Science and Operating Plan For FY14 and FY15 Freshwater Systems Theme

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I. Introduction

This document describes the major activities the Western Alaska Landscape Conservation Cooperative (Western Alaska LCC) will undertake during the federal fiscal years (FY) of 2014 and 2015 (FY14 and FY15), summarizing their rationale and key components. The FY spans from October 1st to September 30th of each year. For context, we begin with an overview of the Western Alaska LCC's activities from inception (2010) to date.

The mission for the LCC states that *"The Western Alaska Landscape Conservation Cooperative promotes coordination, dissemination, and development of applied science to inform landscape level conservation, including terrestrial-marine linkages, in the face of landscape scale stressors, focusing on climate change."* The five guiding principles clearly state how the Western Alaska LCC will operate to ensure that all partner mandates and jurisdictions are respected; how we will add value, not duplicate, existing partnerships; that our focus is on solving biological, physical and sociological issues to promote adaptive management; that we respect social, political and legal limitations in our efforts to promote solutions to climate change and related stressors to benefit the western Alaska conservation community; and, that we operate with transparency and provide access to process and products.

A. Western Alaska LCC Background

The Western Alaska LCC is one of five Landscape Conservation Cooperatives (LCCs) that cover the vast expanse of Alaska. The Western Alaska LCC covers the least studied, and least understood, ecological regions of Alaska. It spans over 750 miles from north to south, including permafrost-dominated landscapes, glacier-covered mountains, complex and massive river deltas, volcanoes, forests, tundra and low shrublands. These dynamic landscapes border three seas including the southern extent of the Chukchi Sea; the mainland edges of the Bering Sea; and the southwestern extent of the Gulf of Alaska (part of the Pacific Ocean) and the Kodiak archipelago.

Officially established in 2011, the Western Alaska LCC is comprised of the partners that participate in LCC activities. The LCC is governed by the Western Alaska LCC Steering Committee which is currently comprised of the State of Alaska, eight federal agencies, and six seats to represent Alaska Native perspectives. The Steering Committee is led by a Chair and Vice Chair positions that alternate between state and federal members of the steering committee. Most Steering Committee members hold unit or program leadership positions within their agencies/organizations (e.g. Park Superintendent, Refuge Manager etc.). The full Steering Committee Charter is posted on our website at: https://westernalaskalcc.org. The six seats to represent Alaska Native perspectives are based on the Regional Native Associations geographies, and Kodiak and Afognak Islands, within the LCC geographic area.

Universities and non-governmental organizations (NGOs) are important partners in the Western Alaska LCC. It is from these groups, as well as agency staff and other conservation partnerships that the Western Alaska LCC seeks assistance to develop important recommendations for the Steering Committee. The LCC staff draw upon the "Science and Traditional Ecological Knowledge Community" and a "Partnership Community" which provide the core expertise for workgroups to develop recommendations to the Steering Committee.

Beginning with a series of community meetings in October and November 2010, the Western Alaska LCC has sought ideas and recommendations to provide focus to the new partnership. This input was vital in establishing the charter, mission, guiding principles and goals for the LCC. In 2011 we focused on understanding the priority science needs and narrowing the discussion to those which were shared science needs to benefit managers across the partnership. Based on these initial meetings, workshops in 2012 were focused on making recommendations on how best to advance our understanding of important conservation science needs within specific topics.

The key areas of uncertainty that were identified during these workshops centered around how ecosystem processes will change and how those changes will impact the resources and ecosystem services that we depend upon in western Alaska. The workshop report can be downloaded from our website at:
http://westernalaskalcc.org/science/sitepages/sciencewkshp.aspx.

In 2011, the Steering Committee decided to focus its funding for FY12 and FY13 towards two pilot programs. The bulk of the effort would be spent on coastal processes, specifically changes in coastal storms and their impacts. A smaller amount of funding would be used to launch state-wide dialog linked to hydrological processes, specifically stream and lake temperature monitoring, which was felt to be a necessary first step for the LCC to engage in addressing some of the critical needs linked to hydrological processes and climate change effects.

B. Long-term Science Strategy Framework

In order to improve the effectiveness of the LCC, it is important to decide on how the LCC will focus its work. Although the Western Alaska LCC Science Framework is still under development during the creation of this FY14-15 Science and Operating Plan, the basic components of the framework have been identified and are guiding our activities described in this document.

Based on the successes of focusing our available funding on the changes in coastal storms and their impacts topic (focus for FY12 and FY13), the LCC has developed a long-term strategy that will continue this practice focusing its work around three themes. The three themes are i) Coastal Systems, ii) Freshwater Systems, and iii) Terrestrial Systems, and we will always encourage projects that are cross-system efforts. The specific program topic for each theme will be decided six to twelve months in advance of the first funding year for that theme.

Each theme will have a two-year funding cycle and six months prior to the start of that cycle we will engage in a "Planning Phase" where the theme is refined to a particular topic of focus. All projects funded under the topic will be required to be completed four years from the start of the funding cycle. For example, in FY12 and FY13 we started with an interest in the theme of *Coastal Systems* and ultimately narrowed to just the topic of "Changes in Coastal Storms and their Impacts". All projects funded under this topic will be completed by the end of FY15.

In FY14 we will begin a focus on Freshwater Systems. Table 1 illustrates the workflow timeline, including the "Planning Phase" which we engaged in during 2013 to refine the theme to a particular topic of focus. Notice that selecting three themes and a four year project window gives us 12 to 18 months to evaluate project results and usefulness, including gathering feedback from interested stakeholders, before we begin the next funding cycle for that theme. This allows us to assess effects of our past efforts and update our understanding of decision maker needs.

One of the challenges with this approach is that not all of the questions we are trying to answer fit cleanly into one of these three themes. While it is not always easy to separate these "systems" because they are all integrated, we will essentially consider topics which are either dependent on habitats in the current theme (coastal, freshwater or terrestrial) or that explore the effects of changes in processes occurring in these systems. Thus, most fish-related questions/topics would likely arise under the freshwater theme, except for habitat/life phases of interest occurring in the near-shore coastal environment. Topics related to freshwater wetlands and the species that depend upon them would also arise under the freshwater theme. Projects focused on a terrestrial species, such as moose, that frequently utilizes wetlands, riparian areas as well as upland habitats, may arise under either a terrestrial or freshwater theme depending upon the specific topic.

Table1. Calendar for the two-year funding cycle by theme, with a four-year project duration. The long-term strategy will be revisited and revised in 2020-2021.

	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21
Coastal Systems	Funding Year	Funding Year	Coastal Projects Completed							
Freshwater Systems		Planning Phase	Funding Year	Funding Year	Freshwater Projects Completed					
Terrestrial Systems				Planning Phase	Funding Year	Funding Year	Terrestrial Projects Completed			
Coastal Systems						Planning Phase	Funding Year	Funding Year	Coastal Projects Completed	
Freshwater Systems								Planning Phase	Funding Year	Funding Year
Terrestrial Systems										Planning Phase

II. FY14 – 15 Science Plan

A. Freshwater Systems Theme

Although we have recently developed the long-term science strategy framework, planning steps for freshwater systems topics have been underway for quite a while. Beginning with some of the original projects that the LCC sponsored in 2011, and ongoing dialog with many partners, the LCC decided to host a Stream and Lake Temperature Monitoring Workshop in November 2012 with co-sponsorship from the Alaska Climate Science Center and collaboration from the Northwest Boreal LCC. This workshop, and the subsequent funding of one of the key recommendations from the workshop, helped to focus our attention on the topic of "Changes in Freshwater Temperature and its Impacts" as the primary science focus for the FY14-15 funding.

Water temperature is an important variable to understand in its relationship to changes in climate for many reasons. Water temperature is an important hydrologic characteristic, both because of what it influences and what it is influenced by (and thus is an indicator of). It is also relatively inexpensive to measure at a site. Many groups monitor water temperature or are considering doing so. Though their objectives differ, this broad interest provides an opportunity for a coordinated statewide approach to water temperature monitoring.

Although water temperature changes and its impacts are clearly important to understanding current and future changes to freshwater systems in western Alaska, it is only one of many important hydrological issues in the region. One of the highest priority needs for Alaska is to update the National Hydrography Dataset (NHD) to ensure that rivers, streams and lakes are accurately located in digital models. The Steering Committee considered selecting this as its primary topic but felt that the recommendations from the workshop in November 2012 provided a stronger connection to climate change. In order to help address this important need, the LCC has been working with the Alaska Climate Science Center, the other LCCs in Alaska and a wide range of partners to make progress on solving one of the key obstacles in the process for updating the NHD for Alaska without using the LCC-specific project funds. The collaboration will resolve some of the technical issues and will establish a path so that locally derived edits can be integrated into the formal NHD layer. This effort builds upon the work of the Fish Habitat Partnerships on the Kenai Peninsula and Matanuska-Susitna Basin in coordination with funding from the Association of Fish and Wildlife Associations. Further, partners from the US Forest Service and the University of Alaska Southeast designed the protocols for making edits and integrating them into the NHD.

We also considered strictly focusing the topic on the recommendations from the workshop which would have emphasized the stream (and rivers) and lake monitoring by itself. The Steering Committee felt strongly that it is important to show the connection to the resources and services that are integral in management decisions. Therefore, a component of the topic for the FY14-15 Freshwater Systems theme will be on the *Impacts* that temperature change is having on fisheries, ecosystem services (such as drinking water), and/or other hydrological processes of fairly direct interest to resource management decision makers.

B. Changes in Freshwater Temperature and its Impacts

Water temperature is an important hydrological characteristic both because of what it influences and what influences it. It is relatively inexpensive to measure at a site, which makes it possible to use as an indicator of the processes that influence, or are influenced by, water temperature. Reasons vary for why someone might want to collect water temperature at a particular site. For example, some may want to know if a stream or lake temperature exceeds the habitat thresholds for salmon or other fish species. Others may want to track temperature because of its link to algal blooms which can impact a community's water treatment facility. Water temperature may also be used as an indicator of change in glaciers or other stream sources, and affects the potential distribution of contaminants throughout a watershed.

1. Stream and Lake Temperature Monitoring

The November 2012 workshop on stream and lake temperature monitoring helped provide a roadmap for how to create a water temperature monitoring network in Alaska that can simultaneously bolster local information needs and generate the information necessary for conducting large geographic assessments of how our stream and lake systems may change under future climate conditions.

The prioritized recommendations for advancing toward regional monitoring and analyses included:

1. Clearly articulate the goals and objectives of the proposed regional network for monitoring stream and lake water temperature.
2. Conduct a more comprehensive inventory of project metadata and attributes (e.g., who, what, where, when) for current and past stream and lake temperature monitoring efforts.
3. Identify a network of 'reference sites', intended to be maintained in "perpetuity" (20 year minimum), that will serve as the network's core observational framework and to which shorter duration observations from other sites can be linked and 'anchored'.
4. Demonstrate the power and value of predictive scenarios based on water temperature data for pilot regions in Alaska.
5. Develop minimum standards for data collection methods for a project to meet so that its water temperature observations can be usable in a regional network analysis.
6. Define the characteristics (architecture) for storing and distributing water temperature data for Alaska.

Since these recommendations were described in 2012, progress has already been made on the first two recommendations and a strategy is now in place for addressing the next three recommendations.

As described above, the goals and objectives for collecting water temperature data vary widely. For the Western Alaska LCC, defining the goals for a voluntary participation water temperature

network is a key step for helping us design a strategy that will improve both local and regional information on how water temperature is changing. The Western Alaska LCC has led the effort to develop preliminary goals and objectives for a water temperature monitoring network in collaboration between the LCCs in Alaska, the Alaska Climate Science Center (ACSC) and a wide range of partners. These preliminary goals and objectives represent the water temperature network goals *from the perspective of the LCCs and the Alaska Climate Science Center* and are not presumed to encompass all the objectives that partners have for collecting temperature data. Nevertheless, it is not possible to achieve the LCC and ACSC goals without the involvement and concurrence of the diverse groups collecting water temperature information in Alaska. In 2013 these goals are still preliminary and will evolve further as the program becomes more developed.

Goal I. Overarching goal of the Water Temperature Monitoring Network: Promote a better practical understanding of three main drivers of change in freshwater ecosystems and habitats at landscape to regional scales.

To understand and predict how changes in temperature may affect freshwater ecosystems and resources requires an understanding of the impacts and trends in three broad categories of drivers of change in freshwater systems (the categories are not necessarily independent):

1. Climate change
2. Physical and ecological processes (e.g., shifts in river courses or succession, respectively)
3. Human-induced changes (e.g., land-use change)

While changes in water temperature are but one aspect, and understanding these changes requires much more than just monitoring, we anticipate many applications for the temperature network's resulting data and information. The majority of our partners are focused on critical needs related to natural resource management and planning in the face of climate change. In turn, we will design the monitoring network to support ecosystems capable of supporting robust populations of naturally occurring species (e.g. salmonids, waterfowl, etc.) and providing key ecosystem services (e.g. drinking water and cultural uses) throughout Alaska. Through this emphasis on water temperature, the LCC can inform partners about predicted changes and effects as they develop their adaptation or mitigation strategies.

Sub-goals from various partners and participants are likely to focus on impacts of water temperature changes related to:

1. Harvest management
2. Eco-tourism management (bear viewing, sport fishing etc.)
3. Water quality
4. Wetland sustainability
5. Ecological integrity

Goal II. Establish a Voluntary Participation State-wide Water Temperature Monitoring Network, with a goal, by 2020, of being able to model temperature changes and project future trends within regions of Alaska.

A. Integrate existing efforts to collect water temperature data such that these data can be compiled to provide a broader geographic and temporal scope.

1. Document project metadata and attributes about water temperature monitoring efforts occurring in Alaska by December 2014 producing a geospatial database to assess opportunities for a water temperature network. (Workshop Recommendation #1)

Progress (2013): The Western Alaska LCC has sponsored a cooperative project with the University of Alaska Anchorage (UAA) to develop this geospatial database.

Anticipated Action: The project with UAA will be completed by September 2014 and analyzed by the ACSC and U.S. Geological Survey (USGS) for the entire state of Alaska as described below. The Western Alaska LCC will coordinate the development and implementation of the UAA project to help ensure that it meets the needs of the broader stakeholders and other LCCs within Alaska.

2. Define data standards and data collection standards based on different levels of precision and measurement frequency required by different objectives (e.g. regulatory objectives standards versus standards where temperature is an ancillary variable). (Workshop Recommendation #5)

Anticipated action: this task was issued as part of the Request for Proposals (RFP) issued by the Western Alaska LCC on August 29th, 2013[1]. The anticipated completion date is September 30th, 2014.

B. Demonstrate the power and value of predictive scenarios utilizing water temperature data for pilot regions within Alaska to generate support and participation in the network. (Workshop Recommendation #4)

Anticipated Action: If data are available, the Western Alaska LCC will sponsor a demonstration project in western Alaska in 2014 or 2015. This will likely be a single-source agreement with the entity in possession of the necessary data.

C. Identify where additional collection sites are needed and where there are opportunities to maintain long-term "anchor" data collection sites (ACSC and USGS)

1. In 2014, categorize rivers, streams and lakes into similar types such as glacial versus non-glacial, high gradient versus low gradient etc. in order to define appropriate monitoring strata. (Workshop Recommendation #3)

[1] https://westernalaskalcc.org/projects/SitePages/rfp2014temperature.aspx

2. Identify existing reference watersheds /systems which may already meet the need of a water temperature network in the analysis geography. (Workshop Recommendation #4)

   Anticipated Action: The ACSC and USGS have agreed to conduct these analyses in 2014 prior to the completion of the Goal II.A. (geospatial database of existing monitoring activities).

3. In 2015, analyze the water temperature monitoring geospatial database to identify opportunities and strategies for recruiting participation into a statewide water temperature monitoring network, including 'long-term' anchor locations, partners collecting discrete samples who may be willing to upgrade to "bronze" collection standards. (Workshop Recommendation #5 - sampling distribution)

   Anticipated Action: The ACSC and USGS have agreed to conduct this analysis in FY2015 after the completion of Goal II.A.1. and Goal II.C.1.

Goal III. Define the characteristics (architecture) for storing and distributing water temperature data from across Alaska (Workshop Recommendation #6)

A. By 2015, identify strategies for storing and distributing water temperature data that maximizes the use of existing data stewards/archives, maintains data management and stewardship with data owners, and identifies potential solutions for smaller non-governmental entities with monitoring data. Many potential strategies exist for consideration, including integrating with existing hydrologic data management systems or archives.

Progress: The Arctic LCC has been working with the University of Alaska Fairbanks to develop a hydro-climate database for the Arctic region (https://westernalaskalcc.org/projects/SitePages/rfp2014temperature.aspx). Through the development of this database, the university created a data harvesting tool that can draw data from a variety of sources provided that those data are in the correct format.

Anticipated Action: Evaluate the potential to use the database developed by the Arctic LCC as a primary data harvesting tool. Work with the Alaska Data Integration Working Group, EPA and the wide array of partners collecting water temperature data to recommend data naming conventions, and other standards necessary to support information sharing across this and other platforms.

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In addition to the above state-wide water temperature monitoring network goals, the Western Alaska LCC has an additional goal to implement the network within the Western Alaska LCC geography.

Goal IV. WALCC Implementation Goal: Begin on-the-ground implementation of a voluntary water temperature monitoring network in one or two geographic areas within the Western Alaska LCC.

A. Establish partnerships within the primary analysis areas identified in Statewide Goal II.C. to serve as the local point of contact and as the network "nexus" for water temperature monitoring information.

> **Anticipated Action:** In the August 29th, 2013 RFP, we are seeking partners who believe they can serve this role within five subregions of the LCC (Figure 1). Through the RFP, we will fund the development of implementation plans that would provide a detailed view of how the partners would serve in this role in the future.

B. Utilize the partnerships established above to expand existing monitoring efforts via training, sensor calibration, providing additional equipment, supporting field data collection and the like, such that enough water temperature data would be available by 2020 to support a regional analysis of climate change effects on water temperature in the lakes and streams in each sub-region such as those demonstrated in Goal IIB.

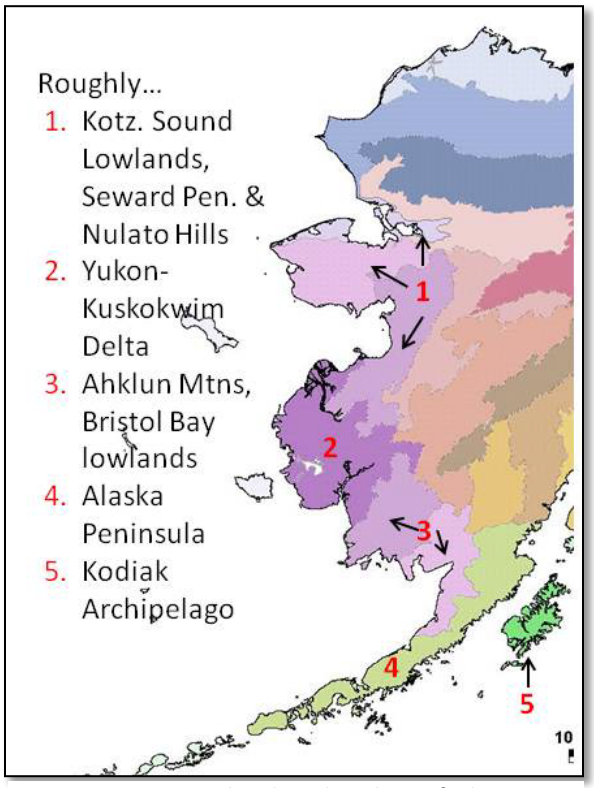

Figure 1: Five geographies based on the Unified Ecoregions of Alaska (Nowacki et al. 2001) are used as the starting place for Goal IV.A.

Anticipated Action: In 2015, provide seed funding to the water temperature monitoring "nexus" partners to expand monitoring activities within those geographies, based on the successful completion of an implementation strategy developed in Goal IV A. Depending on the availability of funds, in 2015, the LCC may sponsor partners to initiate their implementation plans in some of the five subregions in the LCC. It is unlikely that funding will be available through the LCC to implement all five regions in 2015.

2. Understanding the impacts of water temperature change

There are many studies that document the connection between water temperature and changes in either biological responses or in corresponding physical properties (like contaminants spread), but few of these studies were conducted in western Alaska. While results from other locations are useful in providing guidelines and probable outcomes,

uncertainties about the applicability of the results to western Alaska resources would be reduced with studies implemented in western Alaska. The ultimate mission of the LCC is to provide additional information or tools to resource managers in western Alaska, so we place priority on understanding impacts most directly tied to information needs of resource managers.

Resource managers are interested in understanding how changes in temperature will affect other priority resources in western Alaska. The LCC defines its "priority resources" based on the input received during our Shared Science workshop in 2011; these vary by geography, process and system level. The U.S. Fish & Wildlife Service (USFWS), who provides the only predictable project funds to the LCC, defines priority resources as being "biological, ecological, and cultural features and processes". For FY14 and FY15, the Western Alaska LCC has identified changes in water temperature as its priority resource 'process'; it has also identified as priorities for its activities those biological, ecological, environmental processes and ecosystem services that were identified as priorities for the LCC at the Science Workshop *and* that are directly impacted by changes in water temperature.

Clearly changes in water temperature impact aquatic organisms, especially fish. Through our shared science needs workshop in 2011, fish species including salmon, whitefish, sheefish, char, northern pike, arctic grayling, rainbow smelt, rainbow trout and steelhead were all identified as priority[2] fish species for the LCC due to one or more of the following reasons:

- Species of common management interest
- Species or assemblages needed to support (e.g. forage species) the species of common management interest
- Species or assemblages anticipated to be most vulnerable to climate change, and
- Sentinel species or assemblages – i.e., those sensitive enough to climate-induced changes in ecosystems to provide an early indication of pending negative effects on species of concern.

Similarly, water temperature changes may impact waterbirds in western Alaska. Using the same criteria shown above, eight waterbird species were identified as priorities for the Western Alaska LCC: white-fronted geese, marbled godwit, bristle-thighed curlew, yellow-billed and red-throated loons, black scoter and spectacled eider. More information about why these birds and fish were highlighted can be found in chapter 4 of the Shared Science Needs Workshop Report on pages 33-49 (https://westernalaskalcc.org/science/Shared%20Documents/walcc_final_report_web_27june12.pdf). While these species were identified as important during the 2011 Workshop, we recognize that it may be important to focus on other species as surrogates for these, or because of their own importance in meeting our goals related to understanding and addressing climate change in western Alaska.

[2] The use of the term "priority species" is specific to the shared goals of the Western Alaska LCC. Partner agencies/entities within the LCC may have different priorities based on different criteria and mandates.

Some critical information needs may not be linked directly to species but are tied to how water temperature changes may directly affect other processes which, in turn, impact species of interest or the ecosystem services that western Alaska communities depend upon. For example, water temperature can influence when macro-invertebrates (a key source of food for both birds and fish) emerge and breed each spring and summer (Nebeker 1971; see also Hauer et al. 1998). Water temperature has also been linked to changes in the transport and concentration of contaminants (e.g. Sonke and Heimberger 2010, Fisher et al. 2012) and to increased algae or vegetation in lakes where rural Alaska communities draw water, creating problems for water treatment facilities (Brubaker et al. 2009).

Anticipated Action: Through a request for proposal process the LCC will select and sponsor collaborative projects that highlight the importance of understanding changes in freshwater temperature and provide resource managers with new information to understand and predict impacts from temperature changes.

C. Advancing other Freshwater System priority needs

Changes in hydrological processes are a key driver of potential climate change effects in western Alaska. Changes in freshwater temperatures are only one of a suite of many drivers, and others are equally important, though perhaps, harder to address. Within Alaska, there are several inter-agency or cross-stakeholder groups interested in addressing hydrological issues across the state. One of these, the Interagency Hydrology Committee for Alaska (IHCA) was asked by the Alaska Climate Change Executive Roundtable (ACCER) to identify the highest priority needs that would require Alaska-wide coordination and collaboration. While increasing the number and longevity of stream flow gages was the highest priority, its expense and operational challenges led the committee to recommend that ACCER focus on improving the NHD in Alaska.

The NHD is a comprehensive set of digital surface water map data including common features such as lakes, streams, ice fields, coastlines, stream gages, dams, flow-direction networks and links to related databases such as water discharge, water quality, and fish populations. It is the standard across the nation from which projects that require a basic spatial understanding of water are based. Accurately depicted streams, rivers and lakes are critical for meeting science, regulatory, cartographic and natural resource management requirements. Yet in Alaska, NHD has many limitations on its use due to its antiquated status. Users in Alaska confront a variety of errors such as streams outside of their current channels, misrepresented flow lines in braided streams, incorrectly disconnected streams and disconnected reaches that should be continuous. Additionally, lack of a statewide steward for hydrographic data, which all other states have, has resulted in entities maintaining their own partially corrected hydrography datasets, which have diverged over time from the official NHD. While consistently mapped at 1:24,000 in the contiguous U.S. or 'Lower 48', in Alaska the NHD is only mapped at the 1:63,360 scale and is based on 1950s-era topographic maps. Federal, state and local agencies, as well as NGOs such as the National Fish Habitat Partnerships (FHPs), utilize the NHD to model and

provide context for projects locally and nationally, placing Alaska at a disadvantage when our NHD is of inferior quality than that of the rest of the nation.

To address this, the five LCC's in Alaska, led by the Western Alaska, recently partnered with USGS' National Geospatial Program and the University of Alaska's Geographic Information Network of Alaska (GINA) in Southeast and Southcentral Alaska, and successfully competed for $300,000 of national funding under a call for proposals for multi-LCC projects. The project, *Bringing Alaska's Freshwater Hydrography into the 21st Century*, will significantly improve the NHD content and stewardship in Alaska through the creation of a statewide system (Alaska Hydrography or AK Hydro) for making updates accessible, affordable and coordinated. AK Hydro will advance NHD toward meeting national mapping standards consistent with those in the Lower 48, including both a 1:24,000 scale NHD and NHDPlus dataset. NHDPlus, used for hydrologic modeling, stream flow estimates and downstream transport assessments, is available and widely used across the Lower 48, especially for climate change assessment modeling; it is neither available in Alaska nor is there a comparable statewide substitute, severely limiting climate change impact assessments on stream flows and temperatures. The project will also update a portion of the NHD within each of the five LCC's and create a strategy for ongoing updates which could include watersheds of adjacent Canada. The project lays the groundwork for advancing Alaska's NHD to national standards by 2020. Project co-sponsors included the Alaska Hydrography Technical Working Group, USGS National Hydrography Program, Alaska Climate Science Center and the Alaska FHPs: Matanuska-Susitna Basin Salmon Habitat Partnership, Kenai Peninsula FHP, Southwest Alaska Salmon Habitat Partnership, Southeast Alaska FHP (candidate) and the Western Native Trout Initiative.

III. FY14-15 Operating Plan

The goals of the Western Alaska LCC are to:
(https://westernalaskalcc.org/governance/SitePages/governance.aspx)

- Promote communications to enhance understanding regarding effects of climate change in Western Alaska;
- Support coordination and collaboration among partners to improve efficiencies in their common science and information activities;
- Identify and support research, and data collection, analysis, and sharing that address common information needs of land and resource management decision makers;
- Enable synthesis of information at landscape and larger spatial scales; and
- Enhance resource management in western Alaska through applied science and technology transfer.

The LCC's ability to sponsor projects is one way in which we strive to meet our goals, but it is only a portion of the LCC program. Communications strategies also serve an important role in meeting the LCC's goals, especially as projects are completed and there are new data or tools to share. This section describes our Communications Plan for the next two years, the initial

strategy for the Planning Phase of the Terrestrial Systems Theme, Partner Coordination Activities as well as our funding and staffing plans.

A. Communications Strategy

The Western Alaska LCC is committed to providing applied science and knowledge to resource decision makers in western Alaska to assist in their ability to manage resources under the challenges of a changing climate. Our initial communications strategy was largely focused on outreach to inform partners about the new Landscape Conservation Cooperatives network and to determine the role where the Western Alaska LCC would provide the greatest benefit. To do this, we have relied on the traditional outreach tools of providing presentations at conferences, developing a website and mailing list to share documents and information, developing and distributing brochures and requesting feedback on our efforts. We made a concerted effort to contact all 116 Tribal Councils in Western Alaska to inform these governments about the LCC and invite participation at a variety of LCC activity levels. In FY14 and FY15, the LCC will be transitioning out of its initial outreach phase and into a phase more focused on two-way communication with partners and potential partners, and on opportunities to distribute new information from LCC-sponsored projects.

Our communication goals for FY14-15 include:

1. Widely distribute the results of LCC sponsored projects in a manner that i) reaches potential decision makers who can utilize the project results, and, ii) informs partners in how to access the project results and data;
2. Increase our coordination with stakeholders at multiple levels throughout the LCC (i.e., state-wide, regional, watershed, local) such that we continue to strengthen the LCCs engagement and relevance at all geographic levels; and
3. Highlight the successes of the LCC at the national level to garner greater support and funding for LCC operations.

1. Outreach via web, conferences and brochures

a) Website and webinars

In 2013, the LCC launched a new website that provides greater flexibility for staff to update and share information. In FY14-15 we will explore ways to utilize this website to share project information and documents, and develop methods to track how these LCC products are being used to enhance conservation and resource management in western Alaska. The LCC staff work with the project leaders to provide webinars describing their on-going work and their final results. These webinars are announced through our website mailing list and are recorded and posted on our website.

b) Conferences and workshops

Recent conference attendance by LCC staff or Steering Committee members funded through Federal Agencies has been greatly restricted. Nevertheless, participating in conferences is one of the best mechanisms to garner partners, provide information about key LCC activities, and gather information to inform future LCC activities. To the extent allowable, the LCC will look for avenues to participate in conferences which are particularly relevant to the current LCC activities. Principal Investigators of LCC-sponsored projects are typically required to present their project results at one or more conferences where the information is most relevant. Furthermore, conferences bring participants from across western Alaska to a common venue which provides important opportunities for in-person communication.

LCC sponsored workshops are a means to gather expert stakeholder input in making recommendations to the Steering Committee to guide the LCC. If organized and funded through the LCC staff budget (provided by the USFWS), workshop size must be under 30 participants or go through an arduous approval process. In the past, we sought to achieve representation of the various agencies and partners actively working on a particular topic and a mix of participants with research, management and local expertise. We anticipate at least one LCC-hosted workshop which would occur in 2015 to provide recommendations on how to focus the LCC activities for its FY16-17 program on Terrestrial Systems.

c) Brochures and reports

The LCC staff will continue to summarize project selections, project results and major planning decisions through the development and distribution of brochures and reports. The LCC staff anticipates developing at least four of these documents in the next two years which will be focused on 1) Changes in Water Temperature Projects selected, 2) Outreach for the Voluntary Water Temperature Monitoring Network, and 3) Outreach and feedback for the future focus on Terrestrial Systems.

The LCC will also seek partners to develop a synthesis report of current (2012-2015) coastal projects through an RFP in September 2013. This report will be designed to provide a brief summary of coastal projects sponsored by the LCC as well as other projects undertaken by LCC partners. The report will be designed to accomplish two goals: 1) provide the LCC Staff and Steering Committee with a record of current coastal activities that will serve as the basis for defining the most beneficial focus for the LCC when it returns to the Coastal Systems theme; and, 2) provide coastal residents and decision makers and researchers with a record of current activities which may inform their decisions or future research.

2. Exploring Social Media Communication Venues

The LCC will expand its suite of communication strategies to include social media methods and tools. The U.S. Geological Survey has provided the LCC with funding to try different methods and evaluate whether they are good approaches for the LCC to adopt region-wide. At least two approaches are planned through FY15.

Facebook the LCC Staff, with assistance, will identify a set of Facebook partners to begin interacting with about LCC topics and products. We will seek assistance through an RFP in September 2013 to assist the LCC staff in the identification of partners' Facebook sites (such as the Kuskokwim River Intertribal Watershed Council) and provide recommendations on effective communications strategies.

Invasive Plant App for western Alaska. The Western Alaska LCC has funded invasive plant inventories in communities in Bristol Bay[3]. In the September 2013 RFP announcement (see above link) we will build upon that project to provide a smartphone app (for both iPhones and Android phones) to assist residents of Bristol Bay, and elsewhere, in identifying and documenting invasive plants. The Western Alaska LCC will provide **development funds only** with the expectation that the awardee will maintain and host the App for at least three years. At its most basic level, the app must:

- Provide information about invasive plants already known to be in the area based on the user's phone GPS location and/or community reference in comparison to the Alaska Exotic Plants Information Clearinghouse (AKEPIC) database (http://aknhp.uaa.alaska.edu/botany/akepic/).
- Provide decision support to assist in properly identifying the invasive plant and distinguishing it from native plants that may be similar in description.
- Provide very basic control information letting users know if it is safe to pull up the invasive plant by hand or directing them to a site for more detailed treatment information.
- Have low band-width requirements so as to facilitate use in remote regions of Alaska.

3. Youth Outreach

The climate change challenges of today are likely to present even greater challenges to the decision makers of the future. Involving today's youth in gathering knowledge about today's challenges for resource management under changing climate conditions should help to ensure future decision makers have a strong foundation for addressing those changes in the future.

The LCC will explore opportunities for engaging more directly with universities and youth science programs. These opportunities will be incorporated into a refined Communications Strategy that will identify near-term opportunities as well as goals for the future.

B. Terrestrial Systems Planning Phase

Based on our long-term strategic science plan, the Western Alaska LCC will begin planning for its FY16-17 focus on Terrestrial Systems sometime in 2015. At a minimum, the planning phase will consist of the following steps:

[3] https://westernalaskalcc.org/projects/SitePages/2011projects.aspx

1. LCC staff will revisit the priority science needs identified in its Shared Science Needs workshop and subsequent meetings.
2. LCC staff will work with the Steering Committee members to identify current activities and assess whether priorities may have changed since 2011.
3. A task group comprised of individuals recommended through the Steering Committee mixing state, federal, tribal, NGO, university and local expertise, will recommend focal topics to the LCC Steering Committee. This list may be distributed broadly for greater input and prioritization.
4. The Steering Committee will select one or two topics as the primary focus for the FY16-FY17 LCC science program.
5. A Request for Proposals will be issued in September 2014, with a five to six week response period.

Depending on the topic(s) selected, a small workshop (<30 participants) may be held to provide a roadmap for the LCC program.

C. Administrative Management

1. Funding Nuances

a) Funding Federal Partners

The Western Alaska LCC staff funding and primary project support comes through the U.S. Fish & Wildlife Service with additional contributions (both in-kind and monetary) from participating partners. All project funding must meet the funding agencies' requirements and be managed accordingly. One of the challenges faced by the Federal agency partners is the rule set governing the time period that a federal agency can utilize federal funds. The allocations to the Western Alaska LCC are "two year funds" which means that there is a 24 month window of opportunity for most federal agencies to expend those funds. In contrast, when an agreement is developed with a non-federal agency partner they can have up to five years to expend the funds. To even this discrepancy, the Western Alaska LCC Steering Committee has agreed to forward commit LCC funds for Federal projects that successfully compete for selection, if they require funding beyond their legislative access window. As an example, a four year project could be funded to the National Park Service for a total of $200,000.00 but $50,000.00 is needed in the third and fourth year of the projects. If the project is funded in FY14, the Steering Committee would issue $100,000.00 for FY14 and FY15, but would wait to issue the remaining $100,000.00 until FY16 (for use in 2016 and 2017).

b) Preserving Flexibility

Although the Western Alaska LCC has now adopted a pattern where we focus on specific topics for each two-year funding period (see page 4), we need to be able to respond to time-sensitive or unique opportunities regardless of whether or not it fits in the right theme. To preserve this flexibility, the Steering Committee will withhold at least $50,000.00 of its available project

funds for distribution during the middle of the fiscal year (March or April). The following steps will be taken to ensure that the decision is best for the LCC as a whole.

1. During the evaluation of project proposals at the beginning of the fiscal year, projects will be sorted such that the highest priority projects within the known available funding level.
2. These projects will be sorted as to their urgency in funding early in the year or if they can wait for federal budgets to be resolved for later funding.
3. Additional high priority projects that we hope to fund, depending on availability of funds issued through the federal government, will be listed and sorted based on their 'urgency' of funding.
4. New project opportunities that may have been brought to the Steering Committee, but are unrelated to the existing theme (in this case "Changes in water temperature and its impacts") will be requested to develop short proposals which the Steering Committee will evaluate relative to the additional projects identified in bullet #3 and make a decision on which represent the best use of the LCC funds to meet its mission and goals.
5. If no new opportunities have been raised, or if none successfully compete with the additional high priority projects, we will continue to fund from our list of projects related to the current theme.

2. Anticipated budget and staffing

Budget: Currently, the only dedicated funding that the LCC receives is through the USFWS with partners providing significant contributions through projects and in staff time for LCC governance. Additional funding from partner agencies has also been received from the Alaska Climate Science Center, U.S. Geological Survey and the Bureau of Land Management. Because the LCC's funding is part of the Federal Budget there are many uncertainties associated with the ultimate timing and amount of funding the LCC may receive in any fiscal year. In the three years that the Western Alaska LCC has had project funding, the amounts have changed each year from $1.1 million dollars in 2011 to approximately $500,000 in 2013.

The USFWS is contemplating a funding strategy that would provide base funding to all of the LCCs it sponsors. That base funding would reduce uncertainty in managing LCC budgets but is also likely to include a low level of predictable project dollars. The remaining project dollars from the USFWS are likely to be distributed via a competitive process among LCCs based on their activities that are linked to the USFWS mission.

Staffing: The Western Alaska LCC has 2.5 dedicated staff positions, with the half-time position expected to convert to full time in 2014. The positions are: LCC Coordinator, LCC Science Coordinator and a Project Coordinator. The LCC also contributes to salary for three additional staff positions within the USFWS who support all four of the LCCs staffed by the USFWS in Alaska. These positions include a communications/outreach specialist, an administrative

assistant, and the Assistant Regional Director for Science Applications. Funding levels for these shared positions are based on the percent of total funds received by each LCC within the Alaska Region. If current funding levels are maintained, the LCC has potential to hire one additional position which would likely be someone with database and web interface skill sets. Current federal hiring restrictions make filling new positions unlikely in the near future.

3. On-going Project Management

The Western Alaska LCC has sponsored approximately 30 projects between 2011 and 2013. These projects typically take three to four years to complete and require staff tracking and collaboration throughout their implementation. Table 2 provides a listing of the LCC sponsored projects and their anticipated completion date. Roughly 50% of the LCC staff time is needed for project management and oversight to help ensure that the LCC sponsored projects provide the anticipated benefit to decision makers in western Alaska.

Anticipated Action: Many of the projects funded in 2011 will be finished in 2014. The LCC will post project results on its website; work with partners to distribute information broadly within their respective organizations; host webinars to distribute information broadly.

Fund Year	Project Title	Expected End Date
2011	Establishing a distributed permafrost observatory in western Alaska	Dec 2014
2011	Broad-scale lake and permafrost dynamics in the Western Alaska LCC region	Dec 2014
2011	Thermal response of western Alaska lakes and lagoons to past, present, and future changes in climate	Feb 2014
2011	Moored all-season vertical temperature arrays in lakes on Kodiak, Togiak and Alaska Peninsula/Becharof NWRs	Oct 2013
2011	Watershed control of hydrologic sources and thermal conditions in SW Alaska streams: A framework for forecasting effects of changing climate	Mar 2014
2011	Timing and extent of winter snow thaw/refreeze events in Alaska 2001-2008	Complete
2011	Direct snow condition monitoring at key ecological sites in remote western Alaska	Complete
2011	Develop an existing vegetation layer for the Western Alaska LCC region	Sep 2013
2011	Integrated Ecosystem Model	Aug 2016
2011	The tundra in transition: Unraveling the dynamics of western Alaska caribou-tundra ecosystems	Dec 2013
2011	Assessing the vulnerability of western Alaska ecosystems and subsistence resources to non-native plant invasion	Dec 2013
2011	Climate change health assessments for three coastal, riverine and lake system communities	Mar 2014
2012	A high-resolution integrally-coupled ice, tide, wind-wave, and storm surge model for western Alaska	May 2015
2012	Storm surge impacts on biological resources in the YK Delta	Dec 2014
2012	Storm surge climatology and coastal waterfowl/community impacts, Bering Sea coast, western Alaska	Sep 2014
2012	Leveraging opportunity for wave buoy data collection	Dec 2014
2012	Nearshore bathymetric data collection in the vicinity of western Alaska communities	Aug 2014
2012	Compilation of NHD compliant shoreline from Cape Prince of Wales to Cape Espenberg using NOAA extracted vector shoreline	Complete
2012	ShoreZone mapping in Kotzebue Sound	Dec 2014

2012	ShoreZone mapping in Bristol Bay	Sep 2015
2012	The impacts of storm surges on breeding waterbirds on the Yukon-Kuskokwim Delta, Alaska: Past effects and future projected impacts	Aug 2015
2012	Community observation and vulnerability assessment	Dec 2014
2013	Extensive mapping of Bering Sea and Gulf of Alaska coastal change by Landsat time series trend analysis, 1985-2014	Sep 2014
2013	Expanding environmental monitoring instrumentation on Kigigak Island	Dec 2015
2013	Reconnaissance static occupation of tidal benchmarks in western Alaska	Sep 2014
2013	ShoreZone mapping on the Alaska Peninsula	Jan 2015
2013	Alaska Online Aquatic Temperature Site (AK-OATS)	Sep 2014
2013	NHD stewardship in Alaska	Sep 2015

Table 2: Western Alaska LCC sponsored projects for 2011 – 2013.

4. Data management

The Western Alaska LCC has adopted the best management data management practices of the LCC Network with only minor revisions (see the Data Management Template on our website). This policy requires all LCC sponsored projects to have a data management plan in place which is modeled after the USGS data management plan template. Furthermore, the LCC is working with the Alaska Data Integration Working Group to adopt standards for project metadata.

IV. Summary

In FY14-15, the Western Alaska LCC focus will shift from "Changes in Coastal Storms and their Impacts" to "Changes in Freshwater Temperature Change and its Impacts" in accordance with our long-term science strategy. The coastal storms projects funded through the LCC will continue and most will be completed by the end of FY15. Through our new focus on freshwater temperature change, we hope to make progress in the five goals described to advance a Stream and Lake Temperature monitoring network for Alaska with implementation of the network in at least two of the five geographic regions described for the LCC geography. The LCC will continue to collaborate with partners on improving Alaska's NHD to meet national standards.

While improving our ability to understand how freshwater temperature is changing with changing climate constitutes a substantial part of our focus in these two years, the LCC is focusing on temperature as a way to help us understand and plan for potential changes to the priority resources in western Alaska. To ensure that this goal is not forgotten as the LCC strives to improve our ability to understand freshwater temperature change the LCC will also sponsor projects that document effects of water temperature change on species and/or resources.

The LCC will also continue to improve its communications/outreach activities through several approaches. In FY14 a more detailed communications strategy will be developed to help guide our activities for distributing and conveying the results of LCC-sponsored projects. Through support from USGS the LCC will seek partners to develop an Invasive Plant smartphone App to

help people identify invasive plant species throughout Alaska, expand the LCC's use of social media such as Facebook, and to develop an outreach product that summarizes current coastal change projects throughout western Alaska.

In FY15, the Western Alaska LCC will initiate the planning phase for the "Terrestrial Systems" theme. During this phase the LCC will work with partners to identify the terrestrial systems focus for the FY16-FY17 funding years. The LCC will continue to participate as a member of the LCC National Network, and will work with neighboring LCCs to most effectively meet our LCC goals.

V. Literature Referenced

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