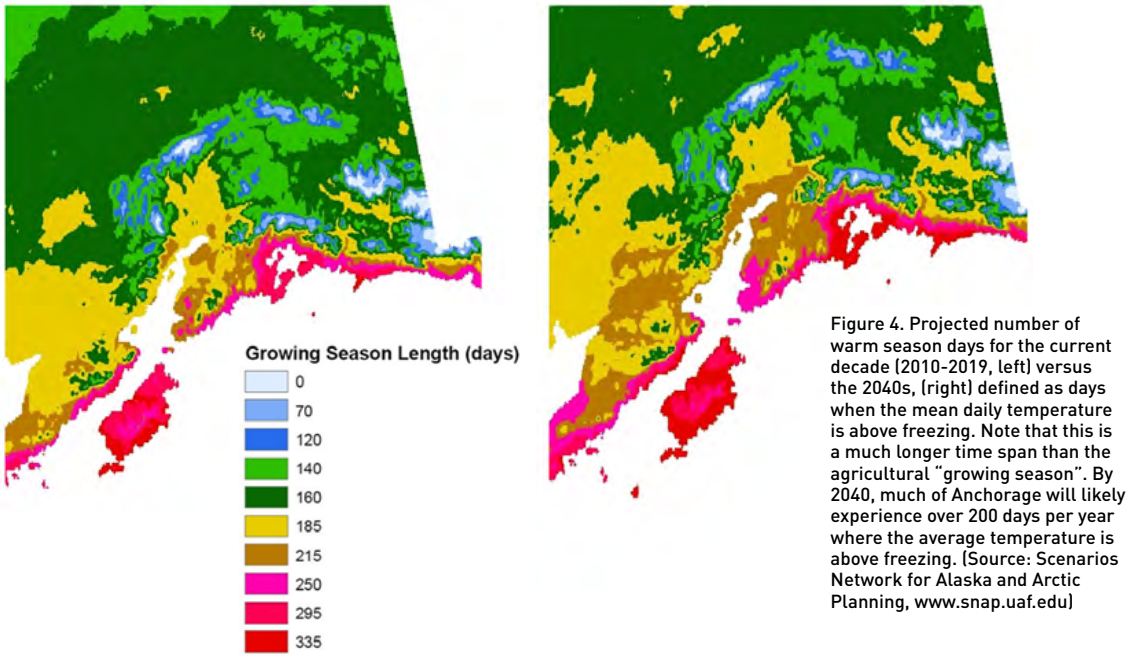


Figure 4. Projected number of warm season days for the current decade (2010-2019, left) versus the 2040s, (right) defined as days when the mean daily temperature is above freezing. Note that this is a much longer time span than the agricultural "growing season". By 2040, much of Anchorage will likely experience over 200 days per year where the average temperature is above freezing. (Source: Scenarios Network for Alaska and Arctic Planning, www.snap.uaf.edu)

Because of Anchorage's heavy reliance on fisheries, large-scale changes to the Earth's oceans impact Anchorage residents on a local level. Alaska will likely experience unpredictable salmon returns and similar impacts on other fisheries.

Climate change will impact the habitat of many animals that are important for subsistence, recreational harvest, and tourism. Scientists expect that many coniferous forests will transition to deciduous forests after wildfires, shifting the range of large animals such as moose and caribou. Warmer temperatures in Anchorage will likely be more hospitable to invasive disease "vectors", such as ticks and mosquitoes. If

these vectors become established, Anchorage residents as well as Alaskan wildlife will be at risk.

Anchorage will likely see an earlier and longer allergy season and more mold, which triggers asthma and causes respiratory disease. Although projections for extreme summer temperatures are lower than other parts of the Lower 48, the lack of air conditioning and acclimation to warm temperatures can still cause heat-related illness.

Many of the recommendations in the Climate Action Plan address these potential impacts of climate change in Anchorage by creating programs and management strategies that make our residents and ecosystems more resilient. Although the best available knowledge of these impacts guided the development of the plan, continued monitoring of these impacts is essential for a quick and effective response.

BOX 2. SPRUCE BEETLE AND CLIMATE CHANGE

Successive years of warm summer temperatures and drier conditions are allowing the spruce beetle to venture farther north.[23] Spruce beetles are more likely to infest trees that are damaged or stressed by storms or drought, and longer periods of warmer temperatures can allow the beetle to transition from a two to one year lifecycle. [24]

In 2018, U.S. Forest Service surveys identified more than 550,000 acres of tree mortality in Southcentral Alaska due to spruce beetle damage, nearly 50% more than in 2017. Swaths of forest from the central Susitna Valley to northwest Kenai Peninsula are currently affected, including 1,500 acres within Anchorage.[25] Find out how to identify the spruce bark beetle and how to protect your trees at http://www.alaskasprucebeetle.org/.

Spruce beetles (left) and spruce beetle damaged tree (right). Photo credit: Michelle Fehribach

UNDERSTANDING ANCHORAGE'S GREENHOUSE GAS EMISSIONS

The scientific community agrees that the world is warming due to the human-caused emissions of greenhouse gases.[26] Almost all human activities in our modern lives contribute to the production of greenhouse gases in some way. This can occur directly through the fuel that runs cars or heats homes, or indirectly from the production and transportation of food and goods that we use every day.[27] The two main greenhouse gases addressed in this plan are carbon dioxide (CO_2) and methane (CH_4), with the majority of actions addressing CO_2 emissions.

Anchorage is currently working on a greenhouse gas inventory to fully understand local emissions from energy use in our vehicles, homes, and businesses, as well as emissions from waste and wastewater. This inventory will be used to refine our targets and track progress towards the goal of reducing local emissions. While previous inventories were done in 2008 [28] and 2017,[29] each has limitations. Updating these inventories is among the most important steps of the Climate Action Plan.

WHERE DO OUR EMISSIONS COME FROM?

Emissions in Anchorage come primarily from three sources: Buildings and Industry (46%), Transportation (42%), and Waste (12%) [32]

BUILDINGS AND INDUSTRY (46%)

TRANSPORTATION (42%)

BUILDINGS AND INDUSTRY

Emissions from buildings and industry include heating and electricity used in buildings as well as energy used for industrial processes (e.g. the Port of Alaska and fisheries' products). Twenty percent of Anchorage's homes have received upgrades through state energy energy programs, saving on average 20-30% on energy use, depending on the program. Further, a recent study showed that Anchorage's commercial buildings could save $40 million annually with cost-effective energy upgrades.

While Anchorage has come a long way in improving its buildings, there are opportunities for significant savings. Pairing energy efficiency with renewable energy will further reduce energy use and costs. For example, the 75 kW solar system that is being installed on the Egan Center will save the equivalent of 65,726 pounds of coal burned annually.

25-kW solar installation on a commercial building in downtown Anchorage. Photo credit: Arctic Solar Ventures

TRANSPORTATION

Vehicles are a major source of greenhouse gas emissions in Anchorage. Prolonged vehicle warm-ups and idle times, particularly in winter, are also a substantial source of air pollution.[30] Improving bike and pedestrian infrastructure and public transportation not only reduces emissions and pollution but can also save people money and expand transportation options. In 2017, the Public Transportation Department updated People Mover routes with a priority on high use areas to provide better service for the residents that rely on public transit.

Electric vehicles are becoming more common in Anchorage. The Municipality of Anchorage is working with electric utilities to develop a regional electric vehicle charging plan to support smart charging infrastructure.

In January 2019, Anchorage Community Development Authority installed an electric vehicle charging station in an EasyPark garage in downtown Anchorage. The charging station will be free to use through the end of 2019.[31] Photo credit: Easy Park

WASTE (12%)

WASTE

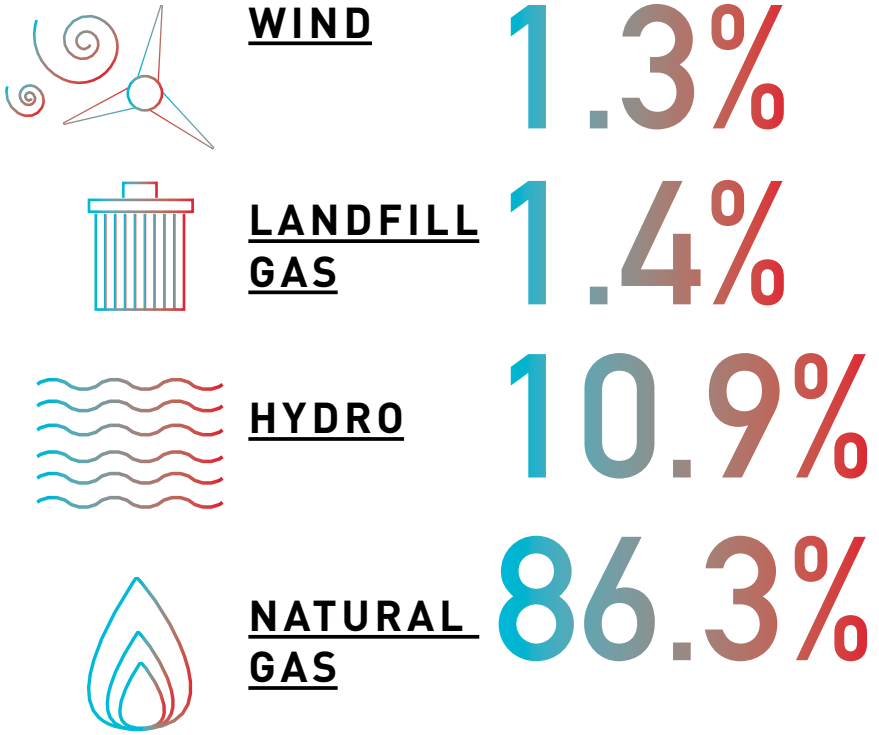
Waste emissions come from solid waste and wastewater operations. Heavy equipment and vehicles are used to transport and process waste and wastewater in Anchorage. The breakdown of organic matter in the landfill produces landfill gas, which is mostly methane.

The Municipality already uses landfill gas to produce energy. A waste-to-energy plant could take further advantage of potential energy in waste. Electric garbage trucks would cut down on vehicle emissions.

Breaking down this electricity use by energy source demonstrates that Anchorage's current energy portfolio is dominated by natural gas. Not only is Anchorage's heat generation almost exclusively from natural gas in buildings, but over 86% of the city's electricity generation is also from burning natural gas.

Over-reliance on one energy source leaves Anchorage vulnerable to price volatility and supply interruptions. Adding renewable energy will diversify our energy supply, improve air quality, and save money on fuel costs.

WHERE DOES ANCHORAGE'S ELECTRICITY COME FROM?



Anchorage electricity generation by fuel type, 2013.[32]

WHO USES ENERGY IN ANCHORAGE?

Residents and businesses consume 79% of electricity and natural gas in Anchorage and could save approximately $70 million/year through energy efficiency upgrades. It is conservatively estimated that cost effective retrofits will result in electrical and natural gas savings of 20% and operations and maintenance savings of 5%, and that all private facilities have potential for a simple payback on investment of 7 years.[32]

The municipal government accounts for 5% of the energy used in Anchorage (4% for buildings and 1% to power streetlights). While many of the actions in this plan address municipal operations, these figures indicate why collaboration with Anchorage residents and businesses is crucial to the success of the plan. Together, the Anchorage community has the opportunity to drastically reduce emissions. Reducing emissions across all sectors is necessary for Anchorage to meet its goals.

STREETLIGHTS 1%

MUNICIPALITY 4%

JBER 7%

OTHER FEDERAL AND STATE 9%

COMMERCIAL-PRIVATE 25%

RESIDENTIAL 54%

Anchorage electricity and natural gas usage by sector, 2015. [32]

CONSOLIDATING ENERGY SOURCES IN ANCHORAGE

In Anchorage, one utility provides natural gas and three utilities provide electricity. With a small load (<500 MW of peak demand), this is an inefficient use of resources. Anchorage voters supported the sale of Municipal Light & Power (ML&P) to Chugach Electric Association (CEA) in an April 2018 ballot proposition. When finalized, the $1 billion sale will eliminate duplication and allow more efficient operation in Anchorage and create the potential for more renewable resources.

KEY TERMS IN THE ANCHORAGE CLIMATE ACTION PLAN

MITIGATION actions work to slow the effects of climate change by reducing greenhouse gas emissions produced in Anchorage. These strategies target key sources of emissions such as energy consumption in buildings, vehicle emissions, transportation, and waste management.

ADAPTATION refers to the activities and strategies that the Municipality and its partners can implement in order to prepare for the impacts of climate change. Anticipating these changes such as warmer winters and increased wildfire risk can guide policies to prevent or minimize impacts on Anchorage's infrastructure, ecosystems, and residents.

GREENHOUSE GAS EMISSIONS refers to the production and release of carbon dioxide, methane, and other gases that are the primary driver of climate change. The vast majority of human-created emissions come from burning fossil fuels, such as coal, oil, and natural gas.

CLIMATE EQUITY ensures that the effects of climate change are addressed through policies and projects that directly address inequality and equally disperse the benefits to all residents.

CO-BENEFITS refer to the positive benefits for the economy, public health, equity, and the local environment as a result of mitigation and adaptation actions that are directed at reducing greenhouse gas emissions and preparing for climate impacts.

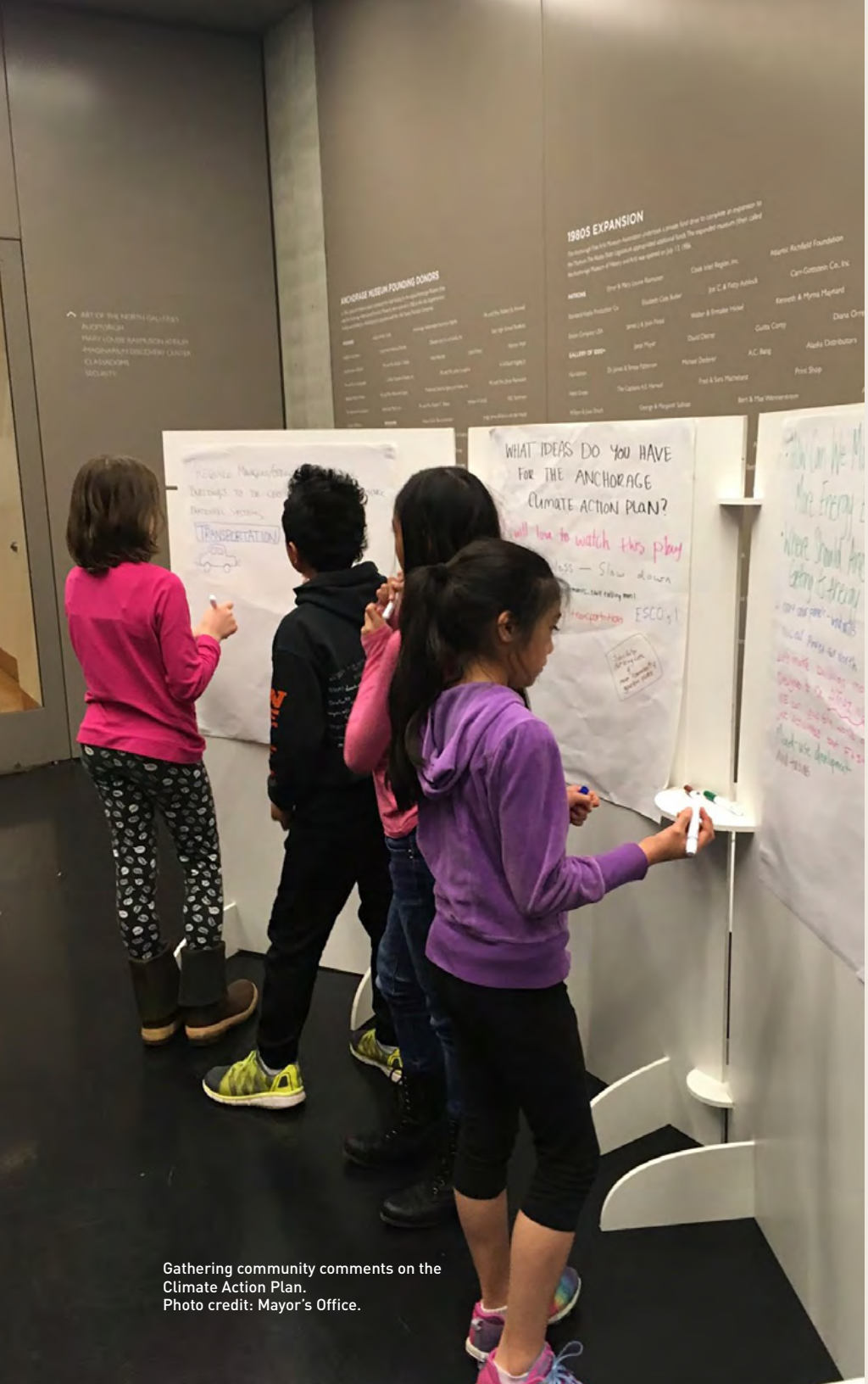
EMBEDDING EQUITY IN CLIMATE ACTION

The Municipality of Anchorage has a bold vision for responding to climate change that integrates the city's values of equity and inclusion. The success of this vision relies upon engaging Anchorage's many and diverse communities. Anchorage ranks among the most ethnically diverse cities in the United States.[33] Climate action can improve quality of life for all residents, regardless of ethnicity or income status.

As Anchorage becomes more diverse and globally connected, it is critical to address persistent disparities in income and health. When communities are economically and structurally isolated, they are more vulnerable to acute shocks. For example, individuals with limited English language proficiency are less likely to access emergency services and programs that could help during or after an extreme weather event, and socially isolated residents may not have a personal network to help them during an emergency.

Actions to reduce emissions and prepare for climate change can promote equity. Energy efficiency saves residents money by reducing energy bills. Ensuring good air quality promotes health. Creating renewable energy economies increases job opportunities for residents. By advancing equity, we build opportunities for residents to respond to a range of challenges.

A robust community engagement strategy was critical for ensuring that the Climate Action Plan reflects the values, goals, priorities, and concerns of all Anchorage residents. The Steering Committee hosted seven interactive public open houses to solicit ideas for the plan and feedback on draft objectives and actions. To ensure that all residents had an opportunity to get involved in the planning process, the Steering Committee also went directly to a variety of community groups with "mobile climate workshops" that were tailored for the organization's particular interest area. **See pages 93-94** for more details about the community engagement process and how community input and equity considerations were incorporated in the Climate Action Plan.



Gathering community comments on the Climate Action Plan.
Photo credit: Mayor's Office.

BY THE NUMBERS

7 public open houses

28 Mobile Climate Workshops

1,300+ event attendees

155 online comments submitted on draft

WHAT DOES IT MEAN TO USE EQUITY AS A GUIDING PRINCIPLE FOR THE ANCHORAGE CLIMATE ACTION PLAN?

- Create a plan that reflects the values, goals, concerns, and innovative ideas of all Anchorage residents.
- Engage residents in decision-making processes that impact them.
- Reduce inequities in access to critical services, including health, green jobs.
- Ensure that the benefits of actions outlined in the Climate Action Plan are shared equitably among all Anchorage residents.
- Create opportunities for residents in new economies (renewable technologies, green building)

CO-BENEFITS OF CLIMATE ACTION

Most of the actions found in the plan will create community and environmental benefits, or co-benefits. Some of the potential co-benefits[34] of implementing the actions in this plan include:

- **Jobs and prosperity**
- **Equity**
- **Environmental quality**
- **Health**

These benefits include:

- ECONOMIC STABILITY
- BETTER EMERGENCY MANAGEMENT AND RESPONSE
- IMPROVED INFRASTRUCTURE AND PUBLIC FACILITIES
- MORE TRANSPORTATION OPTIONS
- MORE PREDICTABLE ENERGY SUPPLY
- SUSTAINABLE NATURAL RESOURCES
- FOOD AND AGRICULTURE STABILITY

CLIMATE ACTION SUPPORTS JOBS AND PROSPERITY

By lowering emissions, Anchorage opens doors to economic opportunity. In the United States, more than 3.3 million Americans are directly employed by the clean energy industry.[35] Anchorage is uniquely poised to develop economic sectors that take advantage of our strategic location and abundance of renewable resources. Identifying and building a clean energy sector provides more economic opportunities for underemployed and unemployed Anchorage residents. For example, the Home Energy Rebate Program generated an estimated 1,332 jobs in Alaska from 2008 - 2011 from direct spending on efficiency upgrades.[36]

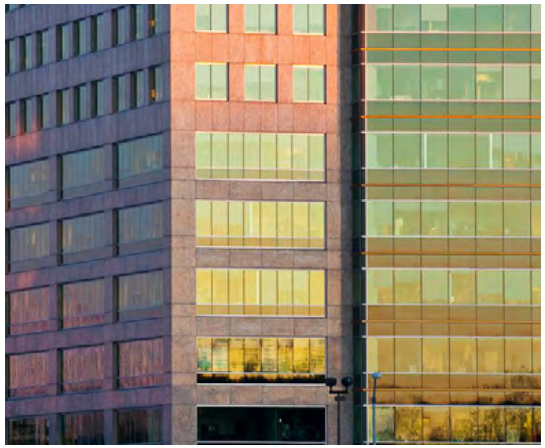


Photo Credit: Carl Battreal

CLIMATE ACTION IMPROVES ENVIRONMENTAL QUALITY

Access to our natural environment is one reason why many people choose to live in Anchorage. Many actions in the plan will improve local environmental quality. For example, actions aimed at reducing flood risk by preserving wetlands also protect this vital wildlife habitat. Development practices that maintain green spaces will help protect our forests.

Photo Credit: Johanna Grasso

CLIMATE ACTION IMPROVES HEALTH

Climate change often has direct impacts on human health, including increased wildfire risk and exposure to vector-borne diseases. These impacts are addressed in the Health and Emergency Preparedness chapter **(pages 58-66)**. Actions found in this plan not only address these impacts but have the potential to improve health. For example, making it more safe and accessible to walk or bike promotes increased physical activity and reduces the risk of crashes.

Photo Credit: Michelle Fehribach

CLIMATE ACTION PLAN SECTORS

GOAL: Reduce greenhouse gas emissions 80% from 2008 levels by 2050, with a goal of 40% by 2030.

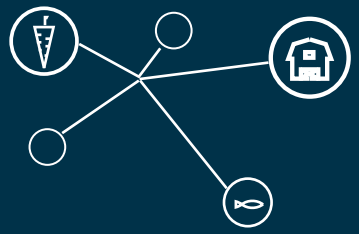
The objectives and associated actions are grouped into the following sectors:

BUILDINGS AND ENERGY

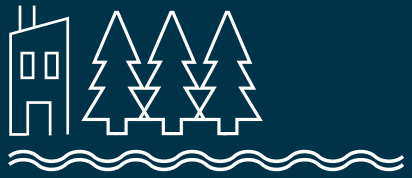
LAND USE AND TRANSPORTATION

CONSUMPTION AND SOLID WASTE

HEALTH AND EMERGENCY PREPAREDNESS



FOOD SYSTEMS



URBAN FOREST AND WATERSHEDS

OUTREACH AND EDUCATION

TERMINOLOGY

VISION = A broad statement that describes where we would like to be by 2050 within each sector.

OBJECTIVES = Steps towards achieving mitigation targets and adaptation goals by 2030.

ACTIONS = Detailed policies, projects, and activities with timeframes to achieve our objectives.

CO-BENEFITS refer to the intended or unintended benefits for the local environment and community as a result of mitigation and adaptation actions that are directed at addressing climate change. The co-benefits column indicates the actions that have the potential for significant, direct co-benefits. The co-benefits noted in this plan include:

High potential to support jobs and prosperity

High potential to advance equity

High potential to improve local environmental quality

High potential to improve health

PRIMARY MUNICIPAL LIAISON & POTENTIAL PARTNERS

To help with implementation and accountability, primary municipal liaisons and potential partners are identified. For Municipality led actions, the Primary Municipal Liaison is the primary department responsible for initiating the implementation of the action and reporting on progress. For partner (university and other) led actions, the Primary Municipal Liaison will be the main point of contact for the Municipality. Successful implementation will often require collaboration and coordination with other departments as well as public and private sector partners.

KEY

Municipal-led actions

Partner-led actions

A full list of municipal departments included in the plan can be found in the Appendix.

IMPLEMENTATION TIMEFRAME

Near-term =

Plan adoption to June 2020

Mid-term =

2020 to 2025

Long-term =

2026 and beyond

Existing and/or ongoing =

currently underway

Uncertain =

depends on funding or other factors

Sector 01

BUILDINGS & ENERGY

BUILDINGS AND ENERGY

Alaska is the third highest state in energy use per capita in the U.S.[37] Buildings and industry account for nearly half of Anchorage's emissions. While cold temperatures and dark winters contribute to high energy use, there are many opportunities to save energy and money through energy efficiency and renewable energy. Warmer temperatures reduce heating needs in the winter but may increase cooling needs in the summer.

In Southcentral Alaska, three new natural gas plants have been completed since 2013. These generate 86% of electricity in Anchorage, with the remaining power coming from wind, hydropower, and landfill gas-to-energy. Heating is also sourced from natural gas. These large investments in natural gas hinder new renewable energy project developments as the energy capacity available on the grid exceeds current demand. Though the increased efficiency of the new plants reduces fuel usage, data-driven collaboration and regional planning with the utilities are critical to moving forward more efficiently.

As noted in the Land Use and Transportation sector, the rise in electric vehicles (EVs) that the Lower 48 is already experiencing will increase electric demand in the near future. Plans for that growth create an opportunity to increase renewable energy generation. More renewable energy will further improve air quality when switching to EVs.

Energy efficiency measures could save approximately $39 million a year for homes and $40 million a year for private commercial buildings.[32] Energy upgrades reduce energy use and costs, improve comfort, and increase the value of homes and businesses. Efficient

ALASKA HAS DEMONSTRATED THE SUCCESS OF INVESTING IN CLEANER ENERGY

Since 2008, state residential energy efficiency programs have assisted more than 40,000 households in becoming more energy efficient, saving residents on average 20 - 35% of their home energy use. Mayor Berkowitz advanced the Energy Smart Lighting Initiative to retrofit Anchorage streetlights with LED fixtures. Municipal Maintenance and Operations (M&O) converted 12,000 lights with an estimated annual cost savings of $780,000. The Municipality of Anchorage will continue to lead by example starting with a deep dive into building energy upgrades, which could save an estimated $3 million in energy costs annually.

On Mar. 28, 2017, Mayor Ethan Berkowitz joined an M&O crew to install a new LED street light and "smart" controller node."

Photo credit: Wayne Johnson, ML&P

Sector 01 title page photo: Steve McCutcheon, McCutcheon Collection; Anchorage Museum, B1990.014.5.EQ.01.1.11

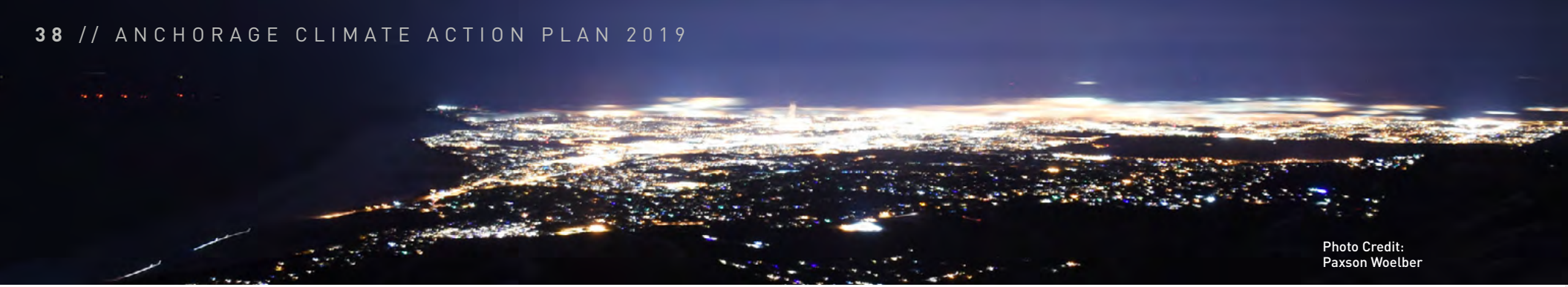


Photo Credit:
Paxson Woelber

building design can cost more up front, but with lower annual energy costs, energy efficiency has the fastest return on investment compared to any type of energy generation. Barriers to energy investments in buildings include lack of knowledge of the cost benefits of efficiency, lack of financing, and a disconnect among owners and renters. To address these barriers, Anchorage is currently exploring new and creative financing mechanisms.

Equity considerations are a key factor for this sector to ensure lower-income residents are not unfairly burdened by rising energy costs or excluded from clean energy incentives. Programs should be designed so that the cost of energy efficiency upgrades is not prohibitive for Anchorage households. Similarly, it is important that the costs of home energy efficiency upgrades are not passed onto tenants through higher rental costs without the benefit of lower energy bills.

Investments in renewable energy are necessary to decrease our energy-related greenhouse gas emissions. Solar and battery prices have dropped 80% in the last decade while the cost of wind power is down by more than half. Bradley Lake, a 120 MW hydroelectric project near Homer, was almost rejected due to its initial construction cost. Now, 28 years later, it is still generating electricity and is the lowest cost energy available on the Railbelt grid. The Railbelt refers to the electrical grid that runs from Fairbanks to Homer and includes Anchorage. Alaska has some of the greatest renewable energy potential in the world. Cook Inlet, with North America's second largest tide, has attracted interest as an energy source for the region.

Some actions with the biggest impact on Anchorage's energy-related greenhouse gas emissions are beyond the jurisdiction of the Municipality of Anchorage. Statewide developments on the horizon include the establishment of a Railbelt-wide "System Operator" to lead regional planning efforts and ensure a level playing field for renewable energy generators.

Creating a policy framework that supports clean energy investments will make Anchorage a more attractive place to live, work, and play. Without action on this front, Anchorage will lose resources to states that are attracting investment and businesses with affordable, reliable, clean energy.[38] Additionally, Anchorage will lose the potential savings from increased use of energy efficiency strategies and renewable energy.

CASE STUDY: COOK INLET HOUSING AUTHORITY (CIHA) HIGH-EFFICIENCY HOMES

CIHA was established in 1974 with the goal of providing affordable housing to people in the Cook Inlet region of Alaska. After decades of successfully providing quality, affordable homes to Alaskan families, CIHA is committed to using efficient design and alternative energy systems in their developments for long-term sustainability. For example, one of the affordable senior housing developments is heated through geothermal ground-source heat-pump technology.[39]

CASE STUDY: SOLARIZE ANCHORAGE

Solarize Anchorage is a community-based solution to reduce the upfront cost of solar photovoltaic (PV) power. The campaign brings neighborhoods together to purchase solar PV panels in bulk and receive a volume discount, making solar PV technology more accessible and affordable for customers. This community-driven program empowers individuals to participate in clean energy solutions to climate change.

The first phase of the campaign occurred in the Airport Heights neighborhood in summer 2018. The campaign received broad community support, with 33 participating homeowners and 146 kW total installed capacity. The participants of the first phase of the campaign received the Solarize discount, federal tax credits, and savings through net-metering. It is estimated that a 3kW solar installation will save homeowners $16,000 over the 25 year projected life of the panels.

This development raises concerns about current *net metering* regulations. Net metering allows a consumer to sell excess energy back to the electrical grid, offsetting the cost of their energy. Currently, net metering is allowed for installations up to 25 kW in size, and utilities are mandated to allow net metering on installed capacities equivalent to 1.5% of their respective average loads. Given current solar PV installation trends, Anchorage utilities are projected to meet this limit within the next several years.[40]

Photo Credit: Ben May, Anchorage Solar

Sector 01: Buildings & Energy

2050 Vision

Buildings and infrastructure in Anchorage are safe, healthy, and affordable for all, and our building practices demonstrate leadership in high latitude climates. Residents, businesses, and organizations have access to affordable clean energy.

Objective 1. Improve energy efficiency of buildings in all sectors.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
1A	Explore incentives for energy and water efficiency, storage, and renewable energy (e.g. expedited permitting, rebates, property tax incentives, utility programs, etc) for all public and private buildings.		Office of Economic and Community Development (OECD), Office of Energy and Sustainability (OES)	Project Management & Engineering (PM&E), MOA Property Appraisal, Anchorage Home Builders Association (AHBA), Building Owners and Managers Association (BOMA), Anchorage School District (ASD), realtors, contractors, design and construction community, Development Services	Near-term and Ongoing
1B	Establish codes that improve energy efficiency. Reach for best practices such as Living Building Challenge, Architecture 2030, LEED, Passive House, net zero, etc. for new residential, commercial, and municipal buildings.		OECD, Building Safety, OES, Maintenance and Operations (M&O), Development Services, Permitting, Real Estate Department	Planning Department, PM&E, Alaska Energy Authority (AEA), BOMA, AHBA, Alaska Housing Finance Corporation (AHFC), Cold Climate Housing Research Center (CCHRC), contractors, design community, labor unions, realtors, mechanical engineers	Mid-term
1C	Implement energy performance tracking and an annual reporting program for buildings over 10,000 square feet, starting with municipal buildings.		Innovation Team (i-Team), OES, M&O	MOA Finance Department, U.S. Department of Energy, AHFC, AEA, ASD, Anchorage electric and gas utilities	Mid-term
1D	Develop a program to facilitate cost-saving building tune-ups for commercial and municipal buildings in order to ensure optimal operation. Studies show that payback ranges from 0.2 to 2.1 years.		OECD	PM&E, MOA Finance Department, BOMA, ASD, design and construction community	Mid-term
1E	Work with community-based organizations on a workforce development program for high energy efficiency building design and construction.		OECD	ASD, King Technical High School, UAA, Alaska Native Science & Engineering Program (ANSEP), Renewable Energy Alaska Project (REAP), Alaska Department of Labor and Workforce Development, Alaska Vocational Technical Center (AVTEC), design and construction community, labor unions, community centers	Mid-term
1F	Require energy audits and implementation of cost effective energy efficiency measures with MOA facilities with priority on highest energy consuming facilities.		OES, M&O, Municipal Manager	MOA Finance Department, MOA Office of Management and Budget (OMB), ASD, AHFC, AEA, BOMA	Mid-term
1G	Develop an energy and water use guide for Municipal employees.		OES	M&O, AHFC, CCHRC	Near-term
1H	Continue to change out MOA streetlights/trail lights to LEDs and more efficient lighting controls.		M&O, Parks and Recreation (P&R), Traffic Department, ML&P	Chugach Electric Association (CEA), Matanuska Electric Association (MEA), ASD, AHD	Near-term to Mid-term
1I	With a focus on low income households and renters, engage residents on low cost ways to save energy and money, such as installing programmable thermostats.		OES, P&R, ML&P, Anchorage Health Department	CEA, MEA, ASD, AEA, AHFC	Near-term to Mid-term

Sector 01: Buildings & Energy

Objective 2. Expand local renewable energy generation and use.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
2A	Establish internal municipal level renewable energy and energy efficiency targets.		Office of the Mayor, OES, OECD, M&O	ASD, CEA, ML&P, MEA, Planning Department, Anchorage Assembly	Mid-term
2B	Quantify potential cost savings and emissions reduction through electrification of sectors (conversion to heat pump water heaters, natural gas dryers, electric vehicles, etc.).		OES	AEA, AHFC, Anchorage electric utilities, builders and developers	Near-term
2C	Explore ways to incentivize renewable energy generation and energy storage projects.		OECD, OES	Private entities with high energy use, clean energy businesses	Mid-term
2D	Explore internal operational and savings opportunities such as those outlined in the 2017 Anchorage Energy Landscape and Opportunities Analysis, including heat recovery, waste to energy, landfill methane recovery, and combined heat and power.		Solid Waste Services (SWS)	AWWU, ML&P, M&O, ASD, OECD	Ongoing
2E	Review the solar process including permitting, and planning, zoning and development regulations to identify and reduce barriers to installing solar through the national SolSmart designation program.		OES	Planning Department, Permitting Department, OECD, solar installers, electric utilities	Ongoing
2F	Explore options for treating Anchorage sewage sludge at the Asplund Wastewater Treatment Facility, including generating electricity with sludge gasification		AWWU	OES, OECD, Anchorage electric utilities	Mid-term
2G	Explore energy recovery at pressure release valves		AWWU	OES, Anchorage electric utilities	Mid-term

Sector 01: Buildings & Energy

Objective 3. Use existing and innovative financing mechanisms to encourage clean energy and energy efficiency.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
3A	Develop a detailed finance map, illustrating the range of finance options to be utilized in meeting the City's climate needs		OES	OMB, MOA Finance Department	Near-term
3B	Identify and develop financing mechanisms to encourage clean energy and water efficiency projects and programs (e.g. green bank, on-bill financing).		OECD, OES	AEA, American Institute of Architects (AIA), AHBA, Association of Alaska Housing Authorities, Connecticut Green Bank, lenders, private banks, Anchorage electric and gas utilities	Mid-term
3D	Work with AHFC and other 3rd party commercial lenders to access currently available financing for public building energy retrofits including Energy Saving Performance Contracts (ESPC).		OES, OECD	M&O, P&R, ASD, AHFC, Alaska Department of Transportation and Public Facilities (AK DOT&PF), Energy Service Companies (ESCOs)	Near-term
3E	Establish a Commercial Property Assessed Clean Energy (C-PACE) program in the MOA to provide financing for clean energy measures in commercial properties.	$	OECD, OES, Anchorage Assembly, Tax Assessor's Office	AEA, Alaska municipal and borough leaders, capital lenders, REAP, BOMA, energy auditors and contractors, AHFC, and C-PACE program administrators and local governments nationwide	Near-term
3F	Develop an MOA policy and procedure to consider life-cycle costs in planning and procurement to evaluate total costs of operations and maintenance over the lifetime of the equipment, facility, service, etc.	$	OES, Finance Department, Purchasing Department	Municipal Manager, OMB, Anchorage Assembly	Mid-term

Sector 01: Buildings & Energy

Objective 4. Work with state and regional partners to enable long-term clean energy solutions.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
4A	Support a System Operator for the Railbelt to provide regional planning, improve system efficiency and increase opportunities for Independent Power Producers.		Office of the Mayor	Regulatory Commission of Alaska (RCA), Alaska State Legislature, AEA, Railbelt electric utilities	Near-term
4B	Continue to work with utilities to allow all customers to opt in to pay for a higher portion of renewable energy.		Office of the Mayor, OES	Electric utilities	Near-term
4C	Evaluate a carbon pricing mechanism to account for the externalities of fossil fuels.		Office of the Mayor, OES	State of Alaska, Alaska Energy Authority, energy industry	Near-term
4D	Advocate for a Railbelt Renewable Portfolio Standard requiring a certain portion of energy to come from renewable energy sources in Alaska.		Office of the Mayor	REAP, Anchorage electric utilities	Near-term
4E	Explore and contribute input toward discussion of increasing the Railbelt net metering cap of 1.5% of utilities' average annual load.		Office of the Mayor	REAP, Anchorage electric utilities, renewable energy businesses	Mid-term

Sector 02

LAND USE & TRANSPORTATION

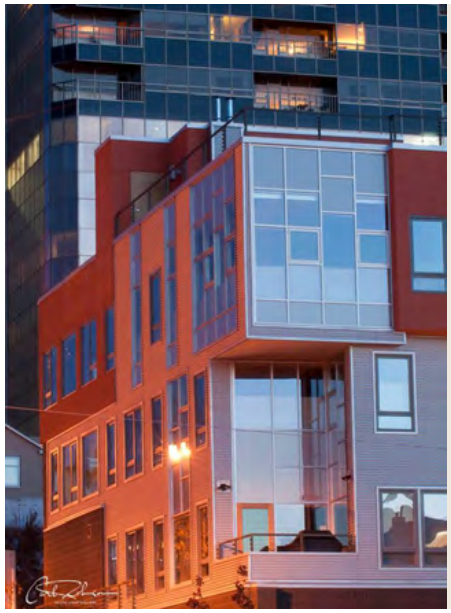
LAND USE AND TRANSPORTATION

City planning strategies provide a unique opportunity to shape the future of our cities. In the past, cities took shape with the convenience of cheap and abundant fuels, and seemingly endless space to expand. Today, cities around the world are taking steps to make their cities more efficient. Smart Growth plans focus on developing the city core with a mix of residential and commercial development and a variety of transportation options.

In 2017, for the first time in 40 years, the largest source of greenhouse gas emissions in the United States was not electricity production but transportation – cars, trucks, planes, trains, and shipping. Transportation emissions currently account for 47% of all the greenhouse gas emissions produced in Anchorage, and highway motor fuel accounts for 53% of end-use energy consumption.[41, 32]

The solution for lowering vehicle emissions is clear -- use less gasoline and diesel fuel. Anchorage can accomplish this by shortening the distances people need to travel, reducing the number of vehicle trips, increasing the use of non-motorized transportation and public transit, and switching to electric vehicles.

Improving the transportation sector requires making it easier to walk, bike, and use transit, transforming urban areas to reduce sprawl, and electrifying vehicle fleets.[42] Employing mixed-use strategies integrates functional residential, commercial, and recreational uses; creates greater connectivity for pedestrians and cyclists; and encourages non-motorized transportation options. Technology-focused measures, such as improving energy efficiency of vehicles and switching fuel sources



Mixed-use development brings together a variety of uses, such as residential, commercial, cultural, institutional, or entertainment, within the same building or in close proximity accessible by walking.

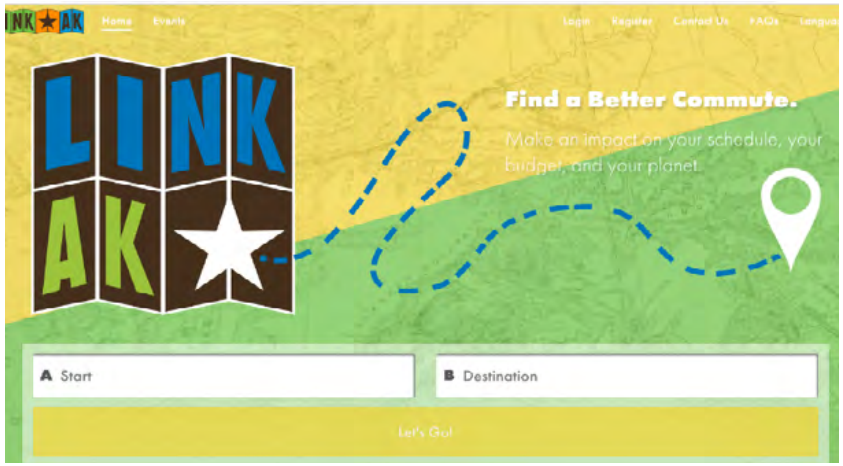
Photo credit: Carl Battreal

Solid Waste Services (SWS) has a small fleet of electric vehicles including this Chevy Bolt.
Photo credit: SWS

Sector 02 title page photo: Municipality of Anchorage

are prominent. It is also critical that residents walk, bike, carpool, and use public transportation more frequently.[43]

Many of the strategies in this sector decrease transportation-related emissions and result in additional co-benefits for Anchorage residents. For example, land use planning that encourages mixed-use development and affordable housing options close to Anchorage's commercial centers makes it easier for people to access work, shopping, restaurants, and cultural activities in their neighborhood. Building additional bicycle and pedestrian infrastructure and investing in a robust bus system creates more transportation options for Anchorage residents. Investing in public commuter transportation makes commuting alternatives like van rideshares, carpooling, and bus rapid transit more realistic for Anchorage workers who live in the Mat-Su Borough. Replacing vehicles in the municipal fleet with electric vehicles and investing in charging stations will provide opportunities for Anchorage residents to utilize electric vehicles. Taking gasoline and diesel cars off of the road will improve air quality throughout Anchorage.



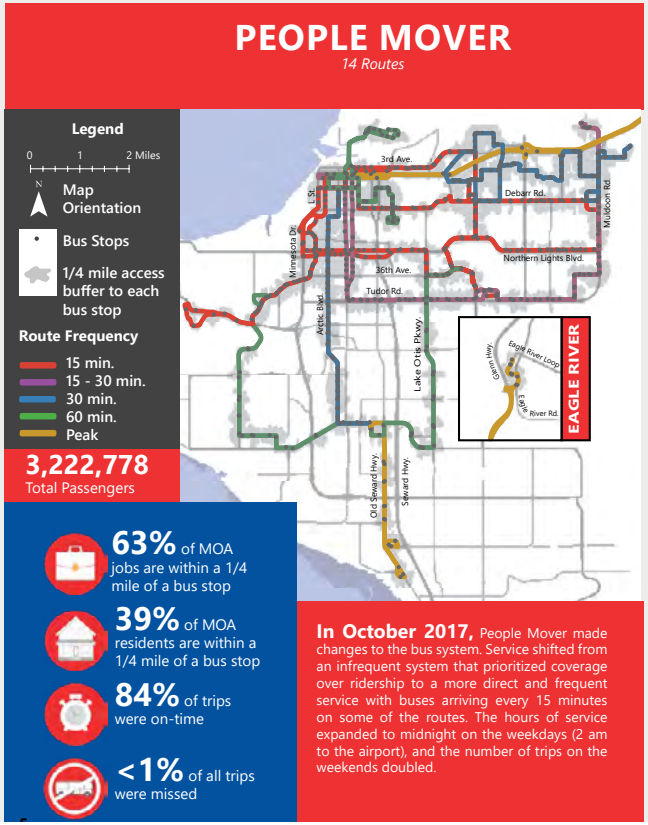
Tools such as LinkAK are available to Anchorage residents to compare travel modes by greenhouse gas emissions, calories, and cost.[44]

Achieving equity through land use and transportation planning is a central goal of the recommendations in this sector. Minority populations are overrepresented on People Mover and other Anchorage public transit options. Conversely, amenities for bike commuting, such as showers or secure bike storage at work, are more available to comparatively affluent residents. High average home prices in Anchorage, particularly in neighborhoods close to downtown and other commercial centers, make it difficult for all Anchorage residents to live close to their workplaces. Land use and transportation policies that address these equity issues are essential for making Anchorage a more walkable, bikeable, and livable community for all residents.

In addition to targeting land use and transportation policy at the municipal level, many of the recommendations in this sector extend outside of the municipal boundaries and will require legislative advocacy at the state and federal level.

CASE STUDY: ANCHORAGE PEOPLE MOVER

Before the new bus system, People Mover grappled with declining weekday ridership for many years. In October 2017, service shifted from an infrequent system that prioritized coverage over ridership to a system that offers more direct and frequent service. Since then, there have been significant improvements in ridership. The Municipality is tracking ridership metrics and regularly adjusting the People Mover routes as necessary to meet community needs.[45]



CASE STUDY: AMATS PASSES COMPLETE STREETS

The Anchorage metropolitan planning organization, Anchorage Metropolitan Area Transportation Solutions (AMATS), passed a "Complete Streets" policy in 2018. Complete Streets is a policy to govern project planning and engineering standards, expanding the focus of street and roadway design from just cars to all users. By taking into consideration the needs of pedestrians, bicyclists, motorists, and transit riders, the new program will increase safety, lower congestion, and provide better alternative modes of transportation. [12]

The first Complete Streets project in Anchorage was for Spenard Road, and featured colored bike lanes, wider sidewalks, and improved pedestrian crossings. Photo credit: Charles Boyle (left) and Brian Looney (right)

Sector 02: Land Use and Transportation

2050 Vision

Anchorage will have walkable, well-designed, and connected neighborhoods that employ mixed-use development and diverse transportation options while celebrating our unique cultures and communities.

Objective 5. Advance land use planning that creates a more livable and resilient community.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
5A	Align Title 21 (Anchorage's land use regulations, development, and design standards) with the 2040 Land Use Plan and Metropolitan Transportation Plan 2040 goals.		Planning Department	Anchorage Assembly, Planning and Zoning Commission, developers	Ongoing
5B	Determine a target for infill development (the use of land within a built-up area for further construction) and redevelopment in commercial and residential centers.		Planning Department	Anchorage Assembly, Planning and Zoning Commission, MOA Real Estate Department, developers	Ongoing
5C	Amend zoning code to allow mini city centers in neighborhoods in order to create more walkable/bikeable communities.		Planning Department	Office of Energy and Sustainability (OES), Project Management and Engineering (PM&E), Office of Economic and Community Development (OECD), Traffic Department	Ongoing
5D	Prioritize and conserve green spaces in transportation, development, and planning projects equitably across Anchorage. Increase incentives for developers to design infill projects that prioritize existing green space (see Urban Forest and Watersheds Action 22C).		Project Management and Engineering (PM&E), Planning Department	Anchorage Metropolitan Area Transportation Solutions (AMATS), Traffic Department, Parks & Recreation (P&R)	Mid-term
5E	Adopt a Complete Streets policy for all MOA transportation improvement projects to parallel the AMATS Complete Streets Policy.		OECD	Anchorage Assembly, PM&E, Planning Department, nonprofits	Mid-term
5F	Fund the Maintenance & Operations Department to address unpredictable winter weather conditions, including rain on snow events. This includes both winter road maintenance and summer repairs.		Maintenance & Operations (M&O)	Traffic, Public Transportation Department (PTD), P&R, Alaska Department of Transportation and Public Facilities (AK DOT&PF)	Mid-term
5G	Invest in safe and covered bus stops with benches. Prioritize winter maintenance so that residents can easily access bus stops.		PTD	Planning Department, APD, M&O (Street Maintenance)	Mid-term

Sector 02: Land Use and Transportation

Objective 6. Increase use of public transit and non-motorized transportation.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
6A	Develop a Short-Range Transit Plan informed by a public transportation feedback survey to expand frequency, connectivity, and coverage of the public transportation system.		PTD	Valley Transit, AMATS	Near-term
6B	Expand participation in the Employer Sponsored Pass program for workplaces to purchase bus passes for employees, students, etc.		PTD	Large employers	Uncertain
6C	Promote the reduced fare program on People Mover and create youth (under 18) ride free.		PTD	Anchorage School District (ASD), University of Alaska Anchorage (UAA), Youth Advisory Commission, local businesses, nonprofits	Near-term
6D	Explore opportunities for increasing public transit commuter options throughout the Municipality, from Eklutna to Girdwood, also considering options for the Mat-Su Valley, including commuter rail.		PTD	OES, OECD, Valley Transit, Alaska Railroad, Mat-Su Borough, Palmer, Wasilla	Mid-term
6E	Encourage carpooling and transit use by improving coordination and developing strategies with other agencies (e.g. developing site design incentives, using Link AK, creating carpool lanes, developing workplace incentives, addressing logistical challenges such as finding people who have similar travel needs).		PTD	Anchorage Health Department (AHD), Planning Department, M&O, AMATS, PM&E, large employers (including MOA, State of Alaska, Mat-Su Borough)	Uncertain
6F	Continue to expand and connect non-motorized transportation facilities. Fund and implement policies and projects recommended by the Anchorage Non-Motorized Plan, such as secure and covered bike storage options.		AMATS, PM&E, Traffic Department	Bike Anchorage, Anchorage Park Foundation, AK DOT&PF, M&O, PTD, APD, P&R, Federation of Community Councils (FCC)	Ongoing
6G	Make it easier for people to walk, bike, or use mobility aids by improving coordination and developing strategies with other agencies (e.g. lighting, winter maintenance of sidewalks, bike pathways and lanes). Prioritize safe routes to school to improve access and appeal of neighborhood schools.		AMATS, PM&E, Traffic Department	AK DOT&PF, PTD, M&O, P&R	Near-term
6H	Support the mode share targets in the 2040 Metropolitan Transportation Plan and create a mode share (percent of travelers using a particular transportation type) tracking method.		PTD, Traffic Department	AMATS, AHD	Ongoing
6I	Promote the use of transportation modes other than single-occupancy vehicles through outreach about the social, health, and environmental benefits (e.g. creating a Bus to Work Day, expanding Bike to Work Day).		AHD	Bike Anchorage, PTD, OES	Near-Term

Sector 02: Land Use and Transportation

Objective 7. Promote the use of energy-efficient vehicles.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
7A	Conduct a municipal fleet inventory and develop a procurement policy to incorporate EVs through right-timing purchases with a planned vehicle-replacement schedule.		OES	Purchasing and Finance Departments, Large MOA fleets: Anchorage Fire Department (AFD), APD, Solid Waste Services, Anchorage Water Wastewater Utility (AWWU), M&O, Municipal Light & Power (ML&P)	Mid-term
7B	Monitor economic viability of transitioning public transit fleet (e.g. People Mover and Anchor Rides) to electric or other alternative fuel vehicles.	❤	PTD, OES	MOA Finance Department, OECD	Ongoing
7C	Cycle out ASD engines or buses that are over 20 years old. Require similar standards from leased buses.	❤	OES	ASD	Near-term
7D	Work with utilities, city and borough planners, and other stakeholders to develop an Electric Vehicle Infrastructure plan for the highway corridor from Fairbanks to Homer to Glennallen, with a focus on the Valley to Anchorage commuters. Apply for Volkswagen settlement funding through Alaska Energy Authority to begin phase I implementation of the plan.	❤ $	OES	Planning Department, AMATS, AK DOT&PF, Fairbanks Metropolitan Area Transportation System, AK Department of Environmental Conservation, regional and local planning depts. along the corridor, Renewable Energy Alaska Project, Railbelt electric utilities, Anchorage Community Development Authority (ACDA)	Near-term
7E	Support the development of low-carbon transportation fueling infrastructure for fleets and the general public.	❤	OES	M&O, OECD, Anchorage electric utilities, ACDA	Uncertain
7F	Support electric car charging station infrastructure in new commercial and multifamily housing during the initial construction phase by laying conduit for charging stations and right-sizing electrical panels.		Planning and Permitting Departments	Anchorage electric utilities, ACDA	Mid-term
7G	Support enforcement of existing Idle Free Zones and explore opportunities for expanding the number of zones.	❤	APD	AHD, ASD	Near-term

Sector 02: Land Use and Transportation

Objective 8. Establish proactive planning approaches that incorporate climate change.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
8A	Increase GIS capacity in order to analyze environmental data in relation to long range and current planning issues that may be impacted by climate change.		Geographic Data and Information Center (GDIC), Planning Department	UAA Center for Conservation Science, AK DF&G, AK DNR Division of Forestry	Uncertain
8B	Incorporate climate projections (e.g. precipitation, temperature, flooding) in transportation, hazard mitigation, and development planning.		Geographic Data and Information Center (GDIC), Planning Department	PM&E, OEM, UAA, UAF	Mid-Term
8C	Map wildland-urban interface area and adopt appropriate guidelines to ensure safety of residents and property.		Development Services	AFD, UAA	Mid-term

Sector 03

CONSUMPTION AND SOLID WASTE

CONSUMPTION AND SOLID WASTE

Solid waste poses many environmental challenges in Anchorage. The Anchorage Regional Landfill, the only municipal solid waste landfill in Anchorage, is a finite resource with approximately 35 years of capacity left.[46] Additionally, solid waste collection and disposal generates greenhouse gas emissions as a result of the operation of heavy equipment and vehicles.

In Anchorage, approximately 1,200 tons of waste are disposed of each day. On average, residents throw away 5-6 pounds of waste every day, while the national average is 4.4 pounds of waste per person.[47,48]

Efforts to use alternative fuels like biodiesel and the electrification of the solid waste collection and disposal fleet will help to offset greenhouse gas emissions. Construction of a new Central Transfer Station will reduce miles driven by the refuse collection fleet, which will reduce overall greenhouse gas emissions.

Less than 20% of all materials in Anchorage get recycled. Increasing recycling outreach and education would increase interest in waste reduction and recycling. Other options to increase recycling include opportunities for multifamily housing and incentives for businesses. The new Central Transfer Station also helps to make waste diversion opportunities (recycling and organics collection) more accessible to Anchorage residents. And as U.S. communities adapt to changing recycling markets as a result of China's scrap import bans, Anchorage must continue to look for markets for recycled materials both within the Municipality and outside.

Organics collection is building momentum in the city, with private businesses in Southcentral Alaska showing renewed interest in accepting organic materials for composting. Solid Waste Services has piloted a household composting project to test community interest in composting. There is widespread community interest in organic material collection.

ANCHORAGE SCHOOL DISTRICT/ALASKA WASTE/SOLID WASTE SERVICES SCHOOL RECYCLING COORDINATOR

Through a grant from the Municipality of Anchorage Solid Waste Services Department and Alaska Waste, ASD has established mixed paper recycling at its 95 schools and 5 administrative buildings. The primary goal of the Recycling program at ASD is to increase education and recycling rates while maintaining an environmentally responsible school district.[49] The school district is also conducting a pilot food scrap collection and composting program that has the potential to be expanded to the district level.

Photo credit: Andres Benitez-Ospina, ASD Recycling Coordinator

Sector 03 title page photo: Laurel Andrews

Anchorage Community Compost drop off location at the Anchorage Regional Landfill.
Photo Credit: Solid Waste Services

Solid waste can be considered an energy resource. The landfill gas-to-energy plant at the Anchorage Regional Landfill provides power to Joint Base Elmendorf-Richardson and reduces the Municipality's overall greenhouse gas emissions. Additionally, SWS will construct landfill leachate evaporators to run off the excess gas. This will reduce the leachate that must be hauled off for disposal and utilize gas that is currently flared. Development of anaerobic digestion or mass burn waste-to-energy facilities are other options that could reduce landfill dependence and provide additional benefits like compost, biogas, and electricity.

Anchorage recently passed a plastic bag ban that prohibits distribution of disposable plastic shopping bags. Similar laws and policies could help lower waste generation in the city. Options include modifying food codes to allow for reusable containers for takeaway, extended producer responsibility laws, and policies that support zero waste principles and practices.

CASE STUDY: ANCHORAGE LANDFILL GAS-TO-ENERGY PROJECT

Through a partnership between the Municipality of Anchorage Solid Waste Services and Doyon Utilities, landfill gas, a byproduct of waste decomposition, produces 7 Megawatts of energy to Joint Base Elmendorf-Richardson (JBER). This energy meets the off-peak demand of the Fort Richardson side of the base.[50]

Photo Credit: Solid Waste Services

Sector 03: Consumption and Solid Waste

2050 Vision

Anchorage has an efficient and innovative solid waste management system that promotes sustainable consumption, recycling and waste reduction.

Objective 9. Restructure waste diversion methods.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
9A	Generate and enact policy (internal and external to MOA) to increase diversion, including policies that look 'upstream' like Extended Producer Responsibility (EPR).		Solid Waste Services (SWS)	Office of the Mayor, Anchorage School District (ASD), private waste haulers, private sector	Mid-term
9B	Create ordinance so waste haulers can incorporate progressive Pay-As-You-Throw (PAYT) residential trash rates.	$	Office of the Mayor	SWS, Anchorage Assembly, Regulatory Commission of Alaska, private waste haulers	Mid-term
9C	Explore mandatory residential curbside recycling.		SWS	Anchorage Assembly, private waste haulers	Long-term
9D	Assess/ expand/ improve infrastructure for recycling and organics collection and processing.	$	SWS	Anchorage Recycling Center, Alaskans for Litter Prevention and Recycling (ALPAR), private waste haulers, recycling and commercial reuse companies, local grocery stores	Mid-term
9E	Increase recycling surcharge on landfill fees to develop more recycling programs and expand education and outreach efforts.	$	SWS	Anchorage Assembly, private waste haulers	Near-term
9F	Offer more recycling options for multi-family residences.		SWS	MOA Code Enforcement, housing providers	Mid-term

Sector 03: Consumption and Solid Waste

Objective 10. Capture potential energy in collected refuse.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
10A	Develop leachate evaporator with excess landfill methane to reduce leachate hauling	$	SWS	Doyon Utilities, Anchorage Water and Wastewater Utility (AWWU), Joint Base Elmendorf-Richardson (JBER)	Mid-term
10B	Identify and implement additional means of energy collection from solid waste (e.g. organics digestion, mass burn).	$	SWS	Alaska Waste, Alaska Energy Authority, AWWU, Central Environmental Inc., Anchorage electric utilities, local compost makers, entrepreneurs	Mid-term

Objective 11. Educate and engage residents and businesses to encourage waste reduction and diversion.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
11A	Expand consumer education (e.g. host community forums and provide direct outreach) on sustainable consumption and materials management, including recycling.		SWS	ASD, AK Department of Environmental Conservation (AK DEC), ALPAR, Green Star, nonprofits, private waste haulers	Near-term
11B	Provide outreach and education to Anchorage businesses in reducing greenhouse gas emissions through their supply chains.		Office of Economic and Community Development (OECD)	SWS, ALPAR, Green Star, nonprofits, shipping companies, local and national businesses	Near- to Mid-term
11C	Conduct a literature review of waste incentive/disincentive programs for the community and businesses that have been successfully implemented in other cities.		SWS	ASD, Anchorage Health Department, UAA	Near-term
11D	Support collaborative consumption community projects, such as neighborhood compost projects, tool libraries, and repair cafes through mini-grant programs (See Food Systems Action 21A).		SWS	The Alaska Center, ALPAR, Green Star, Church of Love, Alaska Master Gardeners, Off the Chain, private waste haulers, zero-waste advocates	Near- to Mid-term
11E	Provide reduce/recycle marketing and signage at storefronts, in parking lots, at point-of-sale, on MOA websites, in local papers, on TV, etc.		OECD	SWS, Traffic Department, local businesses	Near-term

Sector 03: Consumption and Solid Waste

Objective 12. Create and implement waste reduction targets across Municipal operations and for the broader Anchorage community.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
12A	Create sustainability liaisons in all municipal departments who will coordinate recycling and other sustainability measures.		OECD	SWS	Uncertain
12B	Generate and enact waste reduction and diversion policies within the MOA aligned with zero-waste practices.		SWS	SWS, Maintenance and Operations (M&O), Anchorage Assembly	Near-term
12C	Establish community-wide waste reduction targets based on waste trends analysis.		SWS	Port of Alaska, OECD, AK Department of Transportation & Public Facilities (AK DOT&PF), UAA	Mid-term

Objective 13. Optimize refuse collection and disposal systems.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
13A	Optimize the efficiency of solid waste collections and transfer routes.		SWS	Commercial haulers	Near-term
13B	Deploy alternative fueled vehicles – biodiesel/electric vehicles used in solid waste collection and disposal.		SWS	Alaska Waste, local fuel vendors, private waste haulers	Near-term
13C	Expand diversion opportunities for Anchorage by building a new Transfer Station.		SWS	Commercial haulers	Mid-term
13D	Implement improved leachate management at Anchorage Regional Landfill by deploying stormwater diversion measures.		SWS, AWWU	JBER, UAA, AK DEC	Near-term

Sector 04

HEALTH AND EMERGENCY PREPAREDNESS

HEALTH AND EMERGENCY PREPAREDNESS

Climate change is already affecting the health, safety, and the general well-being of Anchorage residents. In this section on Health and Emergency Preparedness, connections are made between climate and health in Anchorage, as well as emerging issues for emergency preparedness. The actions in this sector include strategies to 1) reduce health and safety impacts of climate change, 2) increase household and community resilience, 3) engage diverse communities in climate change resilience planning, and 4) develop research and monitoring programs to support our understanding of and planning for the health and safety impacts of climate change in Anchorage.

HEALTH IMPACTS OF CLIMATE CHANGE IN ANCHORAGE

Climate change impacts the health of Anchorage residents in many ways. As the spring and summer get warmer and wetter, there will likely be an increase in mold, and the allergy season will begin earlier and last longer.[51] This will disproportionately impact Anchorage residents with asthma, allergies, or other chronic conditions. One of the most evident impacts of climate change in Anchorage is our warming winter weather. More winter days will hover around freezing, leading to more icy roads and sidewalks and less opportunity for outside recreation. Outlets for outdoor activities during the long, dark winter months are important for both the physical and mental health of Anchorage residents.

The impacts of climate change on Anchorage's food supply are complex and are addressed more fully in the Food Systems section. In terms of personal nutrition, wild foods such as berries, salmon, and moose are an important part of the diet for many Anchorage residents. Temperature and precipitation changes across Alaska will likely impact the location and quality of habitat for many large game animals. Similarly, large scale changes to ocean ecosystems mean that salmon runs are more unpredictable and other fisheries become more variable.

Ecological changes associated with climate change have also increased wildfire risk in the Anchorage area. Wildfire events in Anchorage threaten homes and property and increase respiratory distress due to smoke. Four of the ten largest fire seasons on record in Alaska have occurred in the past decade. [52]

Warmer summers and milder winters also make Anchorage more hospitable for vectors such as non-native mosquitoes and ticks. These vectors can carry pathogens that cause vector-borne diseases. Eight species of non-native ticks have been found in Alaska[53], and climate change may make it more likely that they will establish and find a new home in the state (Box 4).

CLIMATE CHANGE AND EMERGENCY PREPAREDNESS

It is important to respond to ongoing health and safety concerns. Anchorage and its residents also need to prepare for emerging threats that are either new or previously unrecognized. Examples include winter floods, spring wind storms, summer heat waves, and fall fire events. Businesses also need to have emergency preparedness plans to ensure the safety of customers, visitors, and employees in the event of a natural disaster.

Sector 04 title page photo: Joe Crusey Photographs; Anchorage Museum, B2013.070.21

The Municipality needs to plan ahead and provide support to households and neighborhoods so that they can become more climate-resilient. For example, providing information to residents that explains how climate change affects health and safety can help households prepare for changing weather patterns and can support neighborhood emergency preparedness planning.

Resilient communities are prepared for a variety of disasters. They are able to adapt to and recover from natural hazards, shocks, and stresses while maintaining daily functions and progressing towards long term goals. This is particularly important to consider given Anchorage's deep dependence on the frequent shipments of critical supplies – including medicine and food – from the contiguous U.S. Improving resiliency to the effects of climate change includes securing back up supplies – from the household to community level. Resilience planning includes support for increasing neighborhood engagement in educating and planning for climate-related hazards.

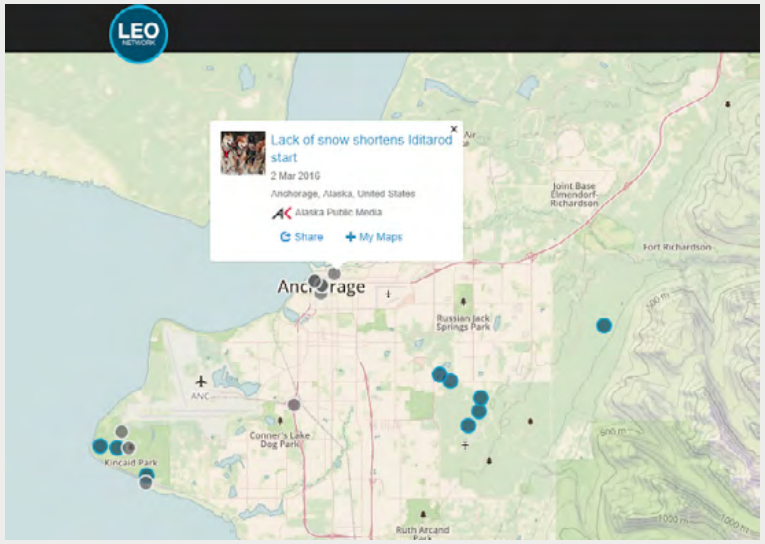
BOX 4. WINTER TICK

The winter tick, or moose tick, is a parasite that has been found in many parts of North America, including the Yukon Territory in Canada. These ticks are a significant threat to wildlife, particularly moose. Moose cannot remove these ticks during grooming and have been found with heavy infestations of thousands of ticks. These heavy infestations can cause anemia, hair loss, distraction from feeding, and ultimately death. As the climate warms, winter ticks are more likely to survive when introduced into Alaska. If this tick species establishes itself in Alaska, it will significantly impact the moose population. The Alaska Office of the State Veterinarian and the Alaska Department of Fish and Game are collaborating with the University of Alaska to monitor and track introductions of new tick species into Alaska. Find out more at https://dec.alaska.gov/eh/vet/ticks

Photo credit: BC Government

CASE STUDY: LOCAL ENVIRONMENTAL OBSERVER (LEO) NETWORK

Arctic communities were among the first to experience impacts from climate change. In 2009, the Alaska Native Tribal Health Consortium (ANTHC) established the Center for Climate and Health to work with local residents and experts to describe connections between environmental impacts, climate change, and health. ANTHC launched the LEO Network in 2012 for local observers and subject matter experts to share knowledge about unusual environmental, weather, and animal events. With LEO, community members can connect to share observations, raise awareness, and find answers about environmental events. ANTHC hosts a monthly webinar and teleconference for participants in Alaska to review and discuss recent environmental observations.



The LEO Network was created to be the eyes, ears, and voice of our changing environment. Here is an example observation:

A resident in Shishmaref in late December 2016 reported on the LEO Network that "The Bering Straits sea ice along the shores of Shishmaref was finally freezing up, but, due to strong southerly winds, the thin ocean sea ice blew away." A scientist from UAF responded with expert information: "At Shishmaref, during the past 20 years, first ice has appeared on average during the third week of November, based on satellite images, a late appearance of first ice would have occurred by the first week of December. Based on those long-term observations, this year's delay into the last week of December is unusual. This late freeze-up is part of a very warm year in Alaska, with ocean temperatures much higher than normal and many of the weather stations on land reporting a record warm year for 2016."

SUBMIT YOUR OBSERVATIONS!

You can help record and document local climate change impacts by sharing your personal observations about unusual environmental events. Go to www.leonetwork.org to submit observations. The observations are added to the Anchorage Climate Event Almanac (www.leonetwork.org/anc-almanac), which was developed for the Anchorage Climate Action Plan by the LEO Network. This website displays events that have been observed in the Anchorage area and can be sorted by category and season. The platform is free and members can track their contributions on their own profile map. Many observations receive a consult from a topic expert. Thank you for helping document our changing city!

Sector 04: Health and Emergency Preparedness

2050 Vision

Anchorage is a flourishing and resilient community that embraces a culture of preparedness and adaptability at household, neighborhood, and municipal levels to equitably improve health and safety.

Objective 14. Reduce risks to health and safety created by ongoing climate impacts.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
14A	Increase household education about water quality and food storage risks resulting from power outages associated with increased extreme weather events (e.g. wind storms, ice storms, avalanches, etc.).		Office of Emergency Management (OEM)	Anchorage Water and Wastewater utilities, Anchorage electric utilities, Anchorage Health Department (AHD)	Near-term
14B	Support education to the public, medical, and veterinary communities about the potential importation of non-native insect vectors (e.g. ticks, mosquitoes, fleas) through human and pet travel to areas outside of Alaska where these insect vectors are prevalent.		AHD	University of Alaska Anchorage (UAA), Alaska Department of Health and Social Services (AK DHSS) Office of the State Veterinarian, Alaska Dept of Fish and Game (ADF&G)	Near-term
14C	Review the current recreational burn guidelines and criteria for "approved burn days" to assess whether additional climate tools or information would be helpful for refining these criteria.		Anchorage Fire Department (AFD)	Alaska Department of Natural Resources (AK DNR) Division of Forestry, National Weather Service (NWS)	Near-term
14D	Expand visibility of the Anchorage Air Quality Index including particulate matter and pollen counts so that the public is aware of bad air quality days. Include strategies for coping with poor air quality days.		AHD	Alaska Department of Environmental Conservation (AK DEC) Division of Air Quality and Public Information Officer, AK DHSS Section of Epidemiology and Public Information Officer, NWS, news outlets	Near-term
14E	Educate the public about the health risks of higher temperatures, develop strategies to check on individuals at greatest risk, and make options for cooling widely accessible.		AHD	Catholic Social Services (CSS), Federation of Community Councils (FCC), United Way, March of Dimes, Older Persons Action Group, community centers, local hospitals	Mid-term
14F	Provide culturally-appropriate resources for health professionals about the potential mental health impacts of climate change including seasonal affective disorder (SAD) and grief counseling for those who have lost their communities or relocated. Develop projections and plans for addressing future mental health needs in the Municipality.		AHD	Anchorage Community Mental Health Services, Inc., UAA, Alaska Pacific University (APU), Alaska Native Tribal Health Consortium (ANTHC), local hospitals, faith-based organizations	Mid-term

Sector 04: Health and Emergency Preparedness

Objective 15. Identify, coordinate, and engage diverse groups of people to ensure that health and safety resources to respond to climate change impacts are inclusive and accessible to all Anchorage residents.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
15A	Increase outreach to diverse populations about climate change and health, natural hazards, and emergency preparedness via broadcast, print, bus ads, social media, and other forms of communication in multiple languages and accessible to individuals with disabilities to ensure that emergency preparedness planning reaches all Anchorage residents.		Muni-wide	FCC, American Red Cross of Alaska, Alaska Disabilities Advisory Group, Anchorage cultural organizations	Near-term and Ongoing
15B	Support and expand a social vulnerability assessment to more effectively respond to diverse neighborhoods and households that are most at risk during emergency situations. Enhance interagency data sharing to increase response capacity across the city.		OEM	AHD, Planning Department, MOA Geographic Data and Information Center (GDIC), UAA, Alaska Department of Commerce, Community, and Economic Development (AK DCCED) Division of Community and Regional Affairs, CSS	Near-term and Ongoing
15C	Work with Get Outdoors Anchorage to develop tools and communication strategies to develop a culture of flexible and diverse outdoor recreation accessible to all Anchorage residents. Enable opportunities to increase the visibility of the program.		Parks and Recreation (P&R)	Get Outdoors Anchorage Coalition, AK DHSS (Chronic Disease Prevention & Health Promotion, esp. Play Every Day), ASD, Anchorage Park Foundation, local outdoor groups (e.g. Nordic Skiing Association of Anchorage, APU, UAA), JBER, NWS, CSS Refugee Assistance and Immigration Services, Alaska Literacy Program	Mid-term

Sector 04: Health and Emergency Preparedness

Objective 16. Build household resilience, self-sufficiency, and capacity to prepare for and respond to the health and safety impacts of climate change.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
16A	Develop an Anchorage-based program to support families who cannot afford to purchase supplies for household emergency preparedness kits to adequately prepare their homes (e.g. solicit emergency supply donations). Identify possible strategies for the structure of the program through a review of donation programs in other communities and engagement with community partners and businesses.		OEM	Anchorage Local Emergency Planning Committee, AFD, American Red Cross of Alaska, Salvation Army Alaska Division	Mid-term
16B	Develop capacity for household wildfire mitigation by supporting a full-time Forester position in the Fire Department and reinstating the Firewise Program. This position and program will support community outreach and education to help homeowners understand the recommendations in the Firewise Manual and provide household inspections (see Urban Forest & Watersheds Action 22A).		AFD	AK DNR Division of Parks and Outdoor Recreation and Division of Forestry, FCC	Uncertain
16C	Create opportunities for safe food preservation and storage education for Anchorage households. Support the development of community kitchen facilities for household food preservation use and shared cold storage such as a community meat lockers (supports Food Systems Action 20G).		AFD	UAF Cooperative Extension, Food Bank of Alaska, AK DEC, UAA, ANTHC, CSS	Mid-term

Sector 04: Health and Emergency Preparedness

Objective 17. Build community resilience, self-sufficiency, and capacity to prepare for and respond to the health and safety impacts of climate change.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
17A	Give Community Councils tools (e.g. webinar trainings on emergency preparedness, facilitation guides, and other materials in multiple languages) to have dialogues about emergency preparedness within neighborhoods and to create local resilience strategies such as an Adopt-A-Neighbor campaign or hosting an OEM CERT-like training session in their community.		OEM	FCC, Alaska Department of Military and Veterans Affairs Division of Homeland Security and Emergency Management (AK DHSEM), UAA, APU Outdoor Studies Wilderness First Responder Program	Near-term
17B	Improve the local Emergency Alert System (EAS) capability by incorporating the Integrated Public Warning And Alert System (IPAWS).		OEM	American Red Cross of Alaska, Federal Emergency Management Agency (FEMA)	Mid-term
17C	Improve local Mass Care response capabilities for sheltering by increasing stocks of prepositioned sheltering supplies and equipment. The increased stocks should include both durable equipment and consumable supplies, including mobility aids, equipment for people with functional needs access, and pet sheltering supplies.		OEM	American Red Cross of Alaska, FCC	Mid-term
17D	Develop an emergency food plan that includes a food needs assessment, plan for stockpiling the necessary food supplies, and a distribution and public communication plan that takes into account those most at risk for food insecurity. Work with local retailers, producers, and warehouses to obtain and store the necessary food stocks.		OEM	AHD, AK DHSEM, AK DNR, AK Division of Agriculture, UAF Cooperative Extension, Alaska Food Policy Council, UAA, APU	Mid-term
17E	Engage the business and health care community in developing emergency response plans and business continuity plans.		Office of Economic and Community Development (OECD)	Anchorage Chamber of Commerce, UAA, Rotary clubs, ANTHC, Providence Alaska Medical Center, Alaska Regional Hospital	Mid-term
17F	Identify key secondary access routes for emergency response and evacuation in the Hillside, Girdwood, and Eagle River areas. Identify funding opportunities for determined routes.		Municipal Manager.	Planning Department, Traffic, AFD, Development Services	Long-term

Sector 04: Health and Emergency Preparedness

Objective 18. Conduct monitoring and research to support our understanding of and planning for the health and safety impacts of climate change.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
18A	Develop a framework for selecting, monitoring, and integrating indicators of health and safety impacts of climate change within clinical contexts, including hospital and clinic admissions related to respiratory, cardiovascular, injuries, and other health outcomes that could be linked to climate change in Anchorage. Include demographic information.		AHD	AFD, AK DHSS, ANTHC, Alaska Native Medical Center, regional hospitals, UAA	Near-term
18B	Support surveillance efforts for the early detection of non-native vectors (e.g. ticks, mosquitoes, fleas) that may impact human or wildlife health (see Urban Forest and Watersheds Actions 24A and 24B).		AHD	AK DHSS , Office of the State Veterinarian, ADF&G, UAA, ANTHC Local Environmental Observer (LEO) Network	Near-term
18C	Work with AK DEC to ensure that data collection protocols for particulate matter monitoring are sufficient to estimate the health impact of smoke exposure during wildfire events.		AHD	AFD, UAA, AK DEC	Near-term
18D	Continue assessments of future water requirements to meet the demands of the population in the Municipality of Anchorage that incorporate regional population growth trends, climate data, and historical seasonal water usage patterns (see Urban Forest and Watersheds Action 23E).		Anchorage Water & Wastewater Utility	MOA Watershed Management, AHD, UAA	Near-term
18E	Conduct a literature review of other communities that have adopted Climate Action Plans with effective emergency preparedness measures to help identify best practices suitable for inclusion in future Anchorage emergency planning documents.		OEM	UAA, APU	Near-term

Cheney Lake
Photo credit: Johanna Grasso

Sector 05

FOOD SYSTEMS

FOOD SYSTEMS

Anchorage's food system has unique challenges and opportunities. These include geography, infrastructure, the scale of agriculture and processing, population density, and a reliance on imported food and products. A food system includes the entire food chain from production, distribution, storage, processing, and access, to end product waste. In addition to the impacts of climate change, food prices are already higher in Alaska and Anchorage compared to many other places in the Lower 48. High food costs reduce food security - a basic human right. [54]

Historically, Alaska Native people and early homesteaders survived on a diet consisting of a variety of local foods, and incorporating Alaska Native values and traditional food practices is still a large part of the food culture in Alaska. In the early 1900's, the Matanuska-Susitna Valley had 33 dairy farms. Though many Alaskans continue subsistence and recreational harvests of game, much remains to be done to achieve greater self-reliance on the local food system. Today, Alaskans, particularly those living in urban Alaska, consume a lot of imported foods - "95% of the $2 billion of food Alaskans purchase is imported".[55]

Locally-sourced food security in Anchorage and across Alaska is vulnerable to shifts in climate through changes that affect important game animals and wild foods. Collecting wild foods when living in Anchorage can be cost prohibitive due to expenditures for fuel, nets, or firearms. Unpredictable salmon returns or berry production add to the cost of harvesting these foods, further increasing inequities across Anchorage. Extreme weather events can delay shipments of food from outside of Alaska. Climate change is also creating local food production opportunities. An earlier spring warm-up has lengthened the growing season and allowed farmers to explore fruit and vegetable species that require a longer time to grow.

Incorporating the values of resilience and self-reliance into the entire food system and decreasing reliance on imported food will increase food security and promote equity in Anchorage. Indigenous ways of knowing and practices of inclusivity and community involvement should be integrated into management, research, and policy decisions throughout the food system. By integrating diverse stakeholders in food systems discussion, the Municipality of Anchorage will be able to create solutions that decrease the Municipality's food-related greenhouse gas emissions while improving food security, disaster preparedness, and equitable access to healthy food options for all Anchorage residents.

ANCHORAGE PARKS AND RECREATION CURRENTLY OPERATES FOUR COMMUNITY GARDENS

The Master Plan for Chanshtnu Muldoon Park includes space for 54 new garden plots, funded through an Anchorage Park Foundation Challenge Grant. Additional garden plots were added at the Fairview Lions Park community garden in 2018- 12 new 10'x20' plots.[56]

Photo credit: Michelle Fehribach

Potential solutions to decrease food-related greenhouse gas emissions and adapt to climate change impacts on the food system in Anchorage are diverse. Options include preserving agricultural land for production, raising awareness of the Alaska Grown program, developing facilities to process local food products, educating on traditional foods, and decreasing food waste.

CASE STUDY: GOVERNMENT HILL COMMONS

Land cleared for the Knik Arm Bridge in the neighborhood of Government Hill has been redeveloped as a "Commons" garden by a nonprofit and neighborhood volunteers. The Commons includes flowering apple, pear, and cherry trees, raised beds of highbush blueberries, raspberries, and other fruits, and space to host picnics and films.[57]

Photo credit: Stephanie Kesler

CASE STUDY: LOCAL FOOD MINI-GRANT PROGRAM SUPPORTS COMMUNITY PROJECTS THAT INCREASE ACCESS TO LOCAL FOOD

In 2018, the Mayor's Office launched the Local Food Mini-Grant Program in partnership with the Alaska Food Policy Council. The program was funded by national nonprofit Cities of Service and the Alaska Department of Health and Social Services. It had a simple goal: to empower Anchorage residents to improve food security and build community resilience in their neighborhoods. The only criterion was that projects had to increase access to locally grown food and demonstrate community involvement. A total of 17 community projects, ranging from school vegetable gardens to edible landscaping, were awarded mini-grants of $500-$1000.

Photo credit: Mayor's office

Sector 05: Food Systems

2050 Vision

Anchorage will have an ecologically, socially, and economically resilient food system, where culturally-relevant and sustainably produced and sourced foods are available to everyone.

Objective 19. Support the Alaska Grown market and enable regional food system solutions to reduce carbon emissions throughout the food supply chain.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
19A	Conduct a regional food system assessment to understand Southcentral Alaska's food and agriculture assets and supply chain bottlenecks. Identify potential markets for Alaska Grown foods.		Office of Economic and Community Development (OECD)	University of Alaska Anchorage (UAA), Alaska Pacific University (APU), Alaska Department of Natural Resources (AK DNR) Division of Agriculture, Alaska Native Corporations, Alaska Department of Fish & Game (ADF&G), US Department of Agriculture (USDA), Alaska Food Policy Council (AFPC), Alaska land trusts	Mid-term
19B	Conduct an assessment of the Anchorage food supply to identify where our food comes from in order to set targets for Anchorage's food sourcing.		OECD	UAA, APU, Port of Alaska, Ted Stevens Anchorage International Airport (TSAIA), Alaska Department of Military and Veterans Affairs Division of Homeland Security and Emergency Management (AK DHSEM), transportation industry, retailers, Mat-Su Valley producers	Mid-term
19C	Analyze existing Municipality of Anchorage purchasing and procurement policies and explore creating a preference for purchasing locally grown (i.e. Alaska Grown) foods.	$	Purchasing Department	Anchorage School District (ASD), Arctic Harvest Deliveries	Near-term
19D	Promote and expand public education campaigns to encourage purchasing and procuring locally grown and produced (i.e. Alaska Grown, ADF&G Roadkill Salvage Program) food at the individual and institutional level		Office of the Mayor	AK DNR Division of Agriculture, Alaska Farmers Market Association, Alaska Seafood Marketing Institute, Alaska Marine Conservation Council, Rising Tide Communications, local media	Near-term
19E	Develop more comprehensive outreach and support for individuals and entrepreneurs interested in developing new Alaska grown and created food products.	$	OECD	Anchorage Economic Development Corporation (AEDC), the Food Corridor, Charlie's Produce, ASD, Anchorage Community Land Trust (ACLT)	Mid-term

Sector 05: Food Systems

Objective 20. Support equitable access and consumption of low-carbon and local foods.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
20A	Identify funding mechanisms for an Municipality of Anchorage position to coordinate and facilitate food system solutions including adaptation and mitigation of climate change impacts. Tasks include education and training for residents and businesses, building relationships between food buyers and food businesses, and coordinating other actions in this section on Food Systems.		Office of the Mayor	AK DNR Division of Agriculture, USDA, AEDC, AFPC, UAA, APU, private industry, and other food organizations	Uncertain
20B	Expand Local Food Mini-Grant Program to support community projects that increase access to local food.		Office of the Mayor	AK Department of Health and Social Services, AFPC, UAA, APU, ACLT, FCC, nonprofits	Near-term
20C	Encourage and incentivize farmers markets to accept payment through food assistance programs, including SNAP, WIC, WIC FMNP, and Seniors FMNP.		AHD (Anchorage Health Department)	Alaska Farmers Market Association	Near-term
20D	Continue to develop edible landscaping in the Municipality of Anchorage Horticulture program and tie current and future edible landscape initiatives together to educate residents about these local food resources and to showcase the variety of plants that can grow in Anchorage		Parks and Recreation (P&R)	UAF Cooperative Extension, Food Bank of Alaska, AFPC, Alaska Master Gardeners	Near-term
20E	Support existing school and community gardens and provide opportunities to expand community growing spaces with a focus on youth, immigrant, and low-income residents.		P&R	Anchorage School Garden Network, UAA, APU, Alaska Master Gardeners, UAF Cooperative Extension, Alaska Botanical Garden	Near-term
20F	Support produce prescription programs in partnership with hospitals, clinics, and local food assistance providers.		AHD	Hospitals, clinics, other health care providers, grocery stores, farmers markets, Food Bank of Alaska, health insurance companies	Mid-term
20G	Develop education strategies for teaching Anchorage residents about growing, harvesting, cooking, and processing local agricultural goods and subsistence resources in neighborhoods most at risk of food insecurity (supports Health and Emergency Preparedness Action 16C).		P&R	AHD, UAF Cooperative Extension, Food Bank of Alaska, Alaska Master Gardeners, ACLT	Mid-term
20H	Support efforts to identify and increase utilization of shared food system assets such as shared food storage space, community commercial kitchens, and group purchasing of growing equipment such as backyard greenhouses or hoop houses.		OECD	AK Department of Environmental Conservation (AK DEC), the Food Corridor, AEDC, ASD, ACLT, Charlie's Produce	Mid-term
20I	Develop a framework for assessing what it means to have a "low carbon diet" in the context of an Alaskan diet that includes wild fish and game.		Office of the Mayor	UAA, APU, AHD, Alaska Native Tribal Health Consortium, ADF&G	Mid-term

Sector 05: Food Systems

Objective 21. Reduce and repurpose food waste and food-related waste.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
21A	Expand curbside and community composting and education on the value and methods for composting.		Solid Waste Services (SWS)	Compost end users (i.e. agriculture sector, landscapers)	In progress
21B	Conduct an organics waste collection pilot project with a sample of Anchorage businesses to test the interest, methodology, and amount of commercial food waste that would need to be accommodated by a commercial organics collection program. Explore possible incentives for food retailers, restaurants, and institutions to participate in food waste reuse and recycling programs.		SWS	ASD, JBER, TSAIA, hospitals, universities, food retailers, restaurants	Mid-term
21C	Revise the Anchorage Food Code to allow people to use personal containers for prepared food take-out.		AHD	Alaska Cabaret, Hotel, Restaurant, and Retailers Association (CHARR)	Mid-term

Sector 06

URBAN FOREST AND WATERSHEDS

URBAN FOREST AND WATERSHEDS

Anchorage's forestlands, waterways, wetlands, and soils are some of the most important tools for mitigating the impacts of climate change. These natural assets, along with green infrastructure and low impact development practices, sequester carbon, improve air quality, provide clean water, and regulate temperatures. Based on field data from ten US cities, urban forests currently store 700 million tons of carbon.[58]

Forests and watersheds provide benefits to residents and visitors of Anchorage, as well as important habitat for Alaska's fish and wildlife. Anchorage is comprised of multiple diverse watersheds that span the land-use gradient from urban to natural.

Trees in yards, parks, and shared right of ways make up the urban forest. These trees provide clean air, shade, protection from the elements, habitat, food, and peace of mind. Recent studies have shown a link between human health and the presence of trees.[59] Urban forests and contact with nature also have documented benefits to mental health and well-being.

But the urban forest, and the benefits that come along with a healthy tree canopy, are not evenly distributed throughout Anchorage. There is a large gradient in tree density across the Municipality.[60] The highest density forests are in the Basher, Hillside, and Glen Alps neighborhoods. Many neighborhoods in Anchorage along the highway corridor, such as Mountain View, Fairview, Spenard, and Taku/Campbell have substantially fewer trees, and as a result, do not benefit from the ecosystem services offered by urban forests such as cooling, beautification, increased property values, privacy, wildlife habitat, and sense of place.[61]

Eklutna Lake and its watershed provide drinking water and hydroelectric power for Anchorage. Anchorage watersheds support year-round recreation including running, walking, biking, cross country skiing, wildlife viewing, and fishing. Many of Anchorage's 250 miles of trails run through these watersheds, connecting neighborhoods, parks, and open spaces. Several Anchorage watersheds support urban salmon runs, a unique feature that benefits residents and attracts visitors.

AN ECOLOGICAL APPROACH TO RUNOFF MANAGEMENT

Bioswales and rain gardens can be used along sidewalks, roofs, and other hard surfaces to capture rainwater and filter out contaminants from runoff that can end up in our waterways. The Municipality of Anchorage currently supports a rain garden program, including free literature, advice, and site visits to residents interested in a Low Impact Development (LID) or rain garden project. [62,63]

Photo credit: Alaska Master Gardener Program.

Sector 06 title page photo: Michelle Fehribach

Westchester Lagoon
Photo credit: Johanna Grasso

CLIMATE IMPACTS ON URBAN FORESTS AND WATERSHEDS

Many changes to the urban forests and watersheds have already been observed in Anchorage. These changes often have ripple effects throughout the ecosystem with consequences for many species. For example, as the treeline in Anchorage moves up in elevation, it will begin to replace alpine tundra. As this happens, less light is reflected from snow cover and more heat is absorbed, creating a feedback loop that facilitates rapid snowmelt and exacerbates issues associated with changing runoff. [64, 65]

Higher temperatures also contribute to increased wildfire risk and exacerbate epidemic occurrences of forest pests and pathogens. Additionally, changes in climate make forests and waterways more hospitable to invasive species. Invasive species have the potential to compete with and displace native species, and destroy habitat for wildlife and fish.

Major hydrologic changes have already been observed in Anchorage and are expected to continue causing degradation of salmon habitat, potential reductions in wildlife abundance, and loss of winter snow sport opportunities.[66] Mid-winter freeze-thaw events require more sand, gravel, and salt to keep roads safe for Anchorage residents. This leads to increased sedimentation and turbidity in our water sources, more frequent and severe flood events, and stormwater infrastructure damage.

CASE STUDY: UNIVERSITY OF ALASKA ANCHORAGE IS A TREE CAMPUS USA

UAA is a Tree Campus USA for the ninth consecutive year, recognized for its conservation efforts in promoting and enhancing our urban forests. The five core requirements to become a Tree Campus USA include: (1) having an established tree advisory committee, (2) a campus tree care plan, (3) campus commitment to annual spending on tree programs, (4) recognition of Arbor Day, and (5) promotion of student participation in service-learning projects.

Encouraging forest protection on UAA's campus not only improves air quality and protection from the elements but also benefits the overall quality of life for students and faculty. Green spaces on campus give students more room to de-stress and take a mental break. Additionally, a well-designed tree campus can have energy efficiency benefits by cutting heating and cooling costs.

UAA aims to preserve large areas of mature vegetation and trees during construction projects in order to preserve and rehabilitate animal habitat. UAA's landscaping team successfully restored habitat around Chester Creek behind student housing. They revegetated 1,450 feet of stream bank by planting 1,000 cottonwood, alder, and willow trees to improve areas that had been damaged by erosion. After revegetation, fish and beavers began to occupy the stream. Beavers no longer live in the area, most likely due to an increase in human activity, but the process demonstrated how landscape management is a valuable asset for urban forest sustainability.

University of Alaska Anchorage
Photo Credit: Ken Graham Photography courtesy of Cornerstone General Contractors

Sector 06: Urban Forest and Watersheds

2050 Vision

Anchorage strives for forests and watersheds that provide all residents and visitors with access to a resilient ecosystem that yields recreational opportunities, clean air and water, peace of mind, and habitat for fish and wildlife.

Objective 22. Maintain or improve the resilience of the urban forest and watersheds in Anchorage to promote ecosystem services and buffer against extreme weather events.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
22A	Sustain a full time, year-round urban forester through the Anchorage Fire Department (AFD) to 1) update the Community Wildfire Protection Plan, 2) implement the plan with active forest management, and 3) facilitate communication and collaboration among agencies, including Parks and Recreation.		AFD	Parks and Recreation (P&R), Planning Department, Alaska Department of Natural Resources (AK DNR) Division of Forestry and Community Forestry Program, UAF Cooperative Extension	Mid-term
22B	Develop an urban forest management plan to establish objectives and best management practices for the Municipality's urban forest and to identify appropriate canopy cover and species diversity goals for Anchorage.		P&R, AFD	Planning Department, AK DNR Division of Forestry and Community Forestry Program, UAF Cooperative Extension	Mid-term
22C	Regularly update the Municipal and Anchorage Bowl Tree Canopy Cover Assessments, including a change analysis showing where the changes in tree canopy and impervious surfaces have occurred. Conduct a P**riority Planting Analysis** to identify and prioritize areas for new planting as well as which species should be planted to support a resilient, diverse urban forest.		PM&E (Watershed Management), Parks & Recreation, MOA GIS	Planning Department, PM&E (Watershed Management), Parks & Rec., MOA GIS, DNR DOF Community Forestry, UAF Cooperative Extension	Mid-term
22D	Preserve existing forested areas through practices that re-purpose already developed areas, such as establishing codes that retain minimum canopy cover on new developments and minimize removal of native soil, ground cover, and shrubs (See Land Use and Transportation Action 5D)		Planning Department, P&R	Anchorage Assembly, AFD, Project Management & Engineering (PM&E), AK DNR Division of Forestry and Community Forestry Program, Alaska Department of Fish and Game (ADF&G), Joint Base Elmendorf-Richardson (JBER)	Uncertain
22E	Support efforts to protect and restore extended riparian corridors, such as Potter Marsh, to maintain wildlife and fish habitat, including efforts to reestablish historical surface channels and connectivity.		PM&E (Watershed Management)	P&R, Planning Department, ADF&G, Anchorage Waterways Council, JBER, U.S. Forest Service, U.S. Fish and Wildlife Service (USFWS)	Long-term
22F	Promote and expand weed pulls, tree plantings, spruce beetle identification and management, wildfire mitigation, and other educational activities that promote stewardship among the public, businesses, and homeowners.		P&R	AK DNR, UAA, APU, ASD	Near-term

Sector 06: Urban Forest and Watersheds

Objective 23. Improve stormwater management to reduce flooding and promote better water quality.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
23A	Improve stormwater management to reduce flooding and promote better water quality.		Planning Department, Real Estate Department	PM&E, Heritage Land Bank (HLB), Alaska Department of Environmental Conservation (AK DEC), Great Land Trust	Long-term
23B	Incentivize and prioritize the development of "green infrastructure" such as parks, wetlands, riparian and wildlife corridors, natural drainage-ways, and low-impact development. Research green infrastructure implementation and long-term viability in a sub-Arctic environment.		PM&E (Watershed Management), Maintenance and Operations (M&O)	UAA Small Business Development Center, Planning Department	Mid-term
23C	Enforce municipal stormwater treatment and green infrastructure requirements, as defined by the Anchorage Stormwater Manual.		PM&E (Watershed Management), Development Services	AK DEC	Mid-term
23D	Expand public education about the value of watersheds, rain gardens, and low-impact development to address stormwater run-off.		PM&E (Watershed Management), Development Services	P&R, UAA, ASD, Anchorage Park Foundation, Campbell Creek Science Center, FCC	Near-term
23E	Continue to support Alaska Pacific University (APU) efforts to monitor Eklutna Watershed (e.g. glacial volume change over time, inflow of water to the lake, recharge) and help make data available to the Anchorage Water and Wastewater Utility (AWWU) and ML&P (See Health and Emergency Preparedness Action 18D).		AWWU	APU, United States Geological Survey (USGS), Eklutna, Inc., AK DEC, ADF&G, USFWS	Uncertain
23F	Continue to monitor chemical snow and ice management treatments and update regulations as needed to respond to changing ice, freeze/thaw, and rain events in a way that supports a healthy watershed.		PM&E, M&O (Street Maintenance)	Alaska Department of Transportation & Public Facilities (AK DOT&PF)	Mid-term

Sector 06: Urban Forest and Watersheds

Objective 24. Reduce the establishment and spread of invasive species (plants, insects, aquatics, wildlife) to make our urban forest more resilient to environmental change.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
24A	Develop a watch list of potentially invasive species that could establish residency in Anchorage due to climate change and distinguish this from species that might naturally expand their range into Anchorage (see Health and Emergency Preparedness Action 18B).		P&R	UAA Center for Conservation Science, AK DNR	Near-term
24B	Document and monitor the spread of invasive species (see Health and Emergency Preparedness Action 18B).		P&R	JBER, UAA	Long-term
24C	Establish agency management practices that reduce the spread of invasive terrestrial (e.g. plants, fungus, etc.) and aquatic species (e.g. establish a source of weed free topsoil or seed mix in Anchorage).	$	Planning Department, P&R	AK DOT&PF	Uncertain
24D	Increase management capacity to rapidly and effectively respond to invasive species outbreaks.		P&R	AK DNR Plant Materials Center, AK DOT&PF, UAF Cooperative Extension	Mid-term

Sector 06: Urban Forest and Watersheds

Objective 25. Increase interagency cooperation to improve ecosystem management.

No.	Actions	Co-benefits	Primary Municipal Liaison	Potential Partners	Timeline
25A	Improve stormwater management by creating a stormwater utility and encourage inter-agency cooperation to increase capacity to handle climate-related events.		Office of the Mayor, PM&E (Watershed Management), AWWU	M&O Street Maintenance, AK DEC, AK DOT&PF	Mid-term
25B	Share information across agencies about illegal use and waste disposal within parks and forests to reduce destruction of forests and negative impacts on water quality.		Anchorage Health Department (AHD), P&R, Anchorage Police Department (APD)	P&R, AK DNR Community Forestry Program	Near-term
25C	Enhance inter-agency communication for wildfire mitigation and emergency response (supports Health and Emergency Preparedness Action 15B).		Office of Emergency Management (OEM), AFD	AK DNR, AK DOT&PF, JBER, National Guard	Mid-term

Sector 07

OUTREACH AND EDUCATION

OUTREACH AND EDUCATION

The success of the Anchorage Climate Action Plan requires partnerships between Anchorage residents, businesses, and many institutions and organizations. Each sector has specific recommendations that require information for and participation from the public. The Outreach and Education chapter creates opportunities for residents to learn about Anchorage's climate and resilience initiatives, engage with municipal staff, and take action. In order for Anchorage residents to participate in implementation of the plan, an engaging and inclusive strategy for education and outreach is crucial for success.

In support of those goals, the Outreach and Education chapter outlines three important objectives: 1) utilizing effective and inclusive outreach methods to ensure that all Anchorage residents benefit throughout the implementation of all sectors of the plan, 2) engaging all Anchorage community groups, businesses, industries, and other institutions (e.g. military) in the development and implementation of the plan, and 3) motivating our community to take individual and collective climate action.

The Municipality is committed to making the Climate Action Plan accessible and relevant to all Anchorage residents. Achieving the goals outlined in the plan will require input and action from all community groups within Anchorage. Outreach to the community about the plan and its implementation will be a multi-faceted effort and will aim to connect, address, and uplift work that is already being done within the community and by other entities across the state. A wide range of outreach strategies is necessary to accommodate residents with varying degrees of access to transportation, technological capacity, language barriers, and non-traditional work schedules.

Photo Credit: Alaska Center for Energy and Power.

CASE STUDY: ALASKA/ ANCHORAGE SOLAR TOURS

The 10th Annual Anchorage Solar Tour (2018) was the largest grassroots solar event in the USA. It showcases solar power use in Anchorage and around the state. Admission to the tour sites is free, and the owners of each site are present, along with some of the designers and builders, to answer questions.[67, 68]

Sector 07 title page photo: Alexandra Long

CASE STUDY: WIND FOR SCHOOLS

The Wind for Schools program was created in 2005 by the U.S. Department of Energy's Wind Powering America program and the National Renewable Energy Laboratory (NREL). It is implemented in Alaska by the Renewable Energy Alaska Project (REAP) and the Alaska Center for Energy and Power (ACEP). Alaska is one of 11 states with a Wind for Schools program. Alaska Wind for Schools provides classroom visits, trains teachers to help implement hands-on curricula, and holds a wind turbine design competition for students in grades 4-12 (KidWind). Additionally, some schools have installed small wind turbines on-site as demonstration projects. There are seven turbines in Alaska that were installed through Wind for Schools, including one at Begich Middle School in Anchorage. You can check out their electricity output and compare to other wind turbines around the nation on OpenEI.[69] The program is open to any school in the state that meets the success criteria. Schools across Alaska are currently in various stages of planning. The program is highly dependent on a network of sponsors at the community and state level to get projects in the ground and provide long-term support. [70, 71]

Photo credit: Colleen Fisk, Renewable Energy Alaska Project

Sector 07: Outreach and Education

2050 Vision:

Anchorage residents and leadership are informed, engaged, and empowered to find community-led climate solutions that bring us to a just and sustainable future.

Objective 26: Ensure access to climate action planning and implementation public processes.

Municipal Liaison: All

Timeline: Ongoing

A. ACTION: Identify and reduce barriers to participation in planning processes as well as new projects and programs. Depending on the event, barriers and solutions may include:

- Language: Ensure the availability of translators and interpreter services for all outreach events and materials.
- Literacy: Provide easy-to-understand materials.
- Childcare: Provide childcare at public events.
- Transportation: Host events at locations accessible by walking or bus.
- Mobility: Ensure that meeting locations are ADA compliant.

B. ACTION: Establish a variety of communication avenues to reach diverse audiences, including through art, mail, public forums, digital surveys, social media, web and phone apps, door-to-door outreach, and more.

TERMINOLOGY

Underserved means people and places that historically and currently do not have equitable resources, access to infrastructure, healthy environments and/or housing choices. Due to historical inequitable policies and practices, disparities exist in both access to services and in outcomes.

Underrepresented recognizes that some communities have historically and currently not had an equal voice in institutions and policy-making and have not been served equitably by programs and services.

Objective 27: Engage community members, especially underrepresented and underserved communities, in the implementation of the Climate Action Plan.

A. ACTION: **Build partnerships with community organizations that are not currently engaged in climate action initiatives.**

Municipal Liaison: Office of the Mayor

Timeline: Ongoing

Tactics

- Establish a variety of communication avenues to reach diverse audiences, including through art, mail, public forums, digital surveys, social media, web and phone apps, door-to-door outreach, and more.

B. ACTION: Partner with and support existing organizations that currently work on climate justice, climate action and education, and other public service organizations already doing work that aligns with other sectors in the plan.

Municipal Liaison: Office of the Mayor

Timeline: Ongoing

Tactics

- Reach out to project managers to see which organizations have contact with municipal agencies and staff and which do not. Devote time to all organizations, with an emphasis on reaching out to groups that are not currently working with the Municipality.

C. ACTION: Increase the visibility of municipal climate action initiatives.

Municipal Liaison: Office of the Mayor

Timeline: Short-term

Tactics

- Identify existing municipal projects and programs that will benefit from a single, branded climate action message, and promote them.
- Develop, sustain and promote an online Anchorage climate action website to provide ongoing access to progress.
- Share information and avenues for getting involved in long term energy planning with local utilities.

Objective 28: Motivate and support Anchorage residents, schools, businesses, community councils, and agencies to help meet the goals of the CAP by reducing their carbon footprints and preparing for climate impacts.

A. ACTION: Partner with community organizations to encourage residents and other entities to reduce their carbon footprints, prepare for climate impacts, and help meet the goals of the CAP.

Municipal Liaison: Office of the Mayor, Solid Waste Services, Anchorage Public Library

Timeline: Ongoing

Tactics

- Compile and create accessible materials for web and in-person distribution, including how-to guides and information about trainings, workshops, and job opportunities.

B. ACTION: Encourage and support businesses to prioritize reducing their carbon footprints, revitalizing neighborhoods, and preparing for climate impacts.

Municipal Liaison: Office of the Mayor, Solid Waste Services, Anchorage Public Library

Timeline: Ongoing

Tactics

- Explore incentives to encourage business innovation on climate action.
- Educate and engage business owners through regular presentations and workshops at business organizations.

C. ACTION: Encourage education about climate change, energy use, and outdoor/natural sciences through K-12, post-secondary, continuing adult education, and extra-curricular education by (1) conducting an inventory of existing curriculum and (2) identifying, incentivizing, and providing materials and resources to educators.

Lead Partner: Anchorage School District

Timeline: Long-term

Tactics

- Audit and utilize existing curricula/materials already freely available, including the CLEAN Network, Strategic Energy Innovations (SEI), and the AKEnergy Smart curricula.
- Host climate-related workshops during teacher in-service days and credit courses.

D. ACTION: Encourage the development of career and technical education programs focused on supporting clean energy and infrastructure jobs (e.g. renewable energy, net-zero building, electrification of transportation infrastructure).

Municipal Liaison: Office of the Mayor

Timeline: Long-term

Tactics

- Promote career pathways, workforce development, and training opportunities within both traditional trades and emerging renewable energy industries that prove effective in reducing carbon emissions.

IMPLEMENTATION AND MONITORING

In addition to the objectives identified in each sector of the Climate Action Plan, there are two overarching, top priority goals that will provide baseline information for tracking and assessing progress on mitigation and adaptation actions.

1. **Complete a greenhouse gas inventory** for Anchorage and update annually to measure progress towards climate goals.
2. **Develop a framework for selecting, monitoring, and sharing indicators** that track 1) environmental changes associated with climate change, 2) impacts of climate change at a neighborhood-level, and 3) adaptation measures and their effectiveness in Anchorage.

The keys to the effective implementation of the Climate Action Plan are ***leadership*** and ***accountability***. The leadership bodies that will oversee the implementation of the plan as well as its activities and expectations are outlined below.

- **Municipal Resilience Sub-Cabinet** that includes representatives from municipal departments and is chaired by the Municipal Energy and Sustainability Manager.
    - Quarterly meetings to review implementation responsibilities, report on progress, and discuss challenges.
    - Develop an annual Climate Action Plan progress report and a workplan for the following year.
    - Update the Climate Action Plan every 5 years and submit to Assembly for consideration and approval.
    - Recognize energy efficiency and life-cycle cost as criteria in budget decisions.
- **Anchorage Climate Action Council** An external body that includes a variety of representatives from entities such as the Municipality, the university, non-profit organizations, state government, tribal entities, local utilities, and local businesses. Activities include:
    - Convene at least annually to review and provide comments on the annual Climate Action Plan progress report and workplan.
    - Review and provide comments on the updated Climate Action Plan every 5 years and participate in the update as necessary.
    - Provide consultation on equity considerations during implementation.
- Accountability and reporting
    - Annual progress report and Climate Action Plan updates will be made available on a public website maintained by the Municipal Office of Energy and Sustainability.

The implementation of the objectives and actions outlined in the Climate Action Plan will require creative financing mechanisms, many of which are already being assessed by the Municipality. Several of these financing options are described below.

RESOURCES FOR IMPLEMENTATION

- **Financing:** The Municipality is exploring a broad range of mechanisms to finance this effort, studying cities worldwide that have developed creative financing options for climate action. They are also developing a detailed Finance Map, which will illustrate the range of finance options to be utilized in meeting the city's climate needs. Many actions in this plan are financially attractive and provide a positive return on investment. Investor financing, donor grants, and cross-sector partnerships have allowed communities to finance projects with means beyond a city budget. With an estimated 20% annual energy savings across the board by investing in energy efficiency and renewable energy, residents, businesses and public entities have a great opportunity to not just keep money in the local economy, but also to foster local jobs and a thriving population.
    - **The Cost of Doing Nothing:** Anchorage will bear a large financial burden due to climate change effects (estimated at $150 million or more annually).[72] Planning and preparation will help ease that burden, thus saving the Municipality from significant additional expenses.
- **Equity:** An Equity Implementation Guide will provide guidance for municipal departments on how to incorporate equity considerations as they implement the projects, programs, and policies outlined in the Climate Action Plan. It will include tools for equity analysis, stakeholder identification, community engagement, and evaluation.

Photo credit: Johanna Grasso

HOW WAS THE CLIMATE ACTION PLAN DEVELOPED?

TIMELINE

2018 2019

SPRING/SUMMER	SEP. - NOV.	DEC. - JAN.	MAR. - APR.	MAY
Steering Committee created planning process; established working groups and Advisory Committee	Working groups developed individual chapters	Reviewed by Steering and Advisory Committees/ Municipality Departments	Public comment period and finalizing plan	Presented to Anchorage Assembly for vote

COMMUNITY MEETINGS AND MOBILE CLIMATE WORKSHOPS

The initial effort to develop a Climate Action Plan for Anchorage began over a decade ago. University of Alaska (UAA) faculty and students wrote a plan, but it wasn't adopted. In December 2017, the Municipality of Anchorage and UAA signed a Memorandum of Understanding to support collaboration on community opportunities and challenges. This plan is the first product of that agreement.

A small group of University and municipal personnel began this project with a survey of climate action plans from cities across the U.S. They then recruited a diverse group of faculty, staff and students; representatives from non-profit, governmental, and community-based organizations; residents; and municipal staff to develop the recommendations found in the plan. Throughout, a community engagement strategy was used that provided multiple opportunities for residents to engage in the planning process.

KEY ADVISORY AND PLAN DEVELOPMENT GROUPS

Four key groups developed the plan: the Steering Committee, Advisory Committee, Working Groups, and the Anchorage community.

The ***Steering Committee***, made up of University of Alaska and municipal staff, was formed to create the framework for the Climate Action Plan. The committee designed and hosted the technical sessions, recruited the Advisory Committee and working group members, ran community engagement meetings, and edited the final plan.

The ***Advisory Committee*** was composed of a group of technical advisors with a wide range of experiences and expertise representing the Climate Action Plan sectors as well as community-based organizations. This committee reflected the diversity found in Anchorage. Members reviewed drafts of the plan, ensuring that the themes of equity and economic prosperity were incorporated throughout and helping to catalyze rapid implementation of the plan.

Seven ***working groups*** were developed to represent the seven sectors (e.g. Buildings and Energy, Land Use and Transportation, etc.) of the Climate Action Plan. University of Alaska and Alaska Pacific University faculty served as working group leads. Municipality of Anchorage staff, other UAA faculty, staff and students, non-profit representatives, and state and federal government employees made up the rest of the working group members. Through a series of three technical sessions, the working groups developed the first draft of the objectives and actions in the plan as well as the narrative text in each of the seven sector chapters.

The ***Anchorage community*** was involved throughout the development of the Climate Action Plan. Community comments were included along with input from municipal staff and the Advisory Committee to help identify priority actions. Community input was analyzed and integrated while developing the overarching goals, vision, and targets as well as the actions and implementation strategies (See Appendix for a list of community engagement events). By the time the plan was submitted to the Anchorage Assembly, over 1,300 residents had been engaged through a variety of presentations, open houses, online feedback opportunities, and workshops.

Incorporating climate equity into the Climate Action Plan development

From the beginning, equity was emphasized as a core value of the Climate Action Plan. All working group members participated in an equity training from the UAA Office of Equity and Compliance at the first technical session. Working groups were instructed to think about how to advance equity goals as they drafted objectives and actions. In addition, the Advisory Committee was tasked with ensuring that

equity was incorporated as an overarching theme throughout the plan. Advisory Committee members reviewed the draft chapters and made revisions based on the following **list of six equity considerations** adapted from Portland Climate Action through Equity[73] and the Austin Climate Resilience Plan[74]:

1. DISPROPORTIONATE IMPACTS

Are there unintended consequences or negative impacts of this action to racial and ethnic communities, limited English proficient individuals, low-income populations, older adults, or people with disabilities? If yes, how do we mitigate these impacts?

2. SHARED BENEFITS

Are racial, ethnic, low-income communities, older adults or people with disabilities positively affected by the action? Will it help build community capacity? Is there a missed opportunity to reduce existing disparities?

3. ACCESSIBILITY

Are the benefits of the action accessible to households and businesses throughout the community? Consider racial and ethnic communities, limited English proficient individuals, low-income populations, older adults, people with disabilities, and minority, women, and emerging small businesses.

4. ENGAGEMENT AND RELATIONSHIP BUILDING

How does the action promote meaningful and culturally appropriate engagement of those most impacted? Does the action encourage building effective, long-term relationships and trust between diverse communities and local government?

5. ALIGNMENT AND PARTNERSHIP

Does the proposed action align with and support existing priorities for racial and ethnic communities, limited English proficient individuals, low-income populations, older adults, and people with disabilities? Does it create an opportunity to leverage resources and build collaborative partnerships?

6. ECONOMIC OPPORTUNITY

Does the proposed action support communities of color and low-income populations through workforce development, contracting opportunities, or the increased diversity of municipal staff?

While the recommendations were drafted with equity considerations in mind, the manner in which the actions are implemented will have a more significant impact on underserved and underrepresented communities. For this reason, the Steering Committee will adapt Portland's Bureau of Planning and Sustainability Equity Toolkit to create an **Equity Implementation Guide** that will be used by municipal staff and partners to ensure that equity is incorporated during the implementation of all actions in the Climate Action Plan.

APPENDICES

COMMUNITY ENGAGEMENT STRATEGY

The Steering Committee used a public website (www.muni.org/ClimateActionPlan), a Climate Action Plan listserv, social media, the Federation of Community Councils newsletter, and community partners to inform residents about the plan, upcoming events, and other opportunities to provide feedback. The Steering Committee hosted seven public events to solicit community ideas for the plan and feedback on draft objectives and actions:

- UAA Center for Community Engagement and Learning Resilient Cities Workshop
- Climate Action Plan Community Kickoff — Loussac Library
- Pop-up Climate Conversations Table — Anchorage Museum
- UAA Center for Community Engagement and Learning Think Tank Discussion
- Climate Action Plan Open House — Anchorage Museum
- Building a Brighter Anchorage Vision Workshop — Mountain View Neighborhood Library
- Climate Action Plan Public Forum — Loussac Library

Community members discuss the Climate Action Plan at a public workshop. Photo credit: Catherine Kemp, Mayor's Office

In order to make it easier for people to get involved with the climate action planning process and include perspectives from all across Anchorage, the Steering Committee offered to bring these presentations and workshops directly to community organizations. These "mobile climate workshops" were tailored specifically for the organization.

Caption: UAA students, faculty, and community members discuss the Climate Action Plan at a campus event. Photo credit: Richard Tilney-Bassett

MOBILE CLIMATE WORKSHOPS

Airport Heights Community Council
Alaska Energy Efficiency Partnership Meeting
Alaska Forum on the Environment
Alaska Marine Policy Forum
Alaska Pacific University course, *Climate Change*
Alaska Seeds of Change
Alaska Trucking Association
Anchorage Business Forum
Anchorage Chamber of Commerce "Make It Monday" Forum
Bartlett Club
BP Citizen Action Program
Chugiak-Eagle River Chamber of Commerce
Chugiak High School
Citizens Climate Lobby
Downtown Rotary Club
Fairview Community Council
Federation of Community Councils
Health and Human Services Commission
Hillside Community Council
Huffman O'Malley Community Council
NAACP Anchorage Branch
Scenic Foothills Community Council
Solid Waste and Recycling Advisory Commission
St. John's United Methodist Church
Turnagain Community Council
UAA Engineering Seminar
UAA Environmental Studies course, *Environmental Planning*
Youth Advisory Commission

MUNICIPAL LIAISONS AND POTENTIAL PARTNERS

MUNICIPAL DEPARTMENTS

NAME	ACRONYM
Anchorage Assembly	
Anchorage Fire Department	AFD
Anchorage Community Development Authority	ACDA
Anchorage Health Department	AHD
Anchorage Metropolitan Area Transportation Solutions	AMATS
Anchorage Police Department	APD
Anchorage Public Library	APL
Anchorage Water and Wastewater Utility	AWWU
Building Safety	
Code Enforcement	
Development Services Department	
Finance Department	
Geographic Data and Information Center	GDIC
Heritage Land Bank	HLB
Innovation Team	i-Team
Local Emergency Planning Committee	LEPC
Maintenance and Operations	M&O
Maintenance and Operations (Street Maintenance)	
Municipal Light and Power	ML&P
Municipal Manager	
Office of Economic and Community Development	OEDC
Office of Emergency Management	OEM
Office of Energy and Sustainability	OES
Office of Management and Budget	OMB
Office of the Mayor	
Parks and Recreation	P&R
Planning Department	
Planning and Zoning Commission	
Permitting	
Port of Alaska	POA
Project Management and Engineering	PM&E
Project Management and Engineering (Watershed Management)	
Property Appraisal Division	
Public Transportation Department	PTD
Purchasing Department	
Real Estate Department	
Solid Waste Services	SWS
Traffic Department	
Youth Advisory Commission	

PARTNER ORGANIZATIONS

Alaska Botanical Garden	
Alaska Chinese Association	
Alaska Climate Action Network	AK CAN!
Alaska Department of Commerce, Community, and Economic Development (including Division of Community and Regional Affairs)	AK DCCED
Alaska Department of Environmental Conservation (including Division of Air Quality and Public Information Officer)	AK DEC
Alaska Department of Fish and Game	ADF&G
Alaska Department of Health and Social Services (including Office of the State Veterinarian, Section of Epidemiology, Public Information Officer, and Chronic Disease Prevention and Health Promotion)	AK DHSS
Alaska Department of Labor and Workforce Development	
Alaska Department of Military and Veterans Affairs Division of Homeland Security and Emergency Management	AK DHSEM
Alaska Department of Natural Resources (including Division of Forestry, Division of Parks and Recreation, Division of Agriculture, Community Forestry Program, and Plant Materials Center)	AK DNR
Alaska Department of Transportation and Public Facilities	AK DOT&PF
Alaska Disabilities Advisory Group	
Alaska Energy Authority	AEA
Alaska Farmers Market Association	
Alaska Federation of Filipino Americans, Inc.	AFFA

Alaska Federation of Natives	AFN
Alaska Food Policy Council	AFPC
Alaska Housing Finance Corporation	AHFC
Alaska Humanities Forum	
Alaska Institute for Justice	AIJ
Alaska Literacy Program	ALP
Alaska Marine Conservation Council	AMCC
Alaska Master Gardeners	
Alaska Native Medical Center	ANMC
Alaska Native Science & Engineering Program	ANSEP
Alaska Native Tribal Health Consortium (including Local Environmental Observer (LEO) Network)	ANTHC
Alaska Pacific University (including Outdoor Studies Wilderness First Responder Program)	APU
Alaska Railroad	
Alaska Seafood Marketing Institute	ASMI
Alaska State Legislature	
Alaska Vocational Technical Center	AVTEC
Alaska Waste	
Alaska Youth for Environmental Action	AYEA
Alaskans for Litter Prevention and Recycling	ALPAR
American Institute of Architects	AIA
American Red Cross of Alaska	
Anchorage Chamber of Commerce	
Anchorage Community Land Trust	ACLT
Anchorage Community Mental Health Services, Inc.	
Anchorage Economic Development Corporation	AEDC
Anchorage Home Builders Association	AHBA
Anchorage Park Foundation	APF
Anchorage Recycling Center	
Anchorage School District	ASD
Anchorage School Garden Network	
Anchorage Waterways Council	

Arctic Harvest Deliveries	
Asian Alaskan Cultural Center	
Association of Alaska Housing Authorities	
Audubon Alaska - National Audubon Society	
Bike Anchorage	
Building Owners and Managers Association	BOMA
Camp Fire Alaska	
Campbell Creek Science Center	
Catholic Social Services (including Refugee Assistance and Immigration Services)	CSS
Central Environmental Inc.	
Charlie's Produce	
Cold Climate Housing Research Center	CCHRC
Cook Inlet Region, Inc.	
Cook Inletkeeper	
Chugach Electric Association	
Church of Love	
Connecticut Green Bank	
Defend the Sacred Alaska	
Doyon Utilities	
Eklutna, Inc.	
Fairbanks Metropolitan Area Transportation System	FMATS
Federation of Community Councils	FCC
Federal Emergency Management Agency	FEMA
First Alaskans Institute	
Food Bank of Alaska	
The Food Corridor	
Get Outdoors Anchorage Coalition	
Green Star	
Great Land Trust	
Hispanic Affairs Council of Alaska	
Joint Base Elmendorf-Richardson	JBER
King Tech High School	

Matanuska Electric Association	MEA
Matanuska-Susitna (Mat-Su) Borough	
National Association for the Advancement of Colored People	NAACP
National Guard	
National Oceanic and Atmospheric Administration	NOAA
National Weather Service	NWS
Native Movement	
Native Village of Eklutna	
Nordic Skiing Association of Anchorage	NSAA
North Pacific Research Board	NPRB
Off the Chain	
Older Persons Action Group	
Polynesian Community Center	
Rising Tide Communications	
Regulatory Commission of Alaska	RCA
Renewable Energy Alaska Project	REAP
Salvation Army Alaska Division	
Spork Consulting	
Sol de Medianoche	
State of Alaska	SOA
The Alaska Center	
Ted Stevens Anchorage International Airport	TSAIA
University of Alaska Anchorage (including Center for Conservation Science, Small Business Development Center)	UAA
University of Alaska Fairbanks (including Cooperative Extension and Scenarios Network for Alaska and Arctic Planning)	UAF
United States Department of Agriculture	USDA
U.S. Department of Energy	USDOA
United States Geological Survey	USGS
U.S. Fish and Wildlife Service	USFWS
Valley Transit	
YWCA Alaska	

RELATED MUNICIPAL AND COMMUNITY PLANS AND REPORTS

- All Hazards Mitigation Plan Update - Anchorage is vulnerable to a wide range of natural, technological, and human/societal hazards. While hazards typically cannot be eliminated, hazard mitigation activities are those that reduce or eliminate the long-term risk to property and human life from hazards.
- AMATS Complete Streets - This policy is a commitment that future AMATS projects will take into account the needs of all users as early as practicable and throughout the transportation planning process.
- Anchorage 2020 Comprehensive Plan - The Anchorage Bowl Comprehensive Plan, adopted by the Anchorage Assembly on February 20, 2001, and amended on September 10, 2002, is a blueprint for development in the Anchorage Bowl during the next 20 years.
- Anchorage 2040 Land Use Plan - The Anchorage 2040 Land Use Plan is a targeted update to the Anchorage 2020—Anchorage Bowl Comprehensive Plan. The Anchorage 2040 Land Use Plan (2040 LUP) updates population and economic forecasts for city growth and land needs through the year 2040 and includes a Land Use Plan Map.
- Anchorage Community Health Needs Assessment 2015 - The purpose of this effort, led by Providence and in collaboration with community partners, is to better understand and address the health needs of Anchorage. Providence, in its commitment to its Mission and desire to create healthier communities together, conducts a CHNA for Anchorage at least once every three years.

- Anchorage Energy Landscape and Opportunities Analysis - This report combines technical, economic, and institutional perspectives to apply an energy landscape analysis toward assessing the current status, opportunities, and challenges for energy efficiency, renewable energy, and community-based economic development for Anchorage.
- Anchorage Forestland Assessment and Management Plan (Draft) - The overarching intent of the Anchorage Forestland Management Plan is to: Preserve and enhance Anchorage's natural and developed forest and the benefits they provide that are critical to the quality of life of residents, visitors, and wildlife.
- Anchorage Non-motorized Transportation Plan - A comprehensive effort to examine the opportunities to increase and expand multi-modal facilities, for both recreation and transportation, throughout the city of Anchorage, Alaska.
- Anchorage Transit System Report Card - This report analyzes all three services (People Mover, AnchorRides, and Rideshare) of the Public Transportation Department (PTD) one year after implementation of the new bus system. Data from this report will be used as a baseline and a starting point to have conversations with the community and help establish where we go from here.
- Anchorage Vision Zero Action Plan - The Municipality of Anchorage is applying a systems-based approach to develop a Vision Zero Action Plan – fatal and serious injury data for all modes of transportation have been gathered and analyzed to understand traffic safety issues and prioritize resources based on evidence of the greatest needs and impact.
- Anchorage Wetlands Management Plan - The purpose of this document is (1) to provide accurate mapping and assessment of freshwater wetlands within the Municipality; (2) to provide a hierarchy of values for wetland units based on function; and (3) to derive management strategies that balance wetland integrity and function while allowing development that would not cause more than minimal adverse impacts.
- Anchored Home Strategic Plan to End Homelessness - Three-year tactical road map which draws on new tools and strategies while building on the community's existing work and planning.
- AWWU Strategic Plan - This plan supports the mission of AWWU through a framework of progressively more specific goals, objectives, and tasks.
- AWWU Water and Wastewater Master Plans - This plan includes improvements focused on resilience of the water distribution and wastewater collection networks. Energy efficiency and resource recovery are important considerations for planning.
- Comprehensive Emergency Operations Plan- This plan is designed to provide general information about how the Municipality of Anchorage will conduct and respond during times of disaster.
- FEMA Risk Report, Region X- Municipality of Anchorage - The Report has two goals: (1) inform communities of their risks related to natural hazards; and (2) enable communities to take action to reduce their risks. State and local officials can use the data provided here to update local plans, communicate risk, inform modifications to development standards, identify mitigation projects, and ultimately take action to reduce risk.
- Key Insights on Business, State, and City Collaboration for a Resilient Anchorage - Summary of key insights from a workshop in March 2016 focusing on opportunities for collaboration in building a climate-resilient Anchorage between business leaders, city, state, federal and tribal officials, nonprofit organizations, and other experts.
- LED Streetlight Retrofit Project Storymap - Investing in energy efficient public lighting saves taxpayers money and will reduce our energy demand.
- Metropolitan Transportation Plan 2040 - MTP 2040 is the blueprint document of recommended transportation improvements over

the next twenty years and is updated every four years by the Anchorage Metropolitan Area Transportation Solutions (AMATS).

- Municipality of Anchorage Community Wildfire Protection Plan - Documents the Anchorage Fire Department progress in mitigating the risks and hazards of wildland fire and projecting its goals for the next three years.
- PM&E Design Criteria Manual - The Design Criteria Manual (DCM) provides guidance on design and standards for streets, drainage, landscaping, trails, lighting, traffic control, public transportation, and plans & specifications across the Municipality.
- SWS Master Plan Executive Summary - The development of an integrated solid waste master plan was authorized in order to optimize the system and assets through improved operational efficiencies, capital improvements and new practices and programs. Goals of the plan include increasing the life of the landfill, improving customer service, protecting the environment and establishing sustainable waste reduction, reuse and recycling programs in Anchorage.
- Welcoming and Resilient Roadmaps - Our roadmap for an equitable, inclusive, diverse Anchorage and a roadmap for success and innovation in a time of environmental and economic transformation.

REFERENCES

1. Global Covenant of Mayors. "Global Covenant of Mayors," 2018. https://www.globalcovenantofmayors.org/.
2. United Nations Climate Change. "The Paris Agreement." https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.
3. U.S. Census Bureau. "QuickFacts: Anchorage Municipality, Alaska." https://www.census.gov/quickfacts/fact/table/anchoragemunicipalityalaskacounty,US/PST045218.
4. Huber, Markus, and Reto Knutti. "Anthropogenic and Natural Warming Inferred from Changes in Earth's Energy Balance." Nature Geoscience 5, no. 1 (January 4, 2012): 31–36. https://doi.org/10.1038/ngeo1327.
5. Markon, Carl, Stephen Gray, Matthew Berman, Laura Eerkes-Medrano, Thomas Hennessy, Henry P. Huntington, Jeremy Littell, Molly McCammon, Richard Thoman, and Sarah F. Trainor. "Chapter 26 : Alaska. Impacts, Risks, and Adaptation in the United States: The Fourth National Climate Assessment, Volume II." Washington, DC, 2018. https://doi.org/10.7930/NCA4.2018.CH26.
6. Meeker, Danielle, and Nathan Kettle. "A Synthesis of Climate Adaptation Planning Needs in Alaska Native Communities." Fairbanks, AK, 2017.
7. Melvin, April M, Peter Larsen, Brent Boehlert, James E Neumann, Paul Chinowsky, Xavier Espinet, Jeremy Martinich, et al. "Climate Change Damages to Alaska Public Infrastructure and the Economics of Proactive Adaptation." Proceedings of the National Academy of Sciences of the United States of America

114, no. 2 (January 10, 2017): E122–31. https://doi.org/10.1073/pnas.1611056113.

8. McDowell Group. "Southcentral Alaska Ports Freight and Fuel Analysis 2016 Update," 2016. https://www.portofalaska.com/wp-content/uploads/McDowell_Group_2016_Report.pdf.

9. American Society of Civil Engineers. "2017 Alaska Infrastructure Report Card," n.d.

10. Melvin, April M., Jessica Murray, Brent Boehlert, Jeremy A. Martinich, Lisa Rennels, and T. Scott Rupp. "Estimating Wildfire Response Costs in Alaska's Changing Climate." Climatic Change 141, no. 4 (April 24, 2017): 783–95. https://doi.org/10.1007/s10584-017-1923-2.

11. CREE. "Municipal-Upgrade City of Anchorage," 2013. https://lighting.cree.com/applications/case-studies/city-of-anchorage.

12. Anchorage Metropolitan Area Transportation Solutions. "Complete Streets Policy," 2018. http://www.muni.org/Departments/OCPD/Planning/AMATS/Policy_Committee/2018/072618/5B_Attachment%20A_Draft%20Complete%20Streets%20Policy.pdf.

13. Municipality of Anchorage Emergency Management. "Emergency Preparedness Information in Many Languages." https://www.muni.org/Departments/OEM/Prepared/Pages/EmergencyPreparednessInfomationinManyLanguages.aspx.

14. Municipality of Anchorage Wildfire Mitigation. "My Firewise Home." https://www.muni.org/Departments/Fire/Wildfire/Pages/MyFirewiseHome.aspx.

15. Municipality of Anchorage Environmental Health Services. "Bike to Work Day." https://www.muni.org/Departments/health/Admin/environment/AirQ/Pages/biketoworkday.aspx.

16. Arguez, Anthony, Imke Durre, Scott Applequist, Russell S. Vose, Michael F. Squires, Xungang Yin, Richard R. Heim, and Timothy W. Owen. "NOAA's 1981–2010 U.S. Climate Normals: An Overview." Bulletin of the American Meteorological Society 93, no. 11 (November 2012): 1687–97. https://doi.org/10.1175/BAMS-D-11-00197.1.

17. Alaska Center for Climate Assessment and Policy, The Alaska Climate Research Center, Search Sea Ice Outlook, National Centers for Environmental Prediction, and The National Weather Service. "Alaska Climate Dispatch A State-Wide Seasonal Summary and Outlook," 2017. https://accap.uaf.edu/sites/default/files/climate_dispatch_May_2018_FINAL.pdf.

18. The Alaska Climate Research Center. http://akclimate.org.

19. University of Alaska Fairbanks International Arctic Research Center. "Scenarios Network for Alaska + Arctic Planning." https://www.snap.uaf.edu/.

20. Anchorage Water & Wastewater Utility. "2017 Anchorage Drinking Water Quality Report," 2017. https://www.awwu.biz/home/showdocument?id=420.

21. Sass, Louis C, Michael G Loso, Jason Geck, Evan E Thoms, and Daniel Mcgrath. "Geometry, Mass Balance and Thinning at Eklutna Glacier, Alaska: An Altitude-Mass-Balance Feedback with Implications for Water Resources." Journal of Glaciology 63, no. 238 (2017): 343–54. https://doi.org/10.1017/jog.2016.146.

22. Murphy, Peter, David Thackray, and Ed Wilson. "Coastal Heritage and Climate Change in England: Assessing Threats and Priorities." Conservation and Management of Archaeological Sites 11, no. 1 (March 18, 2009): 9–15. https://doi.org/10.1179/135050309X12508566208281.

23. University of Alaska Fairbanks. "Spruce Beetle in Alaska's Forests." https://www.alaskasprucebeetle.org/.

24. Berg, Edward E., J. David Henry, Christopher L. Fastie, and Andrew D. De Volder. "Spruce Beetle Outbreaks on the Kenai Peninsula, Alaska, and Kluane National Park and Reserve, Yukon Territory: Relationship to Summer Temperatures and Regional Differences in Disturbance Regimes." Forest Ecology and Management 227, no. 3 (June 1, 2006): 219–32. https://doi.org/10.1016/J.FORECO.2006.02.038.

25. Hollander, Zaz. "Voracious Spruce Bark Beetles Are Back in Force in Southcentral Alaska." Anchorage Daily News, June 11, 2018.

26. Huber, Markus, and Reto Knutti. "Anthropogenic and Natural Warming Inferred from Changes in Earth's Energy Balance." Nature Geoscience 5, no. 1 (January 4, 2012): 31–36. https://doi.org/10.1038/ngeo1327.

27. United States Environmental Protection Agency. "Global Greenhouse Gas Emissions by Economic Sector 2015." https://www.epa.gov/sites/production/files/2016-05/global_emissions_sector_2015.png.

28. Municipality of Anchorage. "Anchorage Carbon Monoxide Emission Inventory and Projections 2007-2023," 2008. http://www.muni.org/Departments/health/Admin/environment/AirQ/Documents/Emission%20Inventory%20and%20Projections.pdf.

29. Shercliffe, Jacob. "Proposed Climate Action Plan for Anchorage," 2017.

30. State of Alaska. "Amendments to: State Air Quality Control Plan Vol. II: Analysis of Problems, Control Actions; Section III.B: Anchorage Transportation Control Program. Anchorage CO Limited Maintenance Plan for 2014-2024," 2013.

31. EasyPark Alaska. "Downtown Anchorage Receives Its First Electric Vehicle Charging Station," 2019. http://www.easyparkalaska.com/latest-news/19-01-02/Downtown_Anchorage_Receives_Its_First_Electric_Vehicle_Charging_Station.aspx.

32. Deerstone Consulting, and Crimp Energy Consulting. "Anchorage Energy Landscape and Opportunities Analysis." Municipality of Anchorage, 2016.

33. U.S. Census Bureau. "QuickFacts: Anchorage Municipality, Alaska." https://www.census.gov/quickfacts/fact/table/anchoragemunicipalityalaskacounty,US/PST045218.

34. Floater, Graham, Catarina Heeckt, Matthew Ulterino, Lisa Mackie, Philipp Rode, Ankit Bhardwaj, Maria Carvalho, Darren Gill, Thomas Bailey, and Rachel Huxley. "Co-Benefits of Urban Climate Action: A Framework for Cities," 2016.

35. Shier, Brian La. "Fact Sheet - Jobs in Renewable Energy and Energy Efficiency (2017)," 2017. http://www.eesi.org/papers/view/fact-sheet-jobs-in-renewable-energy-and-energy-efficiency-2017.

36. Goldsmith, Scott, Sohrab Pathan, and Nathan Wiltse. "Snapshot: The Home Energy Rebate Program," 2012. http://www.cchrc.org/sites/default/files/docs/HERP_snapshot.pdf.

37. U.S. Energy Information Administration. "Rankings: Total Energy Consumed per Capita, 2016 (Million Btu)," n.d. https://www.eia.gov/state/rankings/.

38. "Big Business Sees the Promise of Clean Energy." The Economist, June 10, 2017. https://www.economist.com/business/2017/06/10/big-business-sees-the-promise-of-clean-energy.

39. Cook Inlet Housing Authority. "Our Story." http://www.cookinlethousing.org/who-we-are/our-story-timeline/.

40. Nash, Art, and Chris Pike. "A Solar Design Manual for Alaska," 2018. (p.33). http://acep.uaf.edu/media/260463/EEM-01255_SolarDesignManual_5thEd201805.pdf.

41. "Municipality of Anchorage Greenhouse Gas Emissions Study," 2015.

42. The Intergovernmental Panel on Climate Change. "Global Warming of 1.5 oC," 2018. https://www.ipcc.ch/sr15/.

43. Bliss, Laura. "The Planet Can't Survive Our Transportation Habits." CityLab, October 9, 2018. https://www.citylab.com/transportation/2018/10/un-climate-report-transportation-choices/572494/.

44. "LinkAK." https://linkak.org/#/.

45. Municipality of Anchorage Public Transportation Department. "Public Transportation System Report Card," 2018. http://www.muni.org/Departments/transit/PeopleMover/Documents/Transit%20on%20the%20Move/System%20Report%20Card.pdf.

46. Municipality of Anchorage Solid Waste Services. "Anchorage Landfill Closure Clock." https://acak.statwindow.com/landfill.

47. Municipality of Anchorage Solid Waste Services. "Daily Pounds of Waste Generation per Person (Lbs.)." https://acak.statwindow.com/measures/d3bb5dc5-6de5-46ea-b145-81a9c0066d5b.

48. United State Environmental Protection Agency. "Municipal Solid Waste." https://archive.epa.gov/epawaste/nonhaz/municipal/web/html/.

49. Anchorage School District. "Recycling." https://www.asdk12.org/recycling.

50. Municipality of Anchorage Solid Waste Services. "Anchorage Landfill Gas to Energy Project." https://www.muni.org/Departments/SWS/Pages/AnchLandfillGastoEnergyPrj.aspx.

51. Barne, Charles, Neil E Alexis, Jonathan A Bernstein, John R Cohn, Jeffrey G Demain, Elliot Horner, Estelle Levetin, Andre Nei, and Wanda Phipatanakul. "Climate Change and Our Environment: The Effect on Respiratory and Allergic Disease." The Journal of Allergy and Clinical Immunology. In Practice 1, no. 2 (March 1, 2013): 137–41. https://doi.org/10.1016/j.jaip.2012.07.002.

52. State of Alaska Division of Forestry. "2017 Alaska Wildfires by Area and Protection Level," 2017. http://forestry.alaska.gov/Assets/pdfs/firestats/2017%20Fire%20Statistics.pdf.

53. Durden, Lance A., Kimberlee B. Beckmen, and Robert F. Gerlach. "New Records of Ticks (Acari: Ixodidae) From Dogs, Cats, Humans, and Some Wild Vertebrates in Alaska: Invasion Potential." Journal of Medical Entomology 53, no. 6 (November 1, 2016): 1391–95. https://doi.org/10.1093/jme/tjw128.

54. European Bank for Reconstruction and Development. "Indigenous Peoples: Guidance Authors, Convening Lead Authors, LeaNote," 2010, 1–17. https://doi.org/10.7930/J09G5JR1.On.

55. Meter, Ken, and Megan Phillips Goldenberg. "Building Food Security in Alaska," 2014. http://www.crcworks.org/akfood.pdf.

56. Municipality of Anchorage Parks and Recreation. "Chanshtnu Muldoon Park Master Plan." https://www.muni.org/Departments/parks/Pages/MuldoonCommunityParkMasterPlan.aspx.

57. Holmes, Loren. "Photos: Government Hill Orchard Takes Root." Anchorage Daily News, September 9, 2017. https://www.adn.com/slideshow/alaska-news/anchorage/2017/09/09/photos-government-hill-orchard-begins-to-take-shape/.

58. Nowak, David J., and Daniel E. Crane. "Carbon Storage and Sequestration by Urban Trees in the USA." Environmental Pollution 116, no. 3 (March 1, 2002): 381–89. https://doi.org/10.1016/S0269-7491(01)00214-7.

59. Donovan, Geoffrey H., David T. Butry, Yvonne L. Michael, Jeffrey P. Prestemon, Andrew M. Liebhold, Demetrios Gatziolis, and Megan Y. Mao. "The Relationship Between Trees and Human Health." American Journal of Preventive Medicine 44, no. 2 (February 1, 2013): 139–45. https://doi.org/10.1016/j.amepre.2012.09.066.

60. Davey Resource Group, Inc. "Anchorage Bowl Tree Canopy Assessment," Alaska Department of Natural Resources, 2018.

61. McPherson, E. Gregory, Natalie van Doorn, and John de Goede. "Structure, Function and Value of Street Trees in California, USA." Urban Forestry & Urban Greening 17 (June 1, 2016): 104–15. https://doi.org/10.1016/J.UFUG.2016.03.013.

62. University of Alaska Fairbanks Alaska Master Gardener Blog. "Rain Garden Resources for Alaskans," 2015. https://alaskamastergardener.community.uaf.edu/2015/08/04/rain-garden-resources-for-alaskans/.

63. Municipality of Anchorage Solid Waste Services. "Water Quality," n.d. https://www.muni.org/Departments/SWS/recycle/Documents/5.1%20Water%20Quality%20and%20Rain%20Gardens.pdf.

64. Foley, Jonathan A., John E. Kutzbach, Michael T. Coe, and Samuel Levis. "Feedbacks between Climate and Boreal Forests during the Holocene Epoch." Nature 371, no. 6492 (September 1994): 52–54. https://doi.org/10.1038/371052a0.

65. Chapin III, FS, AD McGuire, JT Randerson, R Pielke, DD Baldocchi, SE Hobbie, N Roulet, et al. "Arctic and Boreal Ecosystems of Western North America as Components of the Climate System." Global Change Biology 6, no. Suppl. 1 (2000): 211–23.

66. Hayward, Gregory H., Steve Colt, Monica L. McTeague, and Teresa N. Hollingsworth. "Climate Change Vulnerability Assessment for the Chugach National Forest and the Kenai Peninsula." Gen. Tech. Rep. PNW-GTR-950. . Portland, OR, 2017.

67. Alaska Solar Tour. "2018 Anchorage Solar Tour." http://alaskasolartour.com/2018-anchorage-solar-tour/.

68. University of Alaska Fairbanks Alaska Center for Energy and Power. "Alaska Solar Tour Celebrates 10 Years," 2018. http://acep.uaf.edu/acep-news/2018/14-may-acep-this-week/alaska-solar-tour-celebrates-10-years.aspx.

69. Open Energy Information. "Wind for Schools Portal/Comparison," 2018. https://openei.org/wiki/Wind_for_Schools_Portal/Comparison.

70. Renewable Energy Alaska Project. "Wind for Schools." https://alaskarenewableenergy.org/index.php/focusareas/education/wind-for-schools/.

71. University of Alaska Fairbanks Alaska Center for Energy and Power. "Alaska Wind for Schools Program." http://acep.uaf.edu/projects-(collection)/alaska-wind-for-schools-program.aspx.

72. Melvin, April M, Peter Larsen, Brent Boehlert, James E Neumann, Paul Chinowsky, Xavier Espinet, Jeremy Martinich, et al. "Climate Change Damages to Alaska Public Infrastructure and the Economics of Proactive Adaptation." Proceedings of the National Academy of Sciences of the United States of America 114, no. 2 (January 10, 2017): E122–31. https://doi.org/10.1073/pnas.1611056113.

73. Williams-Rajee, Desiree, and Taren Evans. "Climate Action through Equity," 2016. https://www.portlandoregon.gov/bps/article/583501.

74. City of Austin Office of Sustainability. Personal communication, July 12, 2018.