

AK LEGISLATURE SPECIAL COMMITTEE FILES SCOMM 145 3128
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NOAA operates 17 long-term continuously operating tide stations in the state of Alaska which provide data and information, relative sea level trends, and are capable of producing real-time data for tsunami and storm surge warnings. The Commission recommends development of coastal hazard assessments for coastal villages, as well as improved coastal flood warnings and high surf advisories. These would require accurate coastline maps, additional weather and ocean monitoring instruments (including tide gauges), more precise models to improve forecasts, and use of modern technology (Aerial Analysis, Lidar, GIS, modeling of storm surge and wave height, etc.), melded with routine village contact and ground-truth measurements.

PRECIPITATION FREQUENCY, RIVER FLOODING, FRESHWATER FLOW:

Alaska has 3000+ river systems, with over 90% of those currently unmonitored. All Alaskans rely on inland and coastal waterways in one or more ways, including but not limited to industry, transportation, food, potable water, energy, and culture. River systems provide important habitat for species important to subsistence and commercial interests. Moreover, coastal freshwater discharge plays an extremely important role in the marine ecosystems surrounding Alaska. Precipitation frequency and distribution is required for design and construction of infrastructure.

Presently, engineers are using an outdated precipitation frequency estimate for design of new structures. The Commission recommends increasing the number of rivers that are monitored or modeled to forecast water quantity. We also recommend using Geographic Information Systems, precipitation and flood frequency studies, new hydrologic and hydraulic models, and advanced remote sensing tools to develop new forms of gridded forecasts as tools for non-gauged areas. We need better research to understand how freshwater input influences ocean currents and properties and how these characteristics and interactions may be expected to change with various potential climate scenarios.

We recommend updating the presently outdated precipitation frequency estimate and using it as a baseline for monitoring climate change. The State of Alaska should meet with federal agencies to design appropriate regional climate service products for Alaska. Increased knowledge of this nature will provide the state and coastal villages with information necessary for village relocation projects due to hydrologic, glacial, or sea level threats.

The Alaska Department of Transportation and Public Facilities, boroughs, and municipalities benefit from long-term hydrologic monitoring by using these data to properly construct bridges, culverts, storm water collection and treatment systems, and other roadside drainage features. Undersized bridges

and culverts are prone to damage or destruction in floods thus requiring costly repairs. Undersized storm sewer systems can lead to unsafe driving conditions and ineffective storm water management. Oversized bridges, culverts, and other drainage structures have unnecessarily high construction costs. Furthermore, this same information can benefit zoning decisions, thus saving life and property by ensuring Alaskans are not building in a previously-unrecognized floodplain. Finally, a better understanding of Alaska's hydrologic processes will affect both freshwater and marine fisheries management.

PRECIPITATION, DROUGHT, WILDFIRE:

Observed data over the last 30 years show increases in annual surface temperatures, with some of the largest increases occurring on the Alaskan North Slope. As temperatures continue to rise, changes in precipitation and an increase in evapo-transpiration are also expected and permafrost will continue to thaw. This may result in an overall net decrease in stream discharge and a net dryer environment with long-term drought issues which could influence the ability of barges to deliver supplies to those villages located on rivers.

On the flip side, headwater glacier areas are expected to see an increase in stream discharge particularly during the spring and fall months. This increase in temperature may also bring about longer, more severe and more widespread fire seasons in Alaska. Based on annual precipitation much of interior and northern Alaska can be classified as a desert, however due to the approximately six months of freezing temperatures that precipitation is only used by vegetation for the other half of the year. With an extended warm season, the water needs of the vegetation will expand as well and the available moisture may be insufficient.

The Alaska Department of Natural Resources has shown that they can mount a successful initial attack on a small fire with an average cost of \$5,000 dollars per incident, whereas the cost to suppress a well-developed fire in Alaska generally ranges between \$3 million and \$30 million. We recommend research to develop better understanding and forecasts of hydrologic changes in Alaska and how these changes (such as the thawing of permafrost and extended warm seasons) impact such diverse areas as wild fire activity, industrial transport on water and ice, subsistence travel and harvest, and habitat and migration of wildlife.

The Commission further recommends that gridded hydrologic modeling be developed for Alaska, and the tools needed for near and long term drought forecasting be developed. We recommend integrating regional climate information and permafrost hydrology to produce hydrologic response scenarios, as well as improving weather and soil moisture forecasts. Precipitation frequency estimates (PFE) are a climate-related precipitation tool.

The PFE data are commonly used to reduce the risk of runoff-related loss of life and property, and to prevent pollution. They provide rainfall related criteria used extensively by the engineering and environmental communities for the design of structures such as sewers and drainage systems, for environmental studies and design, and for sediment control.

The criteria are used by the FEMA to update National Flood Insurance rate maps and by the Environmental Protection Agency's National Pollution Discharge Elimination System Program to regulate pollution control in streams. The statewide PFE data currently available for Alaska is contained in two reports by the Department of Commerce called Technical Papers 47 and 52, last revised in 1963 and 1965, respectively. NOAA's NWS recent updated analyses in the Lower 48 indicated differences up to 30% between the old and new estimates. The Commission recommends updating these estimates.

PERMAFROST THAW:

Transportation and infrastructure could significantly be impacted by permafrost thaw and glacial melt. Supply routes to remote inland towns are threatened where there are no roads for use in the summer, such as places dependent on ice roads and/or river-based resupply routes (too little precipitation or too much glacial melt). Roads already built might begin to deteriorate beyond use and lakes that supply water to create the "ice roads" may no longer be available, not to mention structural failure of buildings, etc. We recommend improving our monitoring and forecasting of permafrost thaw: where, how much, rate, etc. and rate of glacial melt. This would require expanding existing permafrost and river level/flow observing systems across Alaska and improved permafrost and hydraulic forecast models.

MAPPING:

Accurate shoreline maps are essential in order to develop accurate coastal erosion and storm surge forecasts. Accurate bathymetric (ocean bottom) maps are essential for mapping essential fish habitat, and developing more precise ocean circulation and wave models. We recommend that the federal government increase its program to conduct hydrographic surveys in Alaska to develop accurate bathymetric maps, and that the state and federal agencies develop a plan for a comprehensive shoreline map in Alaska.

FISHERIES RESEARCH PRIORITIES RELATIVE TO CLIMATE CHANGE:

- a. Will earlier sea ice retreat result in a later spring phytoplankton bloom, increased coupling with zooplankton and greater pelagic production, and decreased benthic production?
- b. Will reduced frequency and intensity of summer storms reduce surface mixing, increase stratification, and lead to nutrient depletion and less

phytoplankton production? Will this diminish zooplankton production and thus reduce juvenile fish production and survival?

- c. Will an earlier spring transition change the flow along the Alaska Peninsula and thus transport larvae away from offshore piscivores?
- d. Will increases in piscivorous fish species for forage species lead to a decline in fur seals, murre, and kittiwakes?
- e. How will the food web be affected by increasing populations of humpback and fin whales that both consume and compete with forage fish for zooplankton?
- f. Will Sub-Arctic species expand northward and occupy areas formerly occupied by Arctic species?
- g. Will changes in the cold pool on the Bering Sea shelf remove the barrier to northward migration of various fish species, thus increasing the overlap of inner domain forage fish and outer domain piscivores?
- h. How will potential changes in fish distribution, especially forage populations, impact other fish, seabirds, and marine mammals?
- i. Will expected decreased benthic productivity negatively affect feeding and survival of small flatfish and crab and even bottom-feeding marine mammals such as walrus?
- j. Will there be an increase in certain predatory fish such as arrowtooth flounders that have no value to the commercial fisheries? How will they impact the commercial stocks?
- k. Will certain predictable foraging hotspots change location, thus favoring or disadvantaging various seabird and marine mammal foragers?
- l. Will these marine mammal (e.g. fur seals) and seabird populations then change in abundance or location, possibly exposing them to added predation by apex predators (e.g. killer whales)?

NEXT STEPS:

The following recommendations represent the next steps which the Alaska State Legislature may wish to pursue to further the ability of the State of Alaska and the residents of the many cities and villages throughout the state to better prepare for changing climate conditions. Recommendations are made as a function of testimony received or information gleaned from others in the pursuit of Commission responsibilities. The Commission has not limited its recommendations on the basis of any potential need for either state or federal funding, but has left that prioritization to the public processes involved with appropriation matters.

1. NEED A COORDINATED PROCESS FOR VILLAGE RELOCATION EFFORT

The Alaska State legislature should work with the state administration, the Denali Commission, and the U.S. Army Corps of Engineers (COE) to develop criteria by which a community is identified as "at risk" and in need of relocation due to erosion or other potential damage as a result of climate change. These same parties should identify an appropriate entity to coordinate village relocation efforts. The criteria should also allow identification of other communities where the need does not rise to the level of relocation but does require funding for "mitigation/protection" efforts to protect the existing community. Once a community is identified as "at risk" or in need of mitigation/protection efforts, a central coordinating body needs work with the affected community to identify potential funding sources and navigate the maze of documentation requirements for financial assistance.

Once the coordinating body has been identified, and the criteria determining "at risk" and in need of "mitigation/protection" has been established, a statutory change may be needed to clearly identify the duties and responsibilities of the agency so designated as the coordinating body for this purpose. As part of the same legislation, the review process should be clearly delineated. The coordinating agency should be directed to provide a report to the legislature identifying the outcome of the review process with a prioritized request for funding needs that cannot be met through existing state and federal resources, on an annual basis.

Federal funds available for community assistance will likely require a local match. Most of the affected communities do not have the resources to match federal funding. Therefore, a funding mechanism that is reliable must be developed for rural communities in peril from coastal erosion to provide the needed local match funding. This could take the direction of multi-year block grant program to award matching funds to rural communities recognized by the COE as in need of structural and non-structural projects for storm damage prevention and reduction, coastal erosion, and ice and glacial damage in

Alaska. This would include the relocation of affected communities and construction of replacement facilities.

2. CAPITAL PROJECT PLANNING

The Alaska State Legislature should review existing capital planning statutes to determine if amendments are necessary to assure that infrastructure planning, mediation, and replacement all take into account the potential future impacts as a result of climate change. Engineering designs must incorporate best available and proven practices in the Arctic, and project specifications must reflect that requirement for purposes of selecting contractors for state projects. Standards should be developed in conjunction with other public and private entities engaged in engineering in the Arctic to assure that best practices are reflected. In prioritization of major maintenance needs, climate change mitigation should receive consideration in determining a project's placement on the priority list.

3. FEDERAL EFFORTS

The warming of the Arctic is creating an increase in traffic as sea ice retreats for longer periods of time each year. This increase in traffic creates possible public safety concerns that are more appropriately the concern of the federal government. The Alaska State Legislature may wish to develop resolutions demonstrating support for the following federal efforts:

- a. **COASTAL MAPPING** needs to be expanded. A proposal to produce an accurate shoreline that can be monitored with GPS technology has been developed by NOAA's National Geodetic Survey. However, no funding has yet been identified.
- b. **TIDE STATIONS.** NOAA's Center for Ocean Observations and Prediction has tide stations in Western Alaska and north on the Bering Sea Coast as far as the Red Dog Mine dock near Kotzebue. Proposals have been developed to create additional tide stations between Nome and Port Moller for Western Alaska and Bristol Bay, and the Red Dog Dock and Prudhoe Bay for Chukchi and Beaufort Sea measurements. Stations are also needed between Barrow and Kaktovik.
- c. **U.S. COAST GUARD PRESENCE.** The USGC has identified the need for a presence, at least in the warmer months, in both Nome and Barrow. USCG operations are needed to assure the safety of commercial fishing operations in the Bering Strait, where foreign fleets operate in close proximity to American vessels. Also, commercial traffic increases throughout the Arctic will likely

result in increased Homeland Security concerns as well as increase the potential for search and rescue activities. Increased funding for USCG operations in Alaska to enable the conduct of these activities, should be supported.

- d. **ICEBREAKERS.** The United States has three icebreakers. Two of the three are approaching the end of their useful life. The icebreakers are the only vessels capable of traversing the Northern Bering Sea and the Arctic Ocean during much of the year. These vessels are also utilized for Arctic research by the National Science Foundation. Replacement of the older vessels has been authorized by Congress but no funding for replacement has been appropriated for that purpose.

4. PUBLIC INFRASTRUCTURE

The Alaska State Legislature should identify the necessary funds to do an assessment of public infrastructure needs for protection against possible loss due to erosion and the loss of permafrost. It is possible that with identification, infrastructure can be retrofitted to continue to safely function even under changing climate conditions. Priority should be given to assessment of schools, bulk fuel storage facilities, and transportation infrastructure (highways and aviation). Funding for remediation of existing facilities should be given priority in future capital planning.

Failing water and sewage systems could create significant public health hazards. It may be more difficult to identify where systems are at risk of failure than with other public infrastructure. However, the state must be positioned to address such failure immediately to avoid public health threats to small rural communities. This may require an emergency fund be established and funded specifically designed for such a purpose.

5. RESIDENTIAL NEEDS

The Alaska State Legislature should work with the Alaska Housing Finance Corporation to modify existing and/or develop a new low interest loan program (and identify funding needs) to allow loans to home and business owners to make necessary modifications to protect structures from the loss of permafrost and other conditions exacerbated by warming conditions. Loan limits need to be realistically designed to address retrofit of existing structures.

6. RESEARCH

The Alaska State Legislature should support continued research efforts for the study of the Arctic and the effects of climate change. It is important that research efforts be coordinated between state, federal, university, and

private activities in order to maximize the benefits of these efforts and minimize duplication. Research efforts must be catalogued and easily accessible by all interested parties. Research funds provided the University of Alaska specifically for Arctic Climate research should be targeted to research establishing baseline data and address gaps in knowledge regarding Alaska and climate change impacts.

7. CONTINUATION OF CLIMATE CHANGE EFFORTS

The Alaska Climate Impact Assessment Commission concluded that continued identification of potential challenges, threats, and planned responses needs to occur with the Administration. It is felt that this will enhance the development of policy, prioritization of responses, and, in turn, lead to development of funding priorities, program management, and inter-agency collaboration, especially with federal agencies. The Commission supports the organizational, professional and tenured capabilities of the Sub-Cabinet for Climate Change created by the current administration. However, sub-cabinets have no guaranteed existence beyond the administration establishing them. Therefore, the Alaska State Legislature should work with the current administration to create legislation establishing the sub-cabinet approach as a recognized state council, with organization, duties, and responsibilities mirroring the current sub-cabinet structure and activities.

ATTACHMENT A

**STATE OF ALASKA
THE LEGISLATURE**

2006

Source
SCS CSHCR 30(FIN)

**Legislative
Resolve No.**
49



Creating an Alaska Climate Impact Assessment Commission.

BE IT RESOLVED BY THE LEGISLATURE OF THE STATE OF ALASKA:

WHEREAS recent weather patterns have created warming trends that have jeopardized the health and well-being of residents of communities and the natural resources on which they rely; and

WHEREAS flooding and erosion negatively affect coastal and river communities in both rural and urban areas of the state; and

WHEREAS coastal communities are negatively affected by flooding and erosion because of delayed formation of protective shore ice in the fall; and

WHEREAS communities along riverbanks or in river deltas are more susceptible to flooding and erosion caused by ice jams, snow and glacial melts, rising sea levels, changing river patterns, and heavier rainfall; and

WHEREAS permafrost is found beneath approximately 80 percent of the state; and

WHEREAS, in recent years, there has been widespread thawing of permafrost in some areas, causing land to slump and erode, which in turn has caused serious damage to roads, buildings, and other infrastructure; and

WHEREAS the thawing of the permafrost is likely to continue, which will have a continuing negative effect on future structures and development; and

WHEREAS fish and wildlife habitats are changing, affecting the accessibility and viability of certain species; and

WHEREAS resource development and the revenue it generates are potentially negatively affected by the effects of climate change; and

WHEREAS the rapidly retreating sea ice affects polar route navigation and has raised security concerns; and

WHEREAS the state has only one employee working on these issues; and

WHEREAS, although the Arctic Climate Impact Assessment provides the necessary scientific foundation to assess current effects of climate change in the Arctic, it does not address the economic effects of climate change on the State of Alaska; and

WHEREAS a comprehensive plan to address these issues, prevent or mitigate negative effects of climate change, and address economic effects on the state will help save lives, protect public health, preserve economic and resource development, and protect valuable infrastructure;

BE IT RESOLVED by the Alaska State Legislature that there is created an Alaska Climate Impact Assessment Commission; and be it

FURTHER RESOLVED that the commission shall consist of 11 members as follows:

- (1) two senators appointed by the president of the senate;
- (2) two representatives appointed by the speaker of the house of representatives; and
- (3) seven public members appointed jointly by the president of the senate and the speaker of the house of representatives consisting of
 - (A) one member with expertise in climatology or knowledgeable in the area of oceanography;
 - (B) one member who is knowledgeable about Alaska's economy;
 - (C) one member who is knowledgeable in the area of land management or restoration of wildlife and natural resources;
 - (D) one member experienced in arctic and sub-arctic engineering

requirements for public highway and facility construction and maintenance;

(E) a recognized local expert representing affected Alaska communities;

(F) one member who represents affected resource development industries;

(G) one member who represents the affected tourism industries; and be it

FURTHER RESOLVED that the task force shall select a chairperson from among members of the legislature; and be it

FURTHER RESOLVED that the public members of the commission may receive compensation for per diem or reimbursement for travel or other expenses incurred in serving on the commission; and be it

FURTHER RESOLVED that the commission may meet during and between legislative sessions; and be it

FURTHER RESOLVED that the House and Senate Resources Committees may assign committee staff to provide support services for the commission; and be it

FURTHER RESOLVED that the duties of the commission include the following:

(1) assess the current and potential effects of climate warming trends on the citizens, natural resources, public health, and economy of the state, in particular the adverse effects on natural resource development, forest safety, fish and game utilization, transportation, community, and resource development infrastructures;

(2) estimate costs to the state and its citizens of adverse effects associated with climate change;

(3) identify specific circumstances of flooding and erosion that have affected life, property, and economic and resource development in the state;

(4) examine alternative measures to prevent and mitigate the effects of flooding and erosion;

(5) develop policies to guide infrastructure investments in Alaska villages, cities, and boroughs that are most affected by flooding and erosion;

(6) recommend land use regulations, including area standards for designation of land prone to flooding and erosion;

(7) investigate and assess issues involving permafrost and damage caused by permafrost;

(8) recommend policies to decrease the negative effects of climate change; and

(9) identify and coordinate efforts of mutual concern with federal, state, and local agencies; and be it

FURTHER RESOLVED that the commission shall offer recommendations and provide possible solutions and preventative measures that can be implemented by Alaska communities and by the state and federal governments; and be it

FURTHER RESOLVED that the commission shall conduct eight hearings throughout the state to fulfill its purpose; and be it

FURTHER RESOLVED that the commission shall deliver a preliminary report of its findings to the legislature on March 1, 2007, and make a final report to the legislature on January 10, 2008, together with legislative proposals for consideration; and be it

FURTHER RESOLVED that the commission shall be available for legislative hearing on its final report and recommendations; and be it

FURTHER RESOLVED that the continuation or termination of the commission shall be reevaluated at the Second Regular Session of the Twenty-Fifth Alaska State Legislature.

ATTACHMENT B

ALASKA CLIMATE IMPACT ASSESSMENT COMMISSION

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ATTACHMENT C



AK Climate Impact Assessment Commission

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PRELIMINARY REPORT TO THE LEGISLATURE

March 1, 2007

SUMMARY:

HCR 30 (Legislative Resolve 49 / 2006) established the Alaska Climate Impact Assessment Commission and charged it with assessing such effects under climate change in the Arctic, as would affect the citizens, resources, economy, and assets of the State of Alaska. The Commission is composed of two state House members, two state Senators, and seven public members appointed to specifically-defined seats, focusing on climatology/oceanography, communities, tourism, resource development, the economy, engineering/construction/ maintenance, and fish/wildlife/land management issues. Existing legislative staff has been tasked with supporting the work of the Commission. Authorized expenses include travel, per diem, and supplies.

The Commission is to hold at least eight public hearings throughout Alaska, and issue a report of its findings to the Legislature on January 10, 2008. To date, the Commission has held an organizing meeting, and two public hearings. The two public hearings, one each in Fairbanks and Juneau, were composed of invited professional testimony and open public testimony.

The Fairbanks hearing was held on the campus of the University of Alaska, and emphasized a scientific overview of the major climate change issues affecting Alaska. The Juneau public hearing emphasized state agency perceptions of state responsibilities, and in some cases, operational changes which are already underway due to climate warming in the Arctic. An Anchorage public hearing is scheduled for April, and the Commission will soon plan hearings to be held in rural Alaskan communities over the course of the summer and autumn.

The Commission considers existing evidence for Arctic warming trends sufficient to pursue its charge under HCR 30. Current science and climatology indicate that Alaska is a bellwether for climate change in the United States. Commission activities to date have focused on gathering and exchanging information, including anecdotal information, and evaluating it in terms of the Commission's responsibilities. The Commission will necessarily limit the scope of its investigation to provisions in HCR 30; it is not equipped to engage in major academic discourse on many of the unresolved issues within the climate change arena. Along with evaluating public testimony, the Commission has already begun discussing the framework of its final report due next year.

Commission members have participated in other climate change forums, including those organized by the Alaska Federation of Natives, the Alaska Center for Climate Assessment and Policy and the Department of Engineering at the University of Alaska (Anchorage), the Anchorage Business Roundtable and Resource Development Council, the 7th International Conference on Climate Change at the University of Alaska (Fairbanks), and upcoming, the Society of American Military Engineers and the Warming Oceans Forum to be held during the ComFish Alaska exposition in Kodiak. Other opportunities are anticipated throughout 2007.

SCOPE OF RESPONSIBILITIES:

Under HCR 30, the Commission will assess the effects of warming trends on the citizens, natural resources, public health, economy, natural resource development, forest safety, fish and game utilization, transportation, communities, and resource development infrastructures. It is to estimate the costs of adverse climate change to our citizens and the state, recommend policy and regulatory changes, and identify and coordinate efforts of mutual concern with federal, state, and local entities.

In addition, the Commission will more specifically assess problems caused by flooding, erosion, and permafrost melt. To this end, it will identify specific circumstances of flooding and erosion where these affect life, property, economies, and resource development. The Commission is also obliged to examine prevention and mitigation measures for flooding and erosion problems. It may also recommend land use regulations, including standards for the designation of land prone to erosion and flooding.

DRAFT ACTION PLAN:

Over the remainder of 2007, the Commission will continue gathering and prioritizing information, participating in other public climate change forums, and preparing information for its final report. The Commission is already evaluating reporting formats from other governmental bodies and other relevant entities. The Commission's responsibilities will be viewed in the following major interest areas (not prioritized):

- 1) public health and communities (health, municipal impacts)
- 2) fish and game impacts (commercial, sport, subsistence)
- 3) forest impacts (state and federal assets, wildfire suppression, related economic issues)
- 4) economic impacts (tourism, construction, transportation, insurance, federal spending, agriculture, and flooding/erosion/permafrost damage)
- 5) resource development (oil and gas, mining, support industries)
- 6) policy and regulatory aspects (land use, alternative energy, other legislation / regulation changes)
- 7) state assets at risk (harbors, bridges, roadways, airports, parks)

OBSERVATIONS FROM ALASKANS:

A sampling of observations by Alaskans thus far conveys the diversity of impacts being felt by citizens and communities: Unusual, double-crops of blueberries in the Interior; salmon stocks and other species moving northward; waning birch forests in the Interior and declining yellow cedar stocks in the Southeast; increased frequency and intensity of wildfires; negative implications for continued insurance protection for coastal and riverine communities affected by storm surge, flooding, and erosion; a lack of adequate federal, state, or local data for mapping Alaska's areas at risk; emerging impact costs for state infrastructure; and the need for interagency coordination between local, state, and federal officials, including specially chartered entities such as the Denali Commission. These are but a few of the manifestations of climate change which have come forward.

LOOKING AHEAD:

It is expected that the Anchorage public hearing will offer insight from resource extraction industries, construction and engineering interests, research entities, and federal agencies, to name a few.

As the Commission anticipates public hearings in rural areas, particularly in coastal areas, it expects to concentrate in some detail, on flooding and erosion issues, impacts on the subsistence lifestyle, threats to small communities, and fish and game resources.

Ultimately, the biggest challenge facing the Commission will be to focus on and prioritize those issues within the scope of Arctic climate change, which most substantially impact the state, its people, and its economy. Consolidating the panel's findings into useful, relevant information will remain our objective. The potential exists for some measure of positive economic change due to Arctic climate warming. Although speculative, benefits may be seen in Alaska's fisheries, agriculture, and academic research fields, among others.

ATTACHMENT D

Alaska Climate Impact Assessment Commission

INVITED SPEAKER CONTACT INFORMATION

FAIRBANKS PROGRAM (December 7 & 8, 2006)

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Alaska Climate Impact Assessment Commission

INVITED SPEAKER CONTACT INFORMATION

JUNEAU PROGRAM (January 24, 2007)

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Alaska Climate Impact Assessment Commission

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Alaska Climate Impact Assessment Commission

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Alaska Climate Impact Assessment Commission

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Alaska Climate Impact Assessment Commission

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ATTACHMENT E

CLIMATE IMPACT ASSESSMENT COMMISSION

Final Report Site

http://www.housemajority.org/coms/cli/cli_finalreport_20080301.pdf

Public Hearing Information Sites

http://www.housemajority.org/coms/cli/cli_readingfile.php is the site to access documents, resolutions, reports, a copy of HCR 30, a list of commissioners, and the preliminary report.

http://www.housemajority.org/coms/cli/cli_fairbanks.php has the power point presentations from the Fairbanks public hearing.

http://www.housemajority.org/coms/cli/cli_juneau.php has the power point presentations from the Juneau public hearing.

http://www.housemajority.org/coms/cli/cli_anchorage_01.php has the power point presentations from the Anchorage public hearing of April 12 & 13.

http://www.housemajority.org/coms/cli/cli_kotzebue.php has the power point presentations from the Kotzebue public hearing, and an audio record of the hearing.

http://www.housemajority.org/coms/cli/cli_barrow.php has information from the Barrow public hearing (contains only one power point presentation).

http://www.housemajority.org/coms/cli/cli_anchorage_02.php has the power points and other information from the final public hearing, held in Anchorage on October 10.

AUDIO RECORDINGS OF ALL BUT THE KOTZEBUE PUBLIC HEARING MAY BE FOUND AT:

<http://old-mp.legis.state.ak.us/>

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ATTACHMENT F

STATE OF ALASKA

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February 15, 2008

The Honorable Ralph Samuels
Chair, Alaska Climate Impact Assessment Commission
Alaska State Capitol, Room 204
Juneau, AK 99801-1182

Dear Representative Samuels:

Please find enclosed the responses prepared by the following state agencies to your questions regarding the possible impacts of climate change:

Department of Natural Resources (DNR)
Department of Environmental Conservation (DEC)
Department of Health and Social Services (DHSS)
Department of Fish & Game (DFG)
Department of Commerce Community & Economic Development (DCCED)
Department of Transportation & Public Facilities (DOT/PF)
Department of Military & Veteran Affairs (DMVA)

Each agency prepared its own response. If you have any questions concerning a response, please contact the agency who prepared it. Please call me if you have any questions regarding the work of the Governor's Alaska Climate Change Sub-Cabinet.

As you know, in September 2007, Governor Palin signed Administrative Order 238 establishing the Alaska Climate Change Sub-cabinet. The Sub-cabinet is comprised of the commissioners of DNR, DEC, DFG, DCCED and DOT/PF. Liaisons from the Governor's office and the University of Alaska participate in Sub-cabinet meetings. DEC chairs the Sub-cabinet.

The Sub-cabinet is charged with making recommendations to Governor Palin on an Alaska Climate Change Strategy. This strategy is to include measures the state can take to: 1) build its knowledge regarding climate change; 2) avoid or adapt to the predicted effects of climate change; and, 3) mitigate the causes of climate change, through energy conservation and the use of alternative and renewable energy sources. The Sub-cabinet is to also to make recommendations to the Governor on new economic opportunities associated with addressing climate change. This includes commercialization of North Slope natural gas as a low-carbon energy source.

The Sub-cabinet is to give priority to developing a strategy for addressing the needs of Alaska's most at-risk communities. To this end, the Sub-cabinet formed the "Immediate Action Work Group" consisting of senior management from federal and state agencies with expertise and experience regarding capital projects in rural Alaska. This work group will be issuing a report in the next few weeks addressing the erosion and flooding risks threatening the villages of Newtok, Shismaref, Kivalina, Shaktoolik and Unalakleet. It may include other, more general recommendations, such as ways of lowering both capital and operating costs for public infrastructure in these and other similarly situated villages.

DCCED is the state agency taking the lead on working with the affected villages. They are establishing points of contact in these villages and designating a single point of contact at DCCED. The Governor has included a budget request of \$1,100,000 for DCCED to be used in providing planning assistance to these villages. This planning assistance will include helping villages that may be threatened in the near-term to define their needs and communicate with the agencies that might help them address their needs. The list of villages needing both short-term and long-term assistance will certainly expand beyond the five communities named above. Meetings of the Sub-cabinet and workgroups (described below) help assure coordination among the agencies providing services to the at-risk villages.

There may be some actions necessary to address imminent life, health and safety risks. We anticipate most, if not all, capital budget requests coming from the agencies relating to short-term needs will start to appear in the FY 2010 budget. This will allow some needed time for planning and prioritizing projects.

At a November 2007 "roundtable" meeting of federal and state agencies with representatives from communities threatened by coastal erosion and flooding, Senator Ted Stevens stressed the need for the agencies to work together to timely meet the needs of the at-risk villages. He noted that it would take a federal/state partnership. We have also heard Senator Stevens and representatives from federal agencies say it is more likely federal money will be obtained for projects in Alaska if there is state or local matching money for these projects.

The Sub-cabinet will first be looking to existing programs and budgets to see what can be directed to addressing the needs of at-risk communities. For instance, DEC's Village Safe Water (VSW) program uses state and federal funds (typically 75% federal and 25% state) to provide drinking water and sanitation to rural communities. Funds from this program could be available to assist with the relocation of Newtok, a village that very likely has no other choice but to move. However, the VSW funds could only be used for water and sewer projects. Other sources of funds would have to be found for other infrastructure and housing. Additionally, planning money would be needed to coordinate all of the contributions of the various federal and state agencies. The various federal and state programs that might provide resources are not currently structured to work neatly together to construct a new community. This will be a challenge. In some instances it may be necessary to look at regulatory or statutory changes to make these programs more responsive to the needs of the at-risk communities.

The Sub-cabinet is also creating advisory and technical work groups to provide public and expert input to the Sub-cabinet on climate change issues. An "Adaptation Advisory Group" comprised of 20-25 members from federal, state and local agencies, Tribes and individual citizens will identify and evaluate measures the state might take to better prepare for a warming environment. A "Mitigation Advisory Group" of similar size and composition, will make recommendations to the Sub-cabinet on ways the state, industry and individuals might lower greenhouse gas emissions. Again, this will include looking at energy conservation, and the use of alternative and renewable energy. It is a goal of the Sub-cabinet to find "win-win" situations, where the cost of energy is lowered along with the emissions of greenhouse gases. The Sub-cabinet looks forward to coordinate its efforts with those of the Governor's new energy coordinator.

The Adaptation and Mitigation Advisory Groups will be supported by and receive recommendations from Technical Work Groups. There will be approximately five Technical Work Groups under each Advisory Group. The Technical Work Groups will be comprised of persons with expertise and experience in particular areas relevant to the work of the Advisory Groups. The Advisory and Technical Work Groups will be provided logistical and technical support through the agencies, the University of Alaska, several outside non-profits and a local facilitator. The work groups will be start meeting in March 2008 with the goal of having their recommendations to the Sub-cabinet within one year. These recommendations will be considered by the Sub-cabinet in making its recommendations to the Governor. Prior to making its recommendations to the Governor, the Sub-cabinet plans to hold public meetings to review and take input on its draft recommendations. To support the work group process, the Governor has requested \$230,000 for DEC in the supplemental budget. It should be noted additional funding for this effort is being provided by outside foundations and in-kind contributions from the University of Alaska.

It is important to recognize there is a considerable amount of work that is being done around the state by government, Tribal organizations, non-profits, industry and individuals that is already addressing climate change. The Alaska Climate Change Strategy will support and build on the beneficial work that is already being done.

On behalf of the Sub-cabinet, I would like to express our appreciation of the work of the Alaska Climate Impact Assessment Commission. We look forward to receiving your report. Please let me know if there is any additional information the Sub-cabinet can provide that might be helpful to the Commission in finalizing its report.

Sincerely,



Larry Hartig
Commissioner & Chair of the Governor's
Climate Change Sub-cabinet

cc: The Honorable Sarah Palin, Governor
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STATE OF ALASKA

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February 15, 2008

The Honorable Ralph Samuels
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Alaska State Capitol, Room 204
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Representative Samuels:

Your letter of December 20, 2007 is a welcomed opportunity for the Alaska Department of Environmental Conservation (DEC) to provide relevant information for consideration by the Climate Impact Assessment Commission. I appreciate this opportunity and offer any further assistance you believe might be helpful to the Commission in finalizing its report.

You may recall that various DEC directors testified before the Commission last January. We continue to progress in our understanding of climate change issues. The predictions presented in this letter capture our current assessment of potential near-term and potential long-term impacts. While today's communication goes beyond the issues we presented last January, the Commission may wish to refer to the January 2007 presentation for the additional value gained from its photos and charts.

In this letter we describe the possible impacts on DEC's environmental management duties and projects. We also note possible impacts on community and private sector interests. Identifying future costs associated with projected impacts is speculative, but we can confidently say there will be impacts. The data and models to project climate change and forecast its impacts in our geographically expansive and ecologically diverse state are quite immature. Undoubtedly, the scientific data and projections tools of the future will markedly improve our ability to understand and forecast the climatic changes and associated impacts in Alaska.

Key Near-Term Impacts for the Department of Environmental Conservation

- **Threats to community infrastructure.** Erosion and permafrost thawing / subsidence have and will continue to threaten state, community and private sector investments. For DEC, direct state investments are numerous public drinking water and sewer systems with piping and associated treatment facilities.

Private sector or community based investments include shore-line based fuel delivery, storage and electrical power generation.

DEC is addressing these threats through prevention and adaptation strategies. DEC has already assisted villages through feasibility studies and master plans that address the mitigating actions needed to prevent damage caused by climate change to their water and sewer systems. Also, DEC has started adapting to changes in climate by proposing alternative design approaches to reduce and eliminate risks to future facilities, such as the Buckland Piped Water and Sewer Project. As a point of reference, the community of Newtok (70 homes) is relocating to a new site of Martarvik. DEC's village safe water program estimates a new water and sewer infrastructure will cost \$12 to 21 million depending upon the type of system and design details.

DEC's spill prevention and response workload is also increasing due to increased risk of fuel spills where erosion or thawing threatens the structural integrity of fuel storage tanks and piping systems. The most recent example was last fall in Kivalina when several fuel storage tanks had to be emptied and relocated inland at a cost of \$575,000 to the Alaska Village Electric Cooperative.

- **Oil spill risks in new areas.** DEC and other agencies are witnessing increased marine vessel traffic in the Northern Bering Sea and the Chukchi Sea. Receding sea ice is opening the waters for greater use by the merchant marine trade. In a nutshell, the Bering and Chukchi seas are becoming active year-round marine waterways supported by the northern expansion of commercial fisheries, a strong interest in off-shore petroleum exploration and development, and a stronger reliance on merchant marine operators to support the industrial and community needs of northwest Alaska and Siberia. Many marine operators in these areas currently do not have the spill prevention and response plans. Moreover the region generally lacks the equipment resources and support services comparable to those in the Alaska gulf coast, Prince William Sound and Cook Inlet areas. We expect DEC's spill prevention and response workload to increase along with the need for private sector based supporting operations and facilities. In order to fully evaluate the risk posed by maritime transportation expansion in the arctic, a risk assessment similar to the one currently underway for the Aleutians may be necessary. The Aleutian risk assessment is estimated to cost \$3.2 million dollars, which does not include costs for implementing risk mitigation measures.
- **Wildfires are increasing smoke pollution, changing the forest ecology and threatening safety of life and structures.** Major increases in the number, size and season for wildfires were documented in 2004 and 2005 as presented in DNR's response. For DEC, wildland fire smoke is now a far more frequent and serious public health threat for residents throughout Alaska. Smoke pollution conditions in the summer of 2004 were classified as "hazardous" in Fairbanks and other interior villages with pollution exposure far worse than most of the dirtiest cities in the U.S. Some people left town for short or seasonal respites from

the pollution. Since 2004, DEC has shifted 2 staff positions to fire support, hired new pollution forecasting expertise, purchased mobile air monitoring systems and now routinely engages in smoke pollution forecasting and portable monitoring during the fire season.

We are unable to quantify what the health costs are to Alaskans in the form of increased doctor visits, increased use of medication, new illnesses caused by this pollution or number of people experiencing respiratory incidents (i.e. asthma attacks) triggered by fire smoke. What we can say is that recent medical science shows far greater health impacts from fine particle pollution (the primary pollutant of concern in smoke) than previously thought. The medical research stimulated EPA to tighten, by approximately 50%, the national health standard for airborne fine particles in 2006.

Smoke pollution also impacts the state's tourist industry causing potential health risks to visitors, reducing vistas and visitor enjoyment of Alaska

- **New pathogens in animals, fish, wildlife, commercial foods and crops.**

The combination of a global economy and a warming climate brings new species to our state, some of which directly affect the foods we consume and the food products we sell. New infectious diseases (viruses, bacteria, fungi) and parasites will find a naïve vulnerable population unable to defend itself against the invasion. Impacts to aquatic and terrestrial ecosystems will result in subsequent impacts to people, plants and animals. Some naturally occurring species, such as spruce bark beetles, can have a far greater consequential impact to the ecology when a warmer environment supports greater survivability and propagation. Colder temperatures were once protection from pathogens such as West Nile Virus (affecting birds, horses, and caribou), Blue tongue (virus affecting sheep, deer, caribou and cattle), Viral Hemorrhagic Septicemia Virus (viral disease of fish), Ichthyophonus Hoferi (parasite infecting salmon) and Cryptococcus Gatti (tropical fungus affecting both animals and humans, now found in the Pacific Northwest and Vancouver). We are now finding infections caused by these diseases in animals and people farther north than ever previously reported.

DEC's environmental health laboratory is responsible for ensuring the safety of our food products. The state veterinarian, located at DEC, is responsible for the safety of domestic animals and advising and protecting the public from diseases carried by wild animals, fish and birds. As noted in the Health Department letter, the 2004 shellfish outbreak of *Vibrio parahaemolyticus* was linked to warmer ocean waters. Warmer temperatures are associated with an increase in the detection of saxotoxins, like paralytic shell fish poisoning, in Alaskan shellfish. These outbreaks cause significant economic harm to aquaculture and place an increased workload on DEC for laboratory testing of shellfish. DEC's work includes coordination with the Health department on numerous advisories to minimize public exposure to these threats. It is reasonable to expect that Alaska

will witness increasing incidences of other infectious diseases, such as West Nile virus, as the climate continues to warm.

- **Warmer freshwater systems and estuaries are threatening the health and productivity of our fisheries.** A changing climate is raising the water temperature of our lakes, streams, rivers and estuaries. DEC implements water quality standards by setting temperature limits to protect the spawning and rearing habitat of salmon and other fish.

A decade long measurement program of Kenai Peninsula area streams and rivers shows rising temperatures during spawning season that approach and exceed the established standard. Part of the warming is due to a spruce forest die-off resulting in loss of shade over stretches of the waterway causing increased sun exposure and air temperatures. The spruce forest die-off caused by a bark beetle infestation has been linked to a warmer climate. Many silvaculture scientists believe our spruce forest is ecologically giving way to grasslands.

The data collection is most robust for Kenai area waterbodies. Although DEC also has other stream temperature data (mostly in the Cook Inlet region), it is not sufficient to assess the overall state-wide trends for water temperature increases, or to assess the statewide threat for salmon habitat. Warmer waters in coastal Alaska may be one factor explaining the observed northern migration of some salmon and other fish species. DEC's Division of Water is working with DFG and DNR in the Alaska Clean Water Actions (ACWA) program to prioritize and establish long-term water monitoring efforts to track temperature changes over time. Through ACWA, DEC will develop strategies and decision making tools for waterway protection to mitigate some of the impact of stream-side ecological changes.

It is yet more challenging to assess the water quality and subsequent threat to fish habitat that may result from changes in precipitation patterns, glacier melt rates and resultant heavy rivers flows and water quality and downstream salinity conditions in our coastal estuaries. Coastal estuaries are prime rearing and maturing grounds for commercial and subsistence fisheries. The climate change models foretell that changes are underway, but the projections of the global climate models are simply not mature enough for projecting changes at sub-regional scale within Alaska. To be able to assess consequences for our freshwater systems and coastal estuaries, DEC will be determining and monitoring key climate change indicators

- **Field monitoring of baseline conditions is essential for future decisions.** Because there will never be sufficient financial resources to address all of the adaptation needs as warming continues, wise decision making will be a triage of assessing and re-assessing the most urgent needs for decades to come. It is imperative that field measurements be strategically undertaken and integrate with predictive scientific tools so that forecasted consequences of climate change can

be juxtaposed to field trend data. The combined result of applying the best forecasting models with real world field data will minimize the misdirection of funds and improve the potential for addressing the most consequential impacts in a timely fashion. The letters from other agencies, most notably DNR and DOTPF, reinforce the importance of baseline field data.

- **Climate Change project is affecting DEC's staffing.** As the chair agency for the Governor's Sub-cabinet on Climate Change, DEC has shifted duties for a few key staff to undertake this planning project. The Commissioner has re-directed some staff assignments but has not added new staff for this project. Much of the work to be accomplished in FY 2008 and 2009 will be done with the aid of work groups consisting of agency staff and members of the public. Logistical and technical support will be provided to the work groups by the University of Alaska, agency staff and through contractors largely financed by available grant funds. A supplemental budget request by DEC for \$230,000 was recently submitted to the Legislature. This funding request will leverage in excess of \$1 million available through grant sources. The supplemental budget request does not include monies for DEC staff funding and no new positions are created.

The Commissioner and the Director of the Division of Air Quality are the Governor's observers for the Western Climate Initiative (WCI). Under the WCI a growing number of western states and Canadian provinces have agreed to design a cap and trade program to reduce greenhouse gas emissions in all 'partner' states and provinces. The WCI forum is important because it is a large block of states designing the substantive details of a legal framework for climate change laws. These legal foundations may also become some of the underpinnings surfacing in federal bills. If Alaska is to have an influential voice in this forum, it would be necessary to increase the state's investment of time in this process. A good understanding of any cap and trade program will aid the State of Alaska in considering whether to join the WCI as a "partner" and in evaluating similar cap and trade programs that might be part of proposed federal legislation. A good understanding of regional and national discussions on greenhouse gas emissions, and possible alternative "cleaner" energy sources may provide valuable input into an integrated energy policy for Alaska.

It is expected that Congress will enact climate change legislation in the next one to three years. When enacted, the legislation will likely add significant new work at DEC. Most predictably, but not exclusively, in air quality permitting to manage greenhouse gas emissions. However, until the Congressional debate is further matured, it is not possible to provide a firm projection of the workload increase, but we know it will increase.

- **Climate Change laws could positively affect market demands for Alaska natural gas, renewable energy growth and clean fuels from coal.** All bills under discussion in Congress, in one manner or another, reduce carbon emissions from fuel combustion. A carbon constrained fuel market will favor low

carbon natural gas and likely increase the U.S. demand for gas through reduced reliance on coal and oil fuels. Other financial incentives considered in federal legislation may favorably reduce or subsidize development costs for renewable energy projects suitable for rural and urban / railbelt Alaska. Alaska has a large, unrealized potential for wind, hydro and geothermal energy that could favorably benefit from congressional incentives. Alaska's coal resources, especially Cook Inlet area, could also favorably benefit through incentives for new clean coal technologies where sequestering the coal's carbon as it is gasified or combusted with subsequent injection into mature oil reservoirs could eliminate greenhouse gas emissions while improving oil field production. The coal sequestration work is gathering much attention nationally, but retains some technological challenges before we expect widespread use.

- Adaptive management will be necessary in DEC's programs. Where changes in environmental conditions are more rapid or severe, it may be necessary to use an adaptive management and permitting strategy to account for these changes in DEC's oversight of the management and disposal of hazardous substances. For example, additional monitoring requirements, which could financially impact permittees, might be required to track alterations a given discharge will have on a changing receiving environment. Changing climate forces will alter the scientific, engineering and health basis for other decisions routinely made by DEC. We expect this to be an adaptive process.

Key Long -Term impacts for the Department of Environmental Conservation

The impacts listed below are possible outcomes of an extended period of warming and other climate forcing parameters beyond the next one to two decades. These projections are speculative, based upon the early inferences about longer term consequences and appropriately warrant a more thorough review with the advent of greater confidence in the predictive models for a changing climate.

- Increased incidents of community, industrial or military landfill sites becoming exposed to surface waters or marine waters through melting permafrost, failure of freeze-back engineering designs, or erosion induced by sea level rise, river floods or storm waves – a public health and environmental contamination risk.
- Increased risk of oil spills in the Beaufort Sea and Arctic Ocean from offshore development and international marine traffic as the Northwest Passage becomes a viable year-round sea route – increases the demand for spill prevention planning and response capabilities at government and private sector operations. Particular emphasis will need to be put towards prevention planning.
- Significant changes in watershed hydraulics with expansive melting of permafrost dominated watersheds could result in large influences to water quality and fish

habitat as permafrost gives way to percolation and aquifer systems hydraulically connected to stream and river channels.

- Warmer temperatures may bring invasive species carrying new diseases increasing the risk of contamination of drinking water supplies.
- Climate change models predict a strengthening of weather extremes. Higher magnitude rain storms in some geographic areas may results in higher flood stages, greater eroding strength leading to water turbidity impacts, riverbank erosion and uplands flooding at river-side communities - resulting in loss of property, damage or failure of infrastructure, fuel spills and sanitation incidents.
- Warmer summer temperatures may result in more air pollution due to atmospheric chemistry reaction driven by temperature. Specifically, many U.S. cities experience seasonal ozone pollution, whereas Alaska is historically cool enough to avoid these photochemical reactions - may result in increased health incidents, greater restrictions or increase costs of pollution control for industrial operations and an expansion of state air pollution control rules.

Please don't hesitate to contact me if you would like additional information.

Sincerely,



Larry Hartig
Commissioner

cc: Climate Change Sub-Cabinet Members



STATE OF ALASKA
DEPARTMENT OF
COMMERCE
COMMUNITY AND
ECONOMIC DEVELOPMENT
Office of the Commissioner

Sarah Palin, Governor
Paul Notti, Commissioner

February 8, 2008

The Honorable Ralph Samuels, Chairman
Alaska Climate Impact Assessment Commission
State Capitol, Room 204
Juneau, AK 99801-1182

Dear Representative Samuels:

In response to your letter dated December 14, 2007, the Department of Commerce, Community and Economic Development (DCCED) has compiled a list of perceived budgetary impacts, rural municipal impacts, and policy and regulatory recommendations relevant to erosion, flooding, and thawing permafrost.

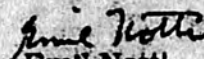
DCCED's mission is to promote a healthy economy and strong communities. The Department is keenly aware of the importance and challenge of this mission in light of the work that the Department is engaged in with Alaska's rural communities. Many communities in the state are currently being impacted by erosion, flooding, and melting permafrost. Perhaps the most severely impacted communities are those located on Alaska's western coast, although riverine communities have been affected by erosion and flooding, and thawing permafrost is impacting communities in Interior Alaska as well. The number of communities impacted by these events is expected to increase in the future.

DCCED Division representatives met recently to discuss the impacts of erosion, flooding, and melting permafrost on the Department's programs and the public we serve. The single broad recommendation that was articulated at this meeting was the need for a statewide comprehensive management plan that provides a framework for the direction the State must take to respond to the climate change related issues of Alaska's communities.

DCCED's response to the budgetary impacts, rural municipal impacts, and policy and regulatory recommendations relevant to erosion, flooding and thawing permafrost, are summarized on the attached pages.

Thank you for giving the Department the opportunity to make recommendations to the Alaska Climate Impact Assessment Commission.

Sincerely,


Emil Nottl
Commissioner

Attachment

BUDGETARY IMPACTS, RURAL MUNICIPAL IMPACTS, AND POLICY AND REGULATORY RECOMMENDATIONS RELEVANT TO EROSION, FLOODING AND THAWING PERMAFROST

IMPACTS ON INFRASTRUCTURE AND BUILDINGS

Thawing of permafrost can lead to ground subsidence, reduced slope stability, increased erosion, landslides, and flooding, all of which can lead to the following impacts to buildings and infrastructure:

- Structural failure in buildings due to thawing of permafrost and melting of ice-covered regions
- Sinking and tilting pilings due to thawing of permafrost and melting of ice-covered regions
- Road damage resulting increased road maintenance costs and major landscape changes from accelerated thawing of permafrost.
- Broken pipelines due to thawing and melting of permafrost and ice-covered regions. For example, as warming continues, the Trans-Alaska Pipeline's support structures, anchored in permafrost and designed for specific temperature ranges, would be affected, costing up to \$800 million to repair.

Many of these issues are already impacting the operations of the Alaska Energy Authority in rural Alaska, necessitating the design of special foundations for new facilities and retrofitting existing facilities to address subsidence issues.

The anticipated budgetary impacts include:

- A need for increased departmental staffing, particularly in the Division of Community and Regional Affairs, to address increased community assistance requests
- Subsequent need for budget increases to address increased community assistance requests
- Increased insurance claims

Anticipated rural community impacts include:

- Deterioration or loss of buildings and critical infrastructure
- Reduced quality of life
- Increased public health problems due to failing water, sewer or fuel facilities.
- Threatened life and property

Policy and regulatory recommendations:

- Encourage incorporated municipalities to utilize land use regulation measures to discourage development in unsuitable areas
- Establish best practices for new development in areas underlain by permafrost

Mitigation Measures:

- Use of special foundations for development in areas underlain by permafrost
- Provide outreach and education to communities regarding best practices

IMPACTS ON COASTAL COMMUNITIES

Sea-level rise is attributed to melting of the arctic ice sheets. Some of the expected impacts of sea-level rise to coastal residents include:

- Increased flooding of low-lying property
- Increasing frequency and severity of storm surges exacerbated by the loss of coastal sea ice.
- Loss of coastal wetlands due to increased beach erosion
- Damage to or loss of infrastructure in coastal areas impacted by erosion and flooding
- Saltwater contamination of drinking water
- Increased need to relocate coastal villages

Several coastal communities are currently experiencing these effects, and the number of villages threatened by severe erosion, storm surge and flooding is expected to increase in the future.

The anticipated budgetary impacts include:

- Need for increased departmental staffing, particularly in the Division of Community and Regional Affairs, to address increased community assistance requests
- Subsequent need for budget increases to address increased community assistance requests, including funding for planning and feasibility studies
- Increased insurance claims

Anticipated rural community impacts include:

- Loss of critical infrastructure
- Impaired delivery of fuel and other critical supplies as critical infrastructure, such as barge landings, is lost
- Increasing costs to community to pay for more expensive delivery of fuels and critical supplies
- Deteriorating infrastructure due to funding agency constraints to invest in threatened villages
- Reduced quality of life
- Increased public health problems due to failing infrastructure, impaired water supplies and poor sanitation, particularly in communities without water/sewer infrastructure

Policy and regulatory recommendations:

- Encourage incorporated municipalities to utilize land use regulation measures to discourage development in the floodplain and areas susceptible to erosion
- Establish best practices for new development in vulnerable areas
- Modify current investment policies to allow for funding infrastructure repairs (or alternative strategies) in threatened communities to maintain acceptable quality of life, while actions (relocation, shoreline protection) are being taken to address threats

Mitigation Measures:

- Elevation of structures built in the floodplain
- Construction of shoreline protection structures (sea walls, gabions, etc) along coastlines susceptible to erosion and storm surge
- Use of each beach nourishment measures when feasible
- Relocation of structures built in areas susceptible to erosion
- Provide outreach and education to communities regarding best practices

IMPACTS ON SUBSISTENCE RESOURCES

Continued thawing of permafrost, and the retreat and thinning of sea ice is likely to cause widespread alterations to the lifecycles, habitats and health of ecosystems of subsistence resources. As habitats change, these populations are likely to undergo dramatic shifts in range and abundance, which in turn will affect communities that are dependant upon subsistence resources.

The anticipated budgetary impacts include:

- Need for increased departmental staffing, especially in the Division of Community and Regional Affairs, to address increased community assistance requests
- Subsequent need for budget increases to address increased community assistance requests

Anticipated rural community impacts include:

- Impaired dietary and economic well-being of subsistence based way of life.
- Loss of traditional meat ice cellars in several northern villages to thaw, making them useless.
- Reduced quality of life

Policy and regulatory recommendations:

- Establish policies to address how the needs of communities with subsistence-based economies will be met

Mitigation Measures:

- Provide technical assistance to communities to develop strategies for dealing with a reduction in subsistence resources
- Build capacity in subsistence-based communities to facilitate economic development in other areas

IMPACTS ON COMMERCIAL FISHERIES

Erosion and melting permafrost could have significant effects on Alaska's lake and riverine fish habitat, which in turn would impact communities and individuals who rely on fisheries resources. Increased stream bank erosion and sedimentation of rivers and streams could alter lake and wetland ecosystems. Additionally, changes in permafrost could alter the lake and wetland ecosystems maintained above the impermeable frost layer.

The stability of many communities and the health of an important sector of the state economy as well as regional and local economies all depend on healthy fish populations and robust commercial fisheries. The seafood industry has billions of dollars of investment riding on healthy commercial fisheries. Specific to DCCED, if fish populations and returns are impacted due to these changes, it could reduce the ability of commercial fisherman to make their fishing loan payments to the Department's fishing loan funds.

Anticipated budgetary impacts include:

- Reduction in the Department's Commercial Fishing Relief income and the earnings of that fund to the General fund.
- Reduction in Fisheries Enhancement Relief income and the earnings of that fund to the General fund

- Reduction in the value of fishing permits and other assets that are held as security for Commercial Fishing Relief and Fisheries Enhancement Relief loans
- Reduced federal funding for Alaska Seafood Marketing promotional efforts

The following rural municipal impacts could result:

- Communities that collect fish taxes would be impacted by decline in gross fishing incomes of fisherman
- Communities with fish processors would be impacted with fewer jobs available for local residents and decreased income for fisherman
- Loss of income in communities who have developed tourism connected with sport fishing

Policy and regulatory recommendations:

- Because the impact to the state's commercial fisheries is a far-reaching issue, policy and regulatory recommendations should be established in a statewide comprehensive management plan

Mitigation Measures:

- Mitigation measures to address climate change related issues should be established in a statewide comprehensive management plan

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER

SARAH PALIN, GOVERNOR

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February 14, 2008

The Honorable Ralph Samuels, Chairman
Alaska Climate Impact Assessment Commission
Alaska House of Representatives
Alaska State Capitol, Room 204
Juneau, AK 99801-1182

Dear Representative Samuels:

As requested in your letter dated December 5, 2007 the Alaska Department of Fish and Game (ADF&G) has identified potential impacts on fish and wildlife populations and their uses due to climate change. Climate change has the potential to positively or negatively impact species, their habitats and/or their food webs, and users of these resources. As a result, we believe management of targeted species may need to become more precautionary because of accelerated changes and increased variability in abundance (i.e., stable ecosystems require the least precaution). Specific impacts we have identified to date are summarized below.

We are currently in the process of prioritizing these impacts and developing budgets to address identified priorities. Unfortunately, we have not progressed sufficiently in this process to report on potential costs. It is our plan to submit needed budget increments to the legislature as part the ADF&G normal budget cycle of future years department budget requests.

Likely Impacts to Commercial, Recreational, and Personal Use Fisheries

- Geographic boundaries of areas opened or closed to fishing may need to be revised as stocks shift in distribution (e.g., northward movement of stocks into the northern Bering Sea and southern Chukchi Sea).
- Extended economic losses are possible as traditional target stocks change in relative abundance and location (e.g., northwestward movement of Bering Sea pollock). This could result in a drop in fish tax revenues, as well as income to fishers and CDQ groups. Economic opportunities may arise, but there may be a time lag prior to capitalizing on these.
- Increases in predatory fish (e.g., arrowtooth flounder, mackerels) may lead to lower guideline harvests for targeted fish (other groundfish and salmon).
- Ocean acidification due to CO₂ buildup may seriously disrupt shell formation in crab, shrimp, and other shellfish, potentially leading to collapse of shellfish fisheries in the long-term. Acidification could also impact zooplankton development, thereby affecting fish survival of species (e.g., sockeye salmon) dependent upon zooplankton.
- The potential for decreased production of some recreationally targeted fish stocks and increases in others may necessitate geographic realignment of fisheries and adjustment of management plans.
- Changes in stream flows and water quality may alter fish species distribution and composition. It could also alter the type and quantity of fish habitat that could impact ecosystem

productivity. Instream flow needs for fish and wildlife and their uses will also need to be reevaluated.

- Access by anglers to waterbodies may improve, degrade, or change significantly as climate changes the extent of wetlands drainage basins. Managers will need to anticipate and mitigate for these changes.
- Fishery managers will need to increase efforts for prevention, monitoring, and control/eradication of invasive species that will be expanding their ranges or those newly arriving.
- Fishery regulations will need to adapt to a longer open water season, allowing for potentially higher harvest rates on some recreational fish stocks.
- Requests for stocking of non-native fishes that are better adapted to warmer water temperatures (e.g., walleye) will need to be considered and policy decisions made regarding these requests.
- New assessments of fish habitat (e.g., anadromous waters or fish community data) will need to be prioritized and implemented to meet our statutory and regulatory responsibilities.
- Adjustments to outreach, education, and involvement programs will need to be made to inform and educate the public about changes in fish and fisheries (both good and bad) due to climate change.

Likely Impacts to Wildlife

- Changes in species distribution and behavior may necessitate adjustments of management plans and harvest regulations.
- New population survey and monitoring strategies may need to be developed; this may require research into new techniques.
- The effect of climate on wildfires is of great interest and concern, since over much of Alaska fire is the predominant habitat change agent and since our main big game species are fire-adapted in different ways. Similarly, we may see a trend where the boreal forest will transition toward grasslands, which would favor a different species mix.
- In the last couple of years the Board of Game has been faced with unusual regulatory requests for extended or extra late hunting seasons to compensate for people's observations that animals' (generally moose) movement timing and pattern have changed. This type of input from villages is anecdotal, and there is no way to know if it has been influenced by the increasing worldwide coverage of climate issues. However, DWC staff have agreed that in several cases, the weather patterns and seasonal temperatures have been unusual (late and warm) and would conceivably affect wildlife movements in the way described by the proponents of the late seasons. This could necessitate changing or adjustment of management plans.
- Changes in sea level and increases in storms and erosion could result in multiple effects:
 1. Coastal dependent species could lose low lying habitats that are critical to their productivity and welfare. These include Pacific brant (Y-K breeding colonies, North Slope molting areas, critical Izembek fall staging), emperor geese (Y-K breeding, molting), cackling Canada geese (Y-K breeding/molting), spectacled eiders (Y-K breeding).
 2. Low-lying coastal staging areas that support millions of shorebirds, geese and ducks during spring and fall staging could degrade. Key examples: Stikine Delta; Copper River Delta and barrier islands; Cook Inlet marshes; Alaska Peninsula flats at Pilot Point, Nelson Lagoon, Izembek Lagoon; Y-K Delta coastal flats and marshes; Safety Lagoon near Nome; Kotzebue Sound lowlands; North Slope salt marshes and connected lakes from Elson Lagoon, Teshekpuk Lake, Colville Delta, Sagavanirktok Delta, Canning Delta, and low barrier islands.

3. There could be positive changes for dusky Canada geese if brackish/salt intrusion is restored to the Copper River Delta (reversion to graminoid sedge marsh from current shrub/forest succession).
 4. Changes could occur in marine productivity (sea temps, nutrient distribution, forage fauna, benthic communities). This could affect food webs important to bird species. Examples include critical clam beds used in winter by the world population of spectacled eiders; impacts on Izembek Lagoon affecting eel grass for brant and fish, benthos for Steller's eiders; marine inverts for shorebirds; loss of productive coastal shoals used by 100,000s of sea ducks.
 5. Very little information on trends in environmental variables is available, and we have no basis for projecting changes--or deciding whether they will be positive or negative. Changes can be modeled, but the availability of regional and local weather data is key. We need to support the efforts of other agencies (like the National Weather Service) to obtain better information.
 6. Changes in climate could warm interior Alaska river basins. These basins are tremendously productive for ducks because of extensive wetland expanses in river valleys, and the dynamics of river flooding and periodic fire. Wetland diversity is changing as permafrost melts and shallow wetlands dry; if river flows are altered--especially seasonal flooding--low habitats could be lost and productivity could drop; increased fire frequency could affect (+/-) nutrient inputs to riparian systems.
- It will be important to monitor species expanding their ranges into Alaska that could impact hunted species and other wildlife with conservation concerns.
 - Changes to general climate patterns and phenology of seasons could have major effects (+/-) over the long term. Breeding success of geese is mostly controlled by the timing of snow melt and mild weather. If spring storms or flooding make breeding more risky, production drops; conversely, far north species controlled by spring weather (early = boom; late = bust) could benefit--snow geese could increase rapidly, eiders could succeed more. In theory, dabbling and diving ducks usually centered in the prairies could increasingly succeed farther north; currently many (e.g., pintails) come to Alaska when prairies are bad, but do not produce much. The latitudinal range of productivity could shift north (not a bad thing), but although the weather may be better, environments would have to become more productive to provide food, brood-rearing conditions, and staging wetlands.
 - Climate change outreach and education currently is underway, but may need to be expanded to include additional target audiences.
 - Alaska's Comprehensive Wildlife Conservation Strategy was developed to assess species at risk throughout Alaska due to a variety of factors, including climate change. The Species Templates included in the strategy identify specific conservation actions relating to climate. A major contribution to the management of identified species of greatest conservation need would be to model potential impacts of climate change on the habitats that support these species.

Likely Impacts to Subsistence Users

- The degree of adaptation in subsistence practices and reliance may change over time due to climate change. To assess potential impacts it will be necessary to monitor economic parameters that characterize the mixed cash-subsistence economies of rural Alaskan communities. The degree of potential effects to rural economies, especially if salmon are adversely impacted, could mirror the economic disasters declared in the previous decade.
- Environmental monitoring will be needed to document the degree of changes in conditions that may affect populations of wildlife and stocks of fish upon which subsistence users have customarily relied. Some examples follow:

1. Changes in freshwater and near shore hydrological conditions may increasingly impact species, populations, and life cycles of fisheries and wildlife resources customarily harvested. Monitoring will be needed to assess changes in water volumes, water courses, currents, distribution and duration of winter ice, and other characteristics that influence abundance and availability of species important to subsistence harvests. Examples include traditional knowledge indicating changes such as lakes drying up, lakes draining, river flows significantly changing, and other dynamic variables such as water temperature that may affect spawning, migration, disease susceptibility, and other aspects of fisheries population biology and management for harvests. Subsistence uses of fish, large mammals and migratory birds may all be affected by such changes.
 2. Various hydrological changes can significantly affect subsistence users' access to harvest of either fish or wildlife. Examples include recent incidence of historically low water in interior Alaskan locations such as McGrath. Such conditions may increase or recur more frequently if future years' conditions include less snow and melt water to replenish rivers and lakes to historic flows or levels. Changes in the seasonality of events such as river freeze up and break-up are having significant impacts on subsistence users' opportunities for customary and traditional uses of fish and wildlife.
 3. Changes to terrestrial conditions also can be expected to influence availability of wildlife and fish species to harvest, as well as access to harvests. For example, if wildfires increase in frequency and extent, winter range for caribou and moose, as well as riparian buffer zones, may be adversely impacted over larger areas and result in longer recovery times than in the recent past.
 4. Range extensions of more temperate plants and animals also may impact subsistence resources and resulting harvests. Monitoring and assessment of changing distribution patterns will be detected in community harvest surveys, as well as biological inventory and monitoring studies. For example, Chinook salmon are reportedly showing up in North Slope subsistence net fisheries, in which they damage the type of gear customarily used for the smaller fish historically present, but also may represent a developing fishery. We also have received reports of cutthroat trout being caught on the lower Kuskokwim River.
- Monitoring of subsistence harvests at the community level is needed to assess harvesting adaptations to changing conditions and flux in available fish and wildlife resources to harvest. Subsistence practices are fundamentally adaptive and need to be monitored to determine the variability and extent of adaptive uses of fish and wildlife resources. For example, hunting marine animals on sea ice has already been changing significantly in arctic regions where nearshore ice no longer persists for much of the traditional harvesting season.
 - Evaluating the levels of confidence needed to detect and monitor change is a critical scientific need for any programmatic effort to assess biological or harvest-related changes associated with climate change.

If you have any questions regarding this information, please feel free to contact Mr. Ken Taylor at (907) 267-2228. Thank you.

Sincerely,



Denby S. Lloyd
Commissioner

STATE OF ALASKA

DEPT. OF HEALTH AND SOCIAL SERVICES
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January 31, 2008

The Honorable Ralph Samuels
Alaska House of Representatives
Alaska State Capitol #204
Juneau, AK 99801-1182

Dear Representative Samuels,

Thank you for your interest in the impact of climate change on the Department of Health and Social Services (DHSS) and Alaska's population as a whole. I am submitting this letter to be included with the Administration's overall response to your panel – as coordinated by Department of Environmental Conservation Commissioner Larry Hartig, who chairs the Governor's sub-cabinet on climate change.

While it is impossible to predict the extent to which global climate change will affect the public's health in the future, there is considerable evidence to date of adverse health outcomes that have already occurred on both a national and a global scale, as demonstrated in the table below obtained from the CDC's *Climate Change and Public Health* website (available at <http://www.cdc.gov/nceh/climatechange/>).

Weather Event	Health Effects	Populations Most Affected
Heat waves	Heat stress	Extremes of age, athletes, people with respiratory disease
Extreme weather events, (rain, hurricane, tornado, flooding)	Injuries, drowning	Coastal, low-lying land dwellers, low Socioeconomic status (SES)
Droughts, floods, increased mean temperature	Vector-, food- and water-borne diseases	Multiple populations at risk
Sea-level rise	Injuries, drowning, water and soil salinization, ecosystem and economic disruption	Coastal, low SES
Drought, ecosystem migration	Food and water shortages, malnutrition	Low SES, elderly, children
Extreme weather events, drought	Mass population movement, international conflict	General population

Increases in ground-level ozone, airborne allergens, and other pollutants	Respiratory disease exacerbations (Chronic obstructive pulmonary disease (COPD), asthma, allergic rhinitis, bronchitis)	Elderly, children, those with respiratory disease
Climate change generally; extreme events	Mental health	Young, displaced, agricultural sector, low SES

DHSS utilized the Arctic Climate Impact Assessment (available at <http://www.acia.uaf.edu/pages/scientific.html>) to assist with the selection of six adverse health outcomes of greatest potential concern to the health of Alaskans as a result of climate change, listed below.

- Changes in animal and plant distribution and accessibility are predicted to affect food availability resulting in an increase in the number of recipients relaying on the Food Stamp Program and Women, Infants and Children Program. Currently, 10% of the Alaskan population is food insecure. An increase in the number of recipients would increase the costs of the food assistance programs.
- An increase in the prevalence of chronic health conditions due to a shift from a traditional diet (due to changes in animal and plant distribution and accessibility) to a more "western" diet. Increased prevalence of chronic diseases may result in increase utilization and cost to the state's health care system.
- An increase in zoonotic and vector-borne disease outbreaks.

In 2004, Alaska experienced the first documented outbreak of *Vibrio parahaemolyticus* gastroenteritis that was attributed to consumption of oysters grown in Alaskan waters, which have shown a consistent warming trend for decades. Record warm water temperatures during 2004 appeared to be associated with the outbreak by promoting bacterial proliferation in water, and subsequent accumulation in oysters. This outbreak expanded the range of epidemiologically confirmed *Vibrio parahaemolyticus* illness to above latitude 60 degrees -more than 1,000 kilometers north of British Columbia, the previously northernmost area of reported illness. Other infectious diseases whose incidence might increase in Alaska as a result of climate change include botulism, paralytic shellfish poisoning, echinococcosis, giardiasis, respiratory infections, bacterial skin infections, and arthropod-borne infections such as California encephalitis virus and Northway virus.

Unpredictable ice and weather conditions may increase the number of accidents associated with traveling in these conditions and also threaten winter subsistence activities. It is difficult to predict the costs to Alaskans due to increased utilization of Alaska's emergency response system and need to increase injury prevention education.