

# **A Strategic Framework for Science in Support of Management in the Southern Sierra Nevada Ecoregion**

**A Collaboratively Developed Approach**

**June 10, 2009**

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**Adopted by Craig Axtell, Superintendent  
Sequoia and Kings Canyon National Parks**

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**Adopted by Tina J. Terrell, Forest Supervisor  
Sequoia National Forest/Giant Sequoia  
National Monument**

**Developed by:  
The US Department of Interior National Park Service, Sequoia/Kings Canyon  
National Parks  
The US Geological Survey, Western Ecological Research Center  
The USDA Forest Service, Pacific Southwest Research Station  
The USDA Forest Service, Sequoia National Forest/Giant Sequoia National  
Monument**

## Proposed Project Focus Areas and Budget Guidelines

Total Available approximately \$1,425,000

### Continue Basic WQ and Limnological Monitoring

- |   |                                 |
|---|---------------------------------|
| 1) BOR Monthly Surface WQ and Quagga Veliger Monitoring | Estimated \$630,000             |
| 2) WQ Platform Data (3 to 5 Platforms)                  | Estimated \$350,000 - \$450,000 |
| 3) Tributary Inflow Monitoring                          | Estimated \$60,000              |

Total Estimate for Basic WQ and Limnological Data (and Veligers) Estimated \$1,090,000

Quagga Mussel Monitoring \$200,000

Twitchell, USGS: Completion of bottom profile data \$25,000

Adult monitoring by dives and ROV budgeted elsewhere and will be done (quarterly, 4 sites)

Additional? 18 sites within the IMAP?, additional invertebrate?, additional fisheries?

### Next Phase of Environmental Health Analysis

Suggested: Summary EDC findings and analysis paper with suggested next steps  
\$200,000

Other potential: Reanalysis of fathead minnow study \$100,000



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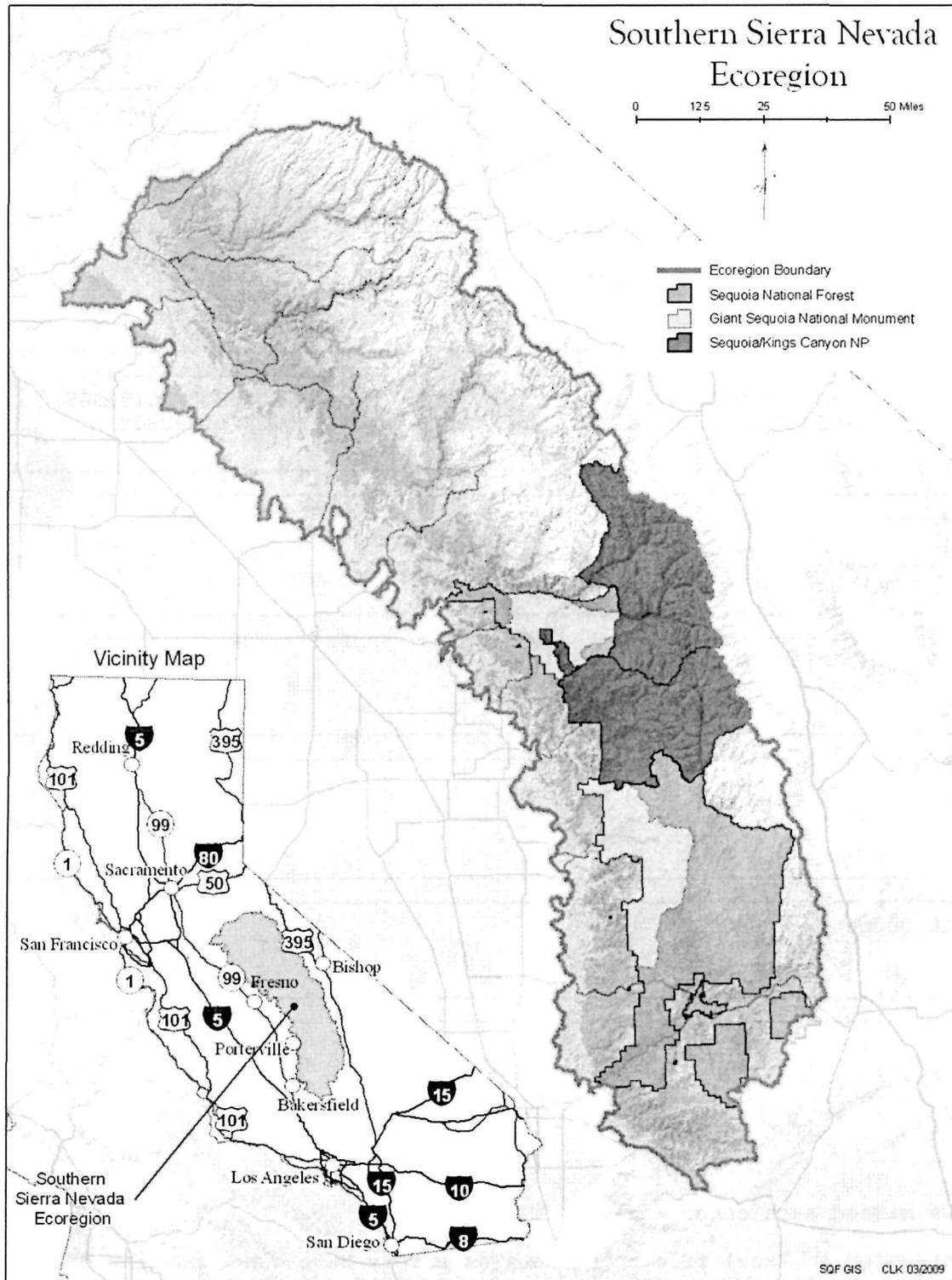
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Figure 1



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| To: |  
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| Kent\_Turner@nps.gov  
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| Cc: |  
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| Daniel J Bright/WRD/USGS/DOI@USGS, Michael J Moran/WRD/USGS/DOI@USGS,  
Michael R Rosen/WRD/USGS/DOI@USGS, Ronald J Veley/WRD/USGS/DOI@USGS |  
  
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| FY 10 Budgets -- USGS  
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Kent:

Sorry we missed each other today.

I am attaching an Excel file that contains a very bare bones outline of our budget requests from Water 2025 monies for FY 2010. I have divided the budgets into 3 main projects: Lake Mead Platforms, Tributary Infows and Transects, and EDCs.

Keep in mind that there is a lot more detail in the numbers than I am

# **Strategic Framework for Science in Support of Management**

## **Drafting Team**

### **John Exline**

District Ranger, Hume Lake Ranger District, Sequoia National Forest/Giant Sequoia National Monument

### **David Graber**

Chief Scientist, Pacific West Region, National Park Service

### **Nathan Stephenson**

Research Ecologist, USGS Western Ecological Research Center, Sequoia-Kings Canyon Field Station

### **Peter Stine**

Program Manager, Principal Research Scientist, Biogeographer, Pacific Southwest Research Station/ Sierra Nevada Research Center

### **Charisse Sydoriak**

Chief, Resources Management and Science, Sequoia and Kings Canyon National Parks

### **Debra Whitall**

Social Scientist, US Forest Service, Region 5

### **Rebecca Reynolds**

President, Rebecca Reynolds Consulting

showing. We have detailed break-outs of costs for staff time and materials, if you are interested. In addition, there is a fair amount of justification for each of these projects that I can't easily communicate in an email. Again, we can provide more details upon request.

Please note that the total gross amounts for the Lake Mead QW Platforms can be adjusted downward if we are able to carry over money from this FY. We are unsure how, or even if, we can do this but if we are able to carry over some money this would help to lower the costs for next FY.

If you have any questions feel free to call or email me. Dan Bright should be back in the office on Monday.

Mike

[attachment "USGS\_budgets\_FY10.xls" deleted by Michael R Rosen/WRD/USGS/DOI]

Michael Moran  
Supervisory Hydrologist  
Nevada Water Science Center  
Southern Nevada Programs  
160 N Stephanie Street  
Henderson, NV 89074  
(702) 564-4545 Office  
(702) 499-1356 Cell

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Kent,

I have a SNAP conf call between 9-11...how about getting together at 11?

Bill D.

Kent Turner

----- Original Message -----

**From:** Kent Turner  
**Sent:** 04/30/2009 12:16 PM PDT  
**To:** William Dickinson  
**Cc:** Gary Warshefski; Kris Kirby  
**Subject:** Re: Meeting on Boat Washing

Bill: I can meet with you anytime tomorrow I'll try around 9a m we need to touch base with Kris on this also to see where she is with a letter to D, and also in general on her analysis of access to boat wash stations. kent

William K Dickinson/LAME/NPS



**William K  
Dickinson/LAME/NPS**  
04/30/2009 11:29 AM

To Kent Turner/LAME/NPS@NPS  
cc

Subject Re: Meeting on Boat Washing

Kent,

Just landed in Oakland and saw this message. Date/time are fine.

We should try to meet tomorrow if possible.

Bill D.

Kent Turner

----- Original Message -----

**From:** Kent Turner  
**Sent:** 04/30/2009 11:18 AM PDT  
**To:** "D Davis" <coastiedee@cox.net>  
**Cc:** William Dickinson  
**Subject:** Re: Meeting on Boat Washing

D: I think 3pm on Monday May 4 sounds fine. The meeting will either be in the Superintendents Office or the conference room next door. I am assuming that time is still good for Bill, hopefully he can confirm (he has been traveling this week, but checking e mails).

I dont think we need a revised proposal prior to the meeting; having it then should be fine.

I assumed you would be at the BOR workshop for quaggas next week, there is why I wasnt available those other days also.

kent

"D Davis" <coastiedee@cox.net>

# Strategic Framework for Science in Support of Management

## Conclusions and Recommendations

This document is a strategic framework for management-directed scientific inquiry. It serves as a foundation for a comprehensive, coordinated approach for integrating science into regional land management activities. The framework's purpose is to guide the creation of a work plan. The development of the work plan is an iterative process that will evolve through collaborative learning.

To implement the strategic framework and the development of the work plan, we recommend a full time professional be dedicated – a person to integrate science and management and to ensure that this effort succeeds.

Whether or not a position is dedicated, we recommend the following framework elements as critical initial actions in this overall effort.

Focus on answering the following questions:

- Which ecosystem elements are important and time sensitive to track?
- Where on the landscape should actions be taken now?
- How does each agent of change affect important ecosystem elements?
- Which agents of change can be slowed and why?
- What tools and approaches further effective human response to known agents of change?

Take swift action to:

- Create a range of plausible future scenarios
- Create an information clearinghouse

In addition to the above, we need a process to engage scientists and managers that will result in a major transformation in thinking about public land management. Climatic change is unlike any other challenge yet encountered by public land managers. The effects of climatic change on resources will be strongly influenced by interactions with other agents of change. The way we manage landscapes will change radically. This situation demands novel thinking and creative management actions. We must avoid committing to a single path or solution and assuming that old ways will suffice. The process to transform thinking will take a substantial commitment of funds and time to achieve.



"D Davis"  
<coastiedee@cox.net>  
04/30/2009 08:13 AM

To <Kent\_Turner@nps.gov>  
cc <William\_K\_Dickinson@nps.gov>  
Subject Re: Meeting on Boat Washing

Kent,

I'd rather you be there. I am attending the Bureau of Rec Workshop next week and don't want to wait until the 14th, so, Monday afternoon works for us.

We've been revising our proposal to clarify our method, do you want a copy prior to the meeting?? I would be happy to deliver one for your review.

Does 3:00, May 4th sound good @ your office??

D

----- Original Message -----

From: <Kent\_Turner@nps.gov>

To: <coastiedee@cox.net>

Cc: <William\_K\_Dickinson@nps.gov>

Sent: Wednesday, April 29, 2009 1:14 PM

Subject: Meeting on Boat Washing

>

> D I've had a chance to discuss potential meeting times with Bill  
> Dickinson and he and I are both available the afternoon of May 4 at  
> anytime  
> and May 14 at say 8:30 am ( I would need to leave by no later than 10 am  
> that day).

>

> If neither of those times work for you, Bill is also available in the  
> afternoon of May 5 and anytime May 6, but I am not available those days.  
> If those are the only times you could meet, you may want to consider  
> meeting without me.

>

> thanks kent

>

>

## **Introduction**

The U.S. Department of the Interior National Park Service, Sequoia and Kings Canyon National Parks (NPS); U.S. Geological Survey, Western Ecological Research Center (USGS); the U.S. Department of Agriculture Forest Service, Pacific Southwest Research Station (PSW); and Sequoia National Forest/ Giant Sequoia National Monument (FS) have entered into a Memorandum of Understanding (MOU) to collaboratively develop a program of research, resources management, and public education to help inform our collective response to climatic change effects on ecosystems of the southern Sierra Nevada. Although our area of interest encompasses the west slope of the Sierra Nevada ecoregion from Yosemite National Park south to Tehachapi Creek (see Figure 1), the pilot area involves only the area of the MOU signatories. We intend to coordinate with other agencies and entities that are not formal signatories to the MOU but that are included in this geographical area.

## ***Purpose***

This Strategic Framework represents an early product of the joint agreement, and outlines the priority science information needs related to the southern Sierra Nevada region. The Framework has been developed strategically, and thus will act as a conceptual guide rather than a detailed prescription for specific science projects. It is meant to help scientists and managers plan, prioritize, fund, execute, and report the results of research aimed at addressing priority information needs relevant to the management of public lands in the face of an uncertain and unprecedented future. The Strategic Framework will lead to relevant and useful science products that help the broad community of policy and decision-makers, resource practitioners, scientists, and citizens to make sound decisions and take effective action in varied and uncertain situations.

## ***Background***

The southern Sierra Nevada ecoregion is of great importance regionally, nationally, and globally, not only for its abundant recreational opportunities, but as the main source of water for California's thriving agriculture, energy production, and domestic water needs. The ecosystems of the southern Sierra Nevada ecoregion provide an array of other ecosystem services to the people of California, the country, and the world. The southern Sierra Nevada ecoregion is relatively intact, and the headwaters and middle watersheds are almost entirely administered for public benefits. However, landscape changes, including the effects of global climatic change, shifting fire regimes, patterns of human land use, and other ecosystem agents of change have already affected the integrity of this ecoregion's natural, cultural, and socio-economic resources and assets.

Global climatic change has already caused significant regional warming and consequent changes in snow hydrology that, in turn, may affect the long-term sustainability of forest, monument, and park resources. Other major drivers of changes in ecosystem structure and function include habitat fragmentation, encroaching urbanization, shifting fire regimes, invasive species, and increasing air pollution, among others. All of these agents of change interact with one another, and affect ecosystems at broad spatial scales, usually requiring that responses also be planned and executed at broad spatial and temporal scales.

**Great Basin Cooperative Ecosystem Studies Unit  
Task Agreement Modification  
National Park Service**

**TASK AGREEMENT NO:** J8R07060012    **MODIFICATION NO.:** 03    **COOPERATIVE AGREEMENT NO.:** H8R07060001    **EFFECTIVE DATES:** 09/30/06-12/31/10

**COOPERATOR:** University of Nevada, Las Vegas

**PROJECT TITLE:** Monitoring and Evaluation of Sensitive Wildlife at Lake Mead National Recreation Area

<b>FISCAL YEAR FUNDING:</b>	<b>2006</b>	<b>ACCOUNT # 8360-4004-455 (411C)</b>	<b>NOT TO EXCEED:</b>	<b>\$ 250,000.00</b>
	2006	8360-C110-454 (411C)		\$ 120,000.00
	2006	8360-C061-577 (411C)		\$ 40,900.00
	2006	8366-1001-NZY (411C)		\$ 50,000.00
	2006	8360-MS23-475 (411C)		\$ 220,667.00
	2006	8360-MS38-475 (411C)		\$ 150,000.00
	2006	8360-MS42-475 (411C)		\$ 25,000.00
	2006	8360-MS56-475 (411C)		\$ 19,000.00
	2006	8360-MS59-475 (411C)		\$ 10,000.00
	2006	8360-0602-474 (411C)		\$ 10,000.00
	2007	8360-MS23-475 (411C)		\$(110,000.00)
	2007	8366-1001-NZY (411C)		\$ 100,000.00
	2007	8360-0702-454 (411C)		\$ 10,000.00
	2008 (new)	8360-MS23-455 (411C)		\$ 210,428.00
	2008 (new)	8360-MS38-455 (411C)		\$ 54,000.00
	2008 (new)	8360-MS39-455 (411C)		\$ 125,000.00
	2008 (new)	8360-C130-NKW (411C)		\$ 100,000.00
	2008 (new)	8360-C140-NKP (41C)		\$ 80,000.00
	2008 (new)	8360-MS42-475 (411C)		\$ 15,000.00
	2008 (new)	8360-MS59-475 (411C)		\$ 10,000.00
	2008 (new)	8360-0702-454 (411C)		\$ 30,000.00
	2008 (new)	8366-1001-NZY (411C)		\$ 55,000.00
	2008 (new)	8360-MS56-475 (411C)		\$ (19,000.00)
			<b>TOTAL:</b>	<b>\$1,555,995.00</b>

**PURPOSE OF MODIFICATION:** The purpose of this modification is to provide additional financial assistance to accomplish task agreement goals, extend effective dates of this agreement and revise account numbers, project dates and statement of work accordingly. These modifications are necessary because of: (1) unforeseen administrative delays in executing Clark County, Nevada Multiple Species Habitat Conservation Program (MSHCP) agreements during fiscal year 2007 as envisioned for the original Task Agreement; (2) modifications made to the technical aspects of these agreements during negotiations with Clark County; and (3) the removal of an MSHCP tortoise monitoring proposal from the task agreement due to uncertainties in its implementation due to need for long term negotiations on methodology with USFWS and MSHCP staff. The delay in funding and project start up, as well technical modifications have necessitated task agreement modification to bring work execution, overall task agreement outcomes and work phases back in synchronization with the timelines of the final executed agreements.

**MODIFICATIONS:**

- ARTICLE I - BACKGROUND AND OBJECTIVES, third paragraph,** is modified as follows:

## ***Guiding Principles***

The following Guiding Principles helped provide a foundation for the Strategic Framework's creation, and may further help guide its implementation.

- Climatic change cannot be addressed in isolation. The effects of climatic change on resources will be strongly influenced by interactions with other agents of change. Therefore this document focuses on all agents of change, even though climatic change is the overarching theme.
- Resource management decisions must be based on sound science, therefore this Strategic Framework focuses on science relevant to managers. Implementation of this Framework requires continuous, iterative collaboration between scientists and managers.
- Humans are both agents of change and the recipients of the outcomes of those changes. These changes affect us in the short and long term: socially, economically and culturally. Because of this inextricable link, this Framework provides a blueprint for collective action.

## ***Strategic Framework Approach and Structure***

Members of the science and land management communities and the public met over two days in September 2008 at the Southern Sierra Science Symposium. The work of the second day resulted in a series of questions related to a broad spectrum of information needs. These questions provided a foundation for the development of the Strategic Framework. A synthesis of the symposium results is included at the end of this document.

A challenge in developing this Strategic Framework was deciding on an organizational structure that would be both useful and transparent to all interested parties. We considered structures based on agents of change, on scientific disciplines, on science activities, and others. We finally chose to organize around the broad classes of information that managers need to make decisions and act. We felt this best allowed us to maintain a sharp focus on the questions most relevant to managers, policy makers, and the public. Specifically, several broad questions emerged regarding southern Sierra Nevada ecosystems and their management:

- First, what is happening, why is it happening, and what does it mean? This question looks at the past and the present. For example, has a particular species been declining? If so, why? And if so, is the decline great enough to be cause for concern? Informed decision-making and management actions are impossible without this foundational information.
- Second, what is a range of plausible futures we might face? This question complements the preceding question by looking to the future. Again, informed decision-making and management actions are impossible without this foundational information

No.	Deliverable	Type	Due date	Amount Allowed	Delivered	End quarter	Accepted	Invoice no later than	Invoice \$\$\$	Invoiced	Payment Received
1	Project kick-off mtg	M1	2/2/2008	\$2,000.00		3/31/2008		5/30/2008	\$2,000	3/27/2008	
2	Data management plan	D1	2/2/2008	\$15,000.00	1/30/2008	3/31/2008		5/30/2008	\$15,000	3/27/2008	
3	2008 annual work plan	D2	2/2/2008	\$26,000.00	1/30/2008	3/31/2008		5/30/2008	\$26,000	3/27/2008	
4	Contract mobilization and key staff listing	D3	2/2/2008	\$31,400.00	1/30/2008	3/31/2008		5/30/2008	\$31,400	3/27/2008	
5	Quarterly progress report	D4	4/1/2008	\$0.00	3/28/2008	6/30/2008	n/a	8/29/2008	\$0.00	n/a	n/a
6	Quarterly progress report	D5	7/1/2008	\$0.00	6/30/2008	9/30/2008	n/a	11/29/2008	\$0.00	n/a	n/a
7	2008 annual project review presentation	D6	8/15/2008	\$0.00	cancelled	9/30/2008	cancelled	11/29/2008	\$0.00	n/a	n/a
8	Quarterly progress report	D7	10/1/2008	\$0.00	9/29/2008	12/31/2008	n/a	3/1/2009	\$0.00	n/a	n/a
9	Quarterly progress report	D8	1/1/2009	\$0.00	12/22/2008	3/31/2009	n/a	5/30/2009	\$0.00	n/a	n/a
10	GIS and data transfer to county	D9	2/1/2009	\$17,700.00	2/1/2009	3/31/2009	2/5/2009	5/30/2009	\$17,700.00		
11	2009 annual work plan	D10	2/1/2009	\$24,000.00	1/30/2009	3/31/2009	2/9/2009	5/30/2009	\$24,000.00		
12	County acceptance of data transfer for NPS-475	M2	3/31/2009	\$3,700.00	3/31/2009	3/31/2009	4/6/2009	5/30/2009	\$3,700.00		
13	County acceptance of data transfer for NPS-476	M3	1/31/2009	\$3,700.00	1/31/2009	3/31/2009	2/5/2009	5/30/2009	\$3,700.00		
14	County acceptance of data transfer for NPS-526	M4	3/1/2009	\$6,100.00	3/1/2009	3/31/2009	3/5/2009	5/30/2009	\$6,100.00		
15	County acceptance of data transfer for NPS-529	M5	3/1/2009	\$4,700.00	3/1/2009	3/31/2009	3/4/2009	5/30/2009	\$4,700.00		
16	County acceptance of data transfer for NPS-532	M6	not yet	\$3,700.00	not yet	not yet	not yet	not yet	not yet	not yet	not yet
17	County acceptance of data transfer for NPS-535	M7	9/25/2008	\$3,700.00	9/25/2008		10/2/2008	12/31/2008	\$3,700	12/17/2008	1/12/2009
18	County acceptance of data transfer for NPS-536	M8	10/31/2008	\$3,700.00	10/31/2008		11/5/2008	2/28/2009	\$3,700	1/9/2009	1/28/2009
19	County acceptance of data transfer for NPS-537	M9	10/18/2008	\$6,100.00	10/18/2008		10/27/2008	2/28/2009	\$6,100	1/9/2009	1/28/2009
20	County acceptance of data transfer for NPS-540	M10	1/31/2009	\$3,700.00	1/31/2009	3/31/2009	2/5/2009	5/30/2009	\$3,700.00		
21	County acceptance of data transfer for NPS-542	M11	3/31/2009	\$6,100.00	3/31/2009	3/31/2009	4/6/2009	5/30/2009	\$6,100.00		
22	County acceptance of data transfer for NPS-545	M12	cancelled	\$3,400.00	cancelled	cancelled	cancelled	cancelled	cancelled	cancelled	cancelled
23	Quarterly progress report	D11	4/1/2009	\$0.00	3/31/2009	6/30/2009	n/a	8/29/2009	\$0.00	n/a	n/a
24	Biennium project summary report	D12	6/30/2009	\$0.00		6/30/2009		8/29/2009			
25	Quarterly progress report	D13	7/1/2009	\$0.00		9/30/2009		11/29/2009			
26	Quarterly progress report	D14	10/1/2009	\$0.00		12/31/2009		3/1/2010			
27	2009 annual project review presentation	D15	10/31/2009	\$0.00		12/31/2009		3/1/2010			
28	Quarterly progress report	D16	1/1/2010	\$0.00		3/31/2010		5/30/2010			
29	GIS and data transfer to county	D17	2/1/2010	\$17,700.00		3/31/2010		5/30/2010			
30	2010 annual workplan	D18	2/1/2010	\$18,000.00		3/31/2010		5/30/2010			
31	County acceptance of data transfer for NPS-475	M13	1/4/2010	\$4,900.00							
32	County acceptance of data transfer for NPS-476	M14	11/4/2010	\$6,000.00							
33	County acceptance of data transfer for NPS-526	M15	5/30/2010	\$8,500.00							
34	County acceptance of data transfer for NPS-529	M16	5/30/2010	\$6,500.00							
35	County acceptance of data transfer for NPS-532	M17	not yet	\$4,900.00	not yet	not yet	not yet	not yet	not yet	not yet	not yet
36	County acceptance of data transfer for NPS-535	M18	2/1/2010	\$4,900.00							
37	County acceptance of data transfer for NPS-536	M19	3/1/2010	\$4,900.00							
38	County acceptance of data transfer for NPS-537	M20	11/18/2009	\$8,500.00							
39	County acceptance of data transfer for NPS-540	M21	11/2/2009	\$4,900.00							
40	County acceptance of data transfer for NPS-542	M22	10/6/2010	\$6,000.00							
41	County acceptance of data transfer for NPS-545	M23	cancelled	\$4,400.00	cancelled	cancelled	cancelled	cancelled	cancelled	cancelled	cancelled
42	Quarterly progress report	D19	4/1/2010	\$0.00		6/30/2010		8/29/2010			
43	Quarterly progress report	D20	7/1/2010	\$0.00		9/30/2010		11/29/2010			

- Third, what can we do about it? This question is about action. If the foundational information answering the preceding two questions indicates that undesirable changes are happening or are likely to happen, what options do we have for adaptation or slowing agents of change?
- Fourth, how can relevant information be made accessible to all who desire it? Answers to the preceding three questions, no matter how sophisticated and potentially useful, are irrelevant to society if the information is not validated and made readily available in useful forms.

These questions drove the formulation of the highest level of the Framework's structure. To keep the Framework strategic, it has just four nested levels of structure. First, from the four major question areas above, broad goal statements were written that express the desired result for each. Second, each goal is subdivided into objectives. Third, under objectives come tasks, which are expanded at the fourth and most detailed level by a set of questions. These questions are meant to help guide implementation, but are not intended to be exhaustive.

For example, the first question "what is happening, why is it happening, and what does it mean?" is represented by the information needs resulting from detection, attribution, and interpretation. The goal for this question is: "We detect and describe ecosystem changes across a range of spatial and temporal scales, can understand why change is occurring, and can interpret its significance."

The goals here have been intentionally written to describe the *outcome* sought as opposed to the *action* that will be taken, to better enable evaluation of progress. That is, plenty of detection, attribution, and interpretation could be done, but the important issue is whether or not that effort has fostered knowledge of why change is occurring, what it means, and whether or not it is significant.

The objectives under each goal express desired results that contribute to the larger goal. For example, under the goal "We detect and describe ecosystem changes across a range of spatial and temporal scales, can understand why change is occurring, and can interpret its significance," there are objectives addressing status and trends, cause and effect relationships, and context for interpretation. The objective for status and trends is "We know the status of ecosystem elements and what has changed since humans began to significantly affect Sierra Nevada resources."

Under objectives are tasks, which address the major areas of work to be accomplished to achieve each objective. For example, a task under status and trends is "develop status and trends information." The tasks are then expanded by sets of questions from which research and other projects can be developed. For example, under "develop status and trends information" falls the question "What ecosystem elements are important and time sensitive to track?"

The approach and four nested structural levels of the Strategic Framework are intended to provide useful organization to complex topics, and to give strategic guidance to the science and land management community for a coordinated science effort in the southern Sierra Nevada.

No.	Deliverable	Type	Due date	Amount Allowed	Delivered	End quarter	Accepted	Invoice no later than	Invoice \$\$\$	Invoiced	Payment Received
1	Contract award and mobilization	M1	3/4/2008	\$3,000.00	3/4/2008	3/31/2008	3/4/2008	5/30/2008	\$3,000.00	5/29/2008	
2	Project kick-off and training mtg	M2	4/3/2008	\$2,000.00	3/18/2008		3/18/2008		\$2,000.00	5/29/2008	
3	Begin peregrine falcon monitoring	M3	3/4/2008	\$3,000.00	3/5/2008	3/31/2008		5/30/2008	\$3,000.00	5/29/2008	
4	Quarterly progress report #1	D1	4/1/2008	\$0.00	3/26/2008	6/30/2008		8/29/2008	\$0.00	5/29/2008	
5	Annual Work plan	D2	4/4/2008	\$1,000.00	3/19/2008	6/30/2008	3/27/2008	8/29/2008	\$1,000.00	5/29/2008	
6	Detailed timeline	D3	4/4/2008	\$1,000.00	3/19/2008	6/30/2008	3/27/2008	8/29/2008	\$1,000.00	5/29/2008	
7	Data management plan	D4	4/19/2008	\$2,000.00	4/21/2008	6/30/2008	4/30/2008	8/29/2008	\$2,000.00	5/29/2008	
8	Quarterly progress report #2	D5	7/1/2008	\$0.00	6/27/2008	9/30/2008	7/14/2008	11/29/2008	\$0.00	1/9/2009	2/13/2009
9	Complete peregrine falcon monitoring	M4	8/31/2008	\$2,000.00	7/9/2008	9/30/2008		11/29/2008	\$2,000.00	1/9/2009	2/13/2009
10	Quarterly progress report #3	D6	10/1/2008	\$0.00	10/1/2008	12/31/2008		3/1/2009	\$0.00	1/9/2009	2/13/2009
11	Annual project review presentation	D7	8/14/2008	\$0.00	8/14/2008	9/30/2008	8/14/2008		\$0.00	1/9/2009	2/13/2009
12	Quarterly progress report #4	D8	1/1/2009	\$0.00	12/30/2008	3/31/2009		5/30/2009	\$0.00	1/9/2009	2/13/2009
13	Begin peregrine falcon monitoring	M5	2/15/2009	\$3,000.00	2/15/2009	3/31/2009		5/30/2009	\$3,000.00	4/29/2009	
14	Annual project data	D9	3/31/2009	\$4,000.00	3/30/2009	3/31/2009	4/6/2009	5/30/2009	\$4,000.00	4/29/2009	
15	Quarterly progress report #5	D10	4/1/2009	\$0.00	3/30/2009	6/30/2009		8/29/2009	\$0.00	4/29/2009	
16	Biennium project summary report	D11	6/30/2009	\$0.00		6/30/2009		8/29/2009			
17	Quarterly progress report #6	D12	7/1/2009	\$0.00		9/30/2009		11/29/2009			
18	Complete peregrine falcon monitoring	M6	8/31/2008	\$2,000.00		9/30/2009		11/29/2009			
19	Quarterly progress report #7	D13	10/1/2009	\$0.00		12/31/2009		3/1/2010			
20	Annual project review presentation	D14	TBD	\$0.00							
21	Quarterly progress report #8	D15	1/1/2010	\$0.00		3/31/2010		5/30/2010			
22	Receipt submittal	D16	TBD	\$0.00							
23	Written oral reports (if requested)	D17	TBD	\$0.00							
24	Draft final project report	D18	1/3/2010	\$2,000.00		3/31/2010		5/30/2010			
25	Final project data	D19	1/3/2010	\$1,000.00		3/31/2010		5/30/2010			
26	Final project report	D20	3/3/2010	\$1,000.00		3/31/2010		5/30/2010			
27	Final biennium project summary report	D21	TBD	\$0.00							
28	Project close-out, final approval of all deliverables	M7	6/30/2010	\$3,120.00		6/30/2010		8/29/2010			
29											
30											
31	<b>Totals</b>			<b>\$30,120.00</b>					<b>\$21,000.00</b>		
32								<b>Amount Remaining</b>	<b>\$9,120.00</b>		
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## **Goal 1: Detection, Attribution and Interpretation**

We detect and describe ecosystem changes across a range of spatial and temporal scales, can understand why change is occurring, and can interpret its significance.

### ***Objective 1: Status and Trends***

We know the status of ecosystem elements and processes and what has changed since humans began to significantly affect Sierra Nevada ecosystems.

**Assumption:** Knowledge of past and present Southern Sierra Nevada geophysical and biotic diversity, ecosystem processes, and human interactions with these diverse resources can provide a critical baseline for evaluating current ecosystem integrity and function, as well as historic change over time, and can therefore prepare us for an uncertain future.

#### **Task 1: Develop status and trends information**

- What ecosystem elements are important and time sensitive to track?
- What fundamental information do we need to be prepared for the future and why is the identified information important?
- What are the descriptions, status, and trends of fundamental and influential elements in the region (e.g. water, soils, and biota)?
- What is established in the literature and what is uncertain about recent status and trends of regional ecosystem elements?

#### **Task 2: Identify agents of change**

- Are climatic change, altered fire regimes, land use, non-native invasive species, and contaminants the most significant agents of change affecting our region?
- Are there other significant agents of change?

#### **Task 3: Identify sensitive and socially valued resources**

- Who are the stakeholders and what do they value?
- What are the bases for these values, e.g. ecosystems services like water?
- How are priority resources identified?
- Are the sensitive and valued resources in an acceptable condition?

44	Quarterly progress report	D21	10/1/2010	\$0.00		12/31/2010		3/1/2011			
45	2010 annual project review presentation	D22	10/31/2010	\$0.00		12/31/2010		3/1/2011			
46	Quarterly progress report	D23	1/1/2011	\$0.00		3/30/2011		5/29/2011			
47	GIS and data transfer to county	D24	2/1/2011	\$0.00		3/30/2011		5/29/2011			
48	2011 annual work plan	D25	2/1/2011	\$0.00		3/30/2011		5/29/2011			
49	Quarterly progress report	D26	4/1/2011	\$0.00		6/30/2011		8/29/2011			
50	Biennium project summary report	D27	6/30/2011	\$0.00		9/30/2011		11/29/2011			
51	Quarterly progress report	D28	7/1/2011	\$0.00		9/30/2011		11/29/2011			
52	Quarterly progress report	D29	10/1/2011	\$0.00		12/31/2011		3/1/2012			
53	2011 annual project review presentation	D30	10/31/2011	\$0.00		12/31/2011		3/1/2012			
54	Final biennium project summary report	D31	11/14/2011	\$0.00		12/31/2011		3/1/2012			
55	Final project report	D32	11/14/2011	15,000		12/31/2011		3/1/2012			
56	Final GIS and data transfer to county	D33	11/14/2011	0		12/31/2011		3/1/2012			
57	Project close-out, final approval of reports and data	M24	2/14/2012	32,988		3/31/2012		5/30/2012			

## ***Objective 2: Understand Key Cause and Effect Relationships***

We understand and can explain how particular agents of change drive changes in ecologically significant and/or socially valued resources.

**Assumption:** To take appropriate management action, we must be able to reliably demonstrate that the changes we observe are attributable to one or more agents of change that threaten our valued resources.

### **Task 1. Understand how social forces affect agents of change**

- What are the demographic forces?
- What are the political forces?
- What are the economic forces?
- What are the cultural forces?
- How do these interact?
- Where are they having the greatest impact and why?

### **Task 2: Understand relative contributions of and interactions among the agents of change**

- How does each agent of change affect ecosystem elements?
- How do cumulative impacts of the agents of change affect the ecosystem elements?
- How do the agents of change interact?
- What makes an ecosystem vulnerable, resistant, or resilient to agents of change?
- What makes human communities willing to adapt, and capable of adapting, to agents of change?

## ***Objective 3: Context for Interpreting Findings***

We understand how the rates and magnitudes of observed changes compare both to past changes (historical range of variability) and to desired conditions.

**Assumption:** Understanding the relative significance of observed changes is prerequisite to deciding what, if any, actions can and should be justified.

### **Task 1: Understand how observed changes compare to past changes**

- How did regional conditions change over long periods before Euroamerican settlement?
- How do recent trends in key agents of change compare to pre-Euroamerican trends?
- How do recent trends in ecosystem structure, composition, and function compare to pre-Euroamerican trends?

### **Task 2: Understand how observed changes compare to desired conditions**

- How do current trends and conditions compare to legal mandates?
- How do current trends and conditions compare to policy?
- How do current trends and conditions compare with stakeholder values?

No.	Deliverable	Type	Due date	Amount Allowed	Delivered	End quarter	Accepted	Invoice no later than	Invoice \$\$\$	Invoiced	Payment Received
1	Contract award and mobilization	M1	3/2/2008	\$10,000.00		3/31/2008		5/30/2008	\$10,000.00	6/24/2008	7/17/2008
2	Submit work plan	D1	3/20/2008	\$6,000.00	3/24/2008	3/31/2008		5/30/2008	\$6,000.00	6/24/2008	7/17/2008
3	Project kick-off meeting	D2	3/20/2008	\$2,000.00		3/31/2008		5/30/2008	\$2,000.00	6/24/2008	7/17/2008
4	Submit data management plan	D3	3/20/2008	\$4,000.00	3/24/2008	3/31/2008		5/30/2008	\$4,000.00	6/24/2008	7/17/2008
5	Begin monitoring Activities	M2	4/1/2008	\$15,000.00	4/1/2008	6/30/2009		8/29/2009	\$15,000.00	9/5/2008	
6	Submit quarterly progress report #1	D4	4/1/2008	\$0.00	3/31/2008	6/30/2009		8/29/2009			
7	Submit quarterly progress report #2	D5	7/1/2008	\$0.00	6/27/2008	9/30/2008		11/29/2008			
8	Submit quarterly progress report #3	D6	10/1/2008	\$0.00	9/30/2008	12/31/2008		3/1/2009			
9	Submit quarterly progress report #4	D7	1/1/2009	\$0.00		3/31/2009		5/30/2009			
10	Submit quarterly progress report #5	D8	4/1/2009	\$0.00		6/30/2009		8/29/2009			
11	Submit annual project data	D9	3/1/2009	\$35,000.00		3/31/2009		5/30/2009			
12	Submit biennium project summary report	D10	6/30/2009	\$5,000.00		6/30/2009		8/29/2009			
13	Submit quarterly progress report #6	D11	7/1/2009	\$0.00		9/30/2009		11/29/2009			
14	Submit quarterly progress report #7	D12	10/1/2009	\$0.00		12/31/2009		3/1/2010			
15	Annual project review presentation	D13	#####	\$0.00		12/31/2009		3/1/2010			
16	Submit quarterly progress report #8	D14	1/1/2010	\$0.00		3/31/2010		5/30/2010			
17	Complete monitoring activities	M3	3/31/2010	\$0.00		3/31/2010		5/30/2010			
18	Submit quarterly progress report #8	D15	4/1/2010	\$0.00		6/30/2010		8/29/2010			
19	Submit draft final project report	D16	4/30/2010	\$5,000.00		6/30/2010		8/29/2010			
20	Submit final data transfer to county	D17	5/30/2010	\$8,000.00		6/30/2010		8/29/2010			
21	Submit final project report to county	D18	5/30/2010	\$9,000.00		6/30/2010		8/29/2010			
22	Submit final biennium project summary report to county	D19	5/30/2010	\$5,000.00		6/30/2010		8/29/2010			
23	Project close out, final approval of all deliverables	M4	6/30/2010	\$10,737.00		6/30/2010		8/29/2010			
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## **Goal 2: Forecast Future Conditions**

We will be able to anticipate possible futures to help us develop feasible responses.

### ***Objective 1: Models describe key relationships***

We have the models needed to help explain relationships among forces driving ecosystems and their value and services.

**Assumption:** Scientific models help simplify and explain relationships.

#### **Task 1: Develop models**

- What models are already available?
- What relationships are not understood?
- What new models do we need?
- What should be the prioritization and sequence of their development?
- How do we validate the models?
- What needs to be parameterized?

### ***Objective 2: Forecasts***

We have forecasts of possible futures resulting from a range of environmental, socio-political, and management conditions.

**Assumption:** Forecasts of future conditions help managers and policy makers proactively consider the ramifications of alternative decisions.

#### **Task 1: Run models**

- What is a plausible range of future socio-political conditions?
- What is a plausible range of future conditions of agents of change, e.g. how bad will air pollution be in 2050?
- What is a plausible range of future ecosystem responses to these conditions?

#### **Task 2: Interpret model results**

- What are the possible implications for ecosystem management?
- What resources are likely to be most sensitive to agents of change?
- What resources are most vulnerable to threshold changes?
- What are the consequences of intervening in ecosystem processes to preserve biodiversity or desirable elements?

### ***Objective 3: Scenarios***

We have scenarios representing a range of possible and plausible futures.

## **Summary: Street Address Data Standard (Final Draft)**

The *United States Street, Landmark, and Postal Address Data Standard* (formerly the Street Address Data Standard) is a draft data processing standard for United States address information. The draft standard defines and specifies elements and structures for creating and organizing address data, defines tests of address data quality, and facilitates address data exchange. An address, as defined in the draft standard, specifies a location by reference to a thoroughfare or landmark; or it specifies a point of postal delivery. The draft standard has four parts: Data Content, Data Classification, Data Quality, and Data Exchange.

The Data Content part defines the simple and complex data elements that comprise an address, and the attributes that describe those elements. Categories of data elements include: address number, street name, occupancy, landmark names, place names, and postal delivery points such as post office boxes. Attributes describe the address and comprise the record-level metadata for addresses. Categories of attributes include address identifiers, geospatial coordinate systems and values, address descriptors, address schema, dates of origin and retirement, data set, and address authority identifiers. For each element and attribute, XML tags and syntaxes are provided. The Data Content part also defines simple and complex elements. Simple elements are those defined independently of all other elements. Complex elements are combinations of simple or other complex elements.

The Data Classification part defines address classes by their syntax: the data elements and the order in which the elements are arranged. Classifying addresses by syntax rather than semantics or meaning allows the users of the standard to focus on record structures, without requiring any assumptions about what the address locates. XML tags and syntaxes are given for each class. Eleven classes are defined and presented in three groups:

1. Thoroughfare classes specify a location by reference to a thoroughfare.
2. Landmark classes specify a location by reference to a named landmark.
3. Postal classes specify points of postal delivery that have no definite relation to the location of the recipient, such as a post office box.

A 12<sup>th</sup> class, the general class, can hold addresses of unknown or mixed classes, such as general-purpose mailing lists.

The Data Quality part checks the internal consistency, both tabular and spatial, of address elements, attributes, and classes. The tests cover attribute (thematic) accuracy, logical consistency, completeness, positional accuracy, and lineage. Each test is named, described, categorized, and presented in SQL-based pseudocode.

The Data Exchange part defines an XML schema document (XSD) to provide a template for the data and metadata needed for address data exchange. It also provides information on preparing data for transmittal (normalizing and packaging) and receipt (unpackaging and localizing). Exchange modes are provided for monolithic (complete dataset) exchange and transactional (adds and deletes) exchanges. XML is used to make address data exchange simpler, more flexible, and more reliable.

The *United States Street, Landmark, and Postal Address Data Standard* has been drafted by the Urban and Regional Information Systems Association (URISA) Address Standard Working Group, with support from the National Emergency Number Association and the U.S. Census Bureau, for submittal to the U.S. Federal Geographic Data Committee.

**Assumption:** Scenarios are useful narratives for a range of plausible futures that form the basis for scenario planning, which is a well-developed and widely-accepted tool for coping with uncertainty.

**Task 1: Create a range of plausible future scenarios**

- What are the questions we want to answer?
- What are the information requirements?
- What is the best way to create plausible scenarios?

**Task 2: Understand scenario utility**

- What do the scenario results suggest?
- How much confidence in these results is warranted?



Sandee  
Dingman/LAME/NPS  
04/03/2009 10:47 AM

To Joseph Hutcheson/LAME/NPS@NPS, Chanteil  
Walter/LAME/NPS@NPS, Curt Deuser/LAME/NPS@NPS,  
Beth Points/LAME/NPS@NPS, Ryan  
cc Aaron Baldwin/LAME/NPS@NPS, Josh  
Fulton/LAME/NPS@NPS, Mary Hinson/LAME/NPS@NPS,  
stephanie.velasquez@fire.ca.go, Kent  
bcc

Subject READ meeting notes and tasks

Hi All:

Thanks to all who participated in the pre-season Resource Advisor meeting yesterday. Attached are the meeting notes and assigned tasks. Note that the target date for completion is May 15.

I've also inserted the task list on this email for ease of access.

#### General Tasks

Add trigger zones to Dispatch CAD – Aaron  
Make mapbook of Trigger zones for Duty Officer and Engine – GIS (Sandee to request)  
Add message service to READ phone – Aaron  
Update READ and emergency contact phone lists (add compliance for ROW contact) – Sandee  
Pre-define Agency Reps as appropriate – Aaron/Mary  
Find a “go to” vehicle for READ use this year – Sandee  
Consider adding Terrain Navigator on laptop for Engines and non-GIS READs – Aaron/Sandee

#### READ Plan Revisions

Update invasive species guidelines – Sandee  
Add cultural guidelines – Glendee Ane

#### Update READ Harddrive

Add 2008 DO/RM 18 – Sandee  
Add FMP FONSI – Chanteil  
Add new Supt Compendium – Chanteil  
Add Muddy Mts Wilderness FONSI – Chanteil  
Add GPSbabel tool – GIS (Sandee to request)  
Update utility corridors – GIS (Sandee to request)  
Update mine land data – GIS (Sandee to request)  
Add new AZ soils data – GIS (Sandee to request)  
Add Landfire data – Sandee/GIS (Sandee to request)  
Update springs data – GIS (Sandee to request)  
Update LAME waterbodies elevation – GIS (Sandee to request)  
Add I&M veg map for PARA – GIS (Sandee to request)  
Add Wildland Urban Interface layer – Sandee/GIS (Sandee to request)  
Update Roads layer – GIS (Sandee to request)

All hard drive updates to be compiled at T:\Resource\READ\materials

## **Goal 3: Tools and Actions**

We have the tools required to take effective and efficient action.

### ***Objective 1: Adaptation***

We have the tools and action options required to effectively adapt to change.

**Assumption:** We have the ability to adjust to impending unprecedented change.

#### **Task 1: Identify the current capacity for adaptation**

- What tools and approaches currently further *ecosystem* resilience, resistance, realignment, and response to known agents of change?
- What tools and approaches currently further *human* resilience, resistance, realignment, and response to known agents of change?

#### **Task 2: Develop new capability to adapt**

- What tools need to be developed to evaluate *ecosystem* resilience, resistance, realignment, and response to known agents of change under varied and uncertain conditions?
- What tools need to be developed to evaluate *human* resilience, resistance, realignment, and response to known agents of change under varied and uncertain conditions?
- How can we strategically identify parts of the landscape for different management actions?
- Where on the landscape should actions be taken now?
- What tools need to be developed to support triage?
- How do human communities develop the willingness and capacity to adapt to agents of change?

### ***Objective 2: Curb undesired agents of change***

We have the tools and action options required to help slow the rate of change.

**Assumption:** Society has the ability to affect agents of change.

#### **Task 1: Identify the current capacity for slowing agents of change**

- Which agents of change can be slowed?
- How can these agents of change be slowed?
- What tools exist to slow them?

#### **Task 2: Develop new capability**

- What information and tools need to be developed to develop capacity?
- Which management action alternatives are feasible?

**Great Basin Cooperative Ecosystem Studies Unit  
Task Agreement Modification  
National Park Service**

**TASK AGREEMENT NO:** J8R07060019    **MODIFICATION NO.:** 01    **COOPERATIVE AGREEMENT NO.:** H8R07060001    **EFFECTIVE DATES:** 09/30/06-11/30/08

**COOPERATOR:** University of Nevada, Las Vegas – Harry Reid Center for Environmental Studies

**PROJECT TITLE:** Development and Support for the Lake Mead National Recreation Area Resource Management Information System

**PURPOSE OF MODIFICATION:** The purpose of this modification is to change office location where the Task Agreement will be administered and where payments should be sent.

**MODIFICATION:**

1. **ARTICLE V.B. – AWARD AND PAYMENT**, is modified to read as:

- B. Standard Form (SF) 270, Request for Advance or Reimbursement, must be submitted for payment to the Contracting Officer at the convenience of UNLV, but not to exceed monthly. The request for reimbursement shall be accompanied by a breakdown sheet showing cost in each budgetary item and shall be addressed to:

Judy Couch, Contracting Officer  
Lake Mead National Recreation Area  
601 Nevada Hwy.  
Boulder City, NV 89005  
(702) 293-8755 phone  
(702) 293-8626 fax  
judy\_couch@nps.gov

2. All other terms and conditions remain unchanged.

**BOARD OF REGENTS OF THE NEVADA SYSTEM  
OF HIGHER EDUCATION, ON BEHALF OF  
UNIVERSITY OF NEVADA, LAS VEGAS**

**NATIONAL PARK SERVICE  
PACIFIC WEST REGIONAL OFFICE - OAKLAND**

*Signature not required*

*/s/ Theresa Fisher*

\_\_\_\_\_  
Rochelle R. Athey  
Executive Director of Sponsored Programs

\_\_\_\_\_  
Theresa Fisher  
Contracting Officer

*6/7/07*

\_\_\_\_\_  
Date

\_\_\_\_\_  
Date

### ***Objective 3: Measure Success***

Actions are evaluated to determine the degree of their success.

**Assumption:** We need to evaluate the success of actions to validate selected goals, objectives, assumptions, and actions and to be accountable resource stewards.

#### **Task1: Understand the consequences of action (including no action)**

- How can science improve accountability in monitoring management actions?
- What are the positive/negative, acceptable/unacceptable, cost effective/not-cost effective risks of management actions to increase ecological and human resilience to a broad range of possible futures?
- How do we know that we are being effective?

#### **Task 2: Assess adaptation actions**

- What prognostic tools exist or need to be developed to judge the probability of success?
- What diagnostic tools exist or need to be developed to measure success?
- What agency mandates or directives are not feasible?
- How do managers identify and define important management thresholds including when to start, stop, and expand management activities?

*Recommended Monitoring Quagga Mussels for 2009 to 2011.doc)*



Next Steps or Recommended Monitoring Quagga Mussels for 2009 to 2011.doc

## **Goal 4: Information Management and Delivery**

We have easy access to the growing body of information and effective ways of disseminating that information to the public, resource managers, and the scientific community.

### ***Objective 1: Clearinghouse***

A place or process will be established for the gathering, storage, and dissemination of high quality information.

**Assumption:** A location (physical or virtual) for readily accessible and credible information is essential.

#### **Task 1: Select the information**

- What should be the scope of the collection?
- What studies, inventories, and monitoring information, etc. already exist and where are they currently located?
- What existing data, reports, and publications of value should be digitized?
- How do we select which of these to make accessible?
- How will new information be vetted to insure its integrity, quality and transparency?

#### **Task 2: Manage the information**

- How can this information be made readily and broadly accessible?
- How will information be accessioned and catalogued?
- How should this information be served?
- How will sensitive information be secured?
- Who will be responsible for creating and maintaining the clearinghouse?

### ***Objective 2: Effective use of information***

Effective and innovative ways will be employed to disseminate, utilize, and monitor information that has been gathered to reach targeted audiences.

**Assumption:** Information needs and the understanding of that information varies among and between the various stakeholders and stakeholder groups.

#### **Task 1: Identify the information needs of target audiences**

- Within the target audiences, what specific groups and individuals are we trying to reach and for what purpose?
- What specific types of information do these groups and individuals need?
- How do these different needs affect the Clearinghouse?



jennell.miller@unlv.edu  
06/09/2009 08:52 AM

To Jennell.miller@unlv.edu  
cc  
bcc Kent Turner/LAME/NPS  
Subject Interagency Water 2025 Summary: 6-3-2009

Hello all,

Please find attached summary from the June 3, 2009 Interagency Water 2025 Meeting. Most of the presenters have had the opportunity to review it. Changes may still be incorporated; the final version will be sent out prior to the next meeting scheduled for August 25, 2009 at the SNWA River Mountains Water Treatment Facility (9am to 12 noon).

**Action items from the June 3 Meeting:**

-- Lake Mead Special Issue of *Lake and Reservoir Management* : Authors who have not yet done so, please be sure to submit manuscripts to Jennell Miller at: [jennell.miller@unlv.edu](mailto:jennell.miller@unlv.edu) ASAP. The technical committee is reviewing manuscripts and will provide their comments directly to authors (and cc Chris Holdren and Todd Tietjen). Papers must be ready to submit electronically to LRM by August 1, 2009. Authors: Please give some thought to names of suggested reviewers for the journal's external peer review process. You will be able to enter these names as part of the on-line submission process.

-- Please review the draft outline for the "Long Term Limnological Resource Monitoring and Research Plan for Lakes Mead and Mohave" (see attached). Please send comments to Kent Turner at [kent\\_turner@nps.gov](mailto:kent_turner@nps.gov) by August 14, 2009 for incorporation in time for the August meeting.

-- One-page statements of work to continue existing projects for one year (or one-year's worth of funding spanned out over several years) would be helpful to have at the August meeting.

-- Next Meeting: Interagency Water 2025 (Wednesday, August 25, 2009 – 9am to 12 noon – SNWA River Mountains Water Treatment Facility). Topics will include continued discussion on the ecological monitoring plan for Lakes Mead and Mohave with a focus on research and monitoring questions for the Water Quality and Limnology and Fish and Aquatic Biota sections, as time allows.

Thank you!

Jennell M. Miller, Ph.D.  
Science and Research Programs Coordinator

University of Nevada, Las Vegas  
Public Lands Institute  
4505 S. Maryland Parkway  
Box 452040  
Las Vegas, NV 89154-2040

p: 702.895.5429  
f: 702.895.5166

[jennell.miller@unlv.edu](mailto:jennell.miller@unlv.edu)

## Glossary

The Strategic Framework development team compiled the following definitions of key terms to ensure that they were used consistently and clearly throughout this document.

**Adaptation** – Management of ecosystems and human communities to ameliorate the undesired effects of agents of change.

**Agents of change** – The Sierra Nevada Ecosystem Project (1996) identified five regional systemic agents of change: rapid climatic change, altered fire regimes, invasive species, habitat fragmentation, and contaminants. In addition to these, we recognize two other important agents of change that must be understood: historic and contemporary recreational activities and land use. Sometimes agents of change are referred to as stressors.

**Clearinghouse** – A centrally located place, virtual or physical, where information is collected and disseminated.

**Cultural resource** – An aspect of a cultural system that is valued by or significantly representative of a culture, or that contains significant information about a culture. A cultural resource may be a tangible entity or a cultural practice. (NPS Management Policies, 2006)

**Decision-maker** – The managerial-level employee who has been delegated authority to make decisions or to otherwise take an action that would affect [public land] resources or values (NPS Management Policies, 2006). Here refers to resource managers, policy makers, and line officers.

**Ecosystem** – A system formed by the interaction of a community of organisms with their physical and biological environment, considered as a unit. (NPS Management Policies, 2006)

**Ecosystem element** – A living or non-living physical object in any ecosystem. Elements scale from individual organisms and single rocks or water bodies to species-populations and entire drainages or landscapes. Ecosystem elements are the “nouns” in the system in contrast with ecosystem processes, the “verbs.”

**Forecast** – A projection of future conditions based on a model that is incomplete, poorly validated, or otherwise known or suspected to be imperfect. Because our understanding of ecosystems is imperfect, ecosystem models give us forecasts, not predictions.

**Management intervention** – A management action designed to intentionally alter ecosystem conditions.

**Mitigation** – [With respect to global warming] An action taken to reduce the rate of increase of greenhouse gases in the atmosphere to slow the rate of global warming. Mitigation may be in the form of reducing releases of greenhouse gases, or of sequestering those already in the atmosphere.

**Natural resource** – A living or non-living physical object that is derived from the natural world, such as plants, animals, soil, water and air.

**Realignment** – Management actions that adjust ecosystems to the reality of large, rapid, and uncontrollable environmental changes, rather than trying to restore and maintain past ecosystem conditions.



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**Resilience** – The ability to recover from changes induced by a stress.

**Resistance** – The ability to resist or absorb stresses without changing greatly.

**Resource** – Any physical or virtual entity of limited availability. In this context, only natural and cultural resources are considered. (See Natural Resource and Cultural Resource.)

**Resource practitioners (specialists)** – Those who advise decision-makers and actively manage resources for accepted purposes and needs.

**Response** – Management actions meant to facilitate transitions of ecosystems from current to new conditions.

**Scenario** – A plausible and internally consistent narrative about a possible future. Scenarios may or may not incorporate model forecasts. A very simple example of a scenario: “In 2050 the Sierra Nevada is warmer and wetter, but snow is melting much earlier; wildfires are somewhat larger and harder to control; recreational visitation has more than doubled; and a previously unknown pathogen is killing giant sequoias at 10 times the ‘normal’ rate.”

**Scenario planning** – Scenario planning is a strategic planning process in which managers invent and then consider, in depth, several varied scenarios of plausible futures with the objective of revealing potential surprises and producing unexpected leaps of understanding. These scenarios provide a tool for transforming the perceptions of a management team. The point is to make strategic decisions that will be sound for a range of plausible futures, and scenario planning makes this possible by considering choices in the context of possible futures.

**Southern Sierra Nevada Ecoregion** – A broad geographic area and the associated ecosystem types located south of the Tuolumne watershed to the Tehachapi Creek, to the east of the 450 foot contour and west of the Sierra Nevada crest.

**Stakeholders** – Any individual or group interested in all or parts of a particular project, landscape, or resource.

**Stressor** – See Agents of Change.

**Target audience** – A group of four broad categories of people consisting of decision makers, resource specialists, scientists, and the public.

**Tool** – A tool is a device or entity used to accomplish a task or facilitate more effective action; it serves as a means to an end.



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# **A Synthesis of Questions Asked at the Southern Sierra Science Symposium**

**September 5, 2008**

As a first step toward the development of this Strategic framework, the MOU signatories organized a two-day symposium, which took place on September 4 and 5, 2008. The first day of the symposium involved scientists presenting on a range of topics related to climatic change and the Southern Sierra Nevada ecoregion. The second day was a forum for brainstorming the range of information needs related to climatic change and other agents of change in the Southern Sierra.

The results of the symposium's second day provided a foundation for the development of the Strategic Framework. The Framework development team used this material in the development of the strategic goals, objectives, tasks and questions. The development team's synthesis work of the Symposium Day Two material is included here for reference.

The development team acknowledges the important contribution of the following individuals.

## **Symposium Day Two Participants**

John Austin (NPS), Craig Axtell (NPS), Roger Bales (UC Merced), Klaus Barber (USFS), Colleen Bathe (NPS), John Battles (UC Berkeley), Danny Boiano (NPS), Matt Brooks (USGS), Tony Caprio (NPS), Ricardo Cisneros (USFS), Jeff Cordes (USFS), Marianne Emmendorfer (USFS), Annie Esperanza (NPS), John Exline (USFS), Carrie Fox (Fox Mediation), Linn Gassaway (USFS), Dave Graber (NPS), Steve Hanna (USFS), Sylvia Haultain (NPS), Don Hunsaker (CSU-Fresno), Carolyn Hunsaker (PSW), Barbara Johnson (USFS), Terry Johnson (USFS), Rob Klinger (USGS), Rick Larson (USFS), Pat Lineback (NPS), Kathleen Matthews (PSW), Rachel Mazur (NPS), Connie Millar (PSW), Tom Munton (PSW), Linda Mutch (NPS), Malcolm North (PSW), Dave Parsons (USFS-Aldo Leopold Institute), George Powell (USFS), Trent Procter (USFS), Kathryn Purcell (PSW), Joe Reyes (USFS), Nancy Ruthenbeck (USFS), Brent Skaggs (USFS), Scott Stephens (UC Berkeley), Nate Stephenson (USGS), Peter Stine (PSW), Teresa Sue (USFS), Priscilla Summers (USFS), Charisse Sydoriak (NPS), Tina Terrell (USFS), Craig Thompson (PSW), Phil van Mantgem (USGS), Jan van Wagendonk (USGS), Tom Warner (NPS), Harold Werner (NPS), Jim Whitfield (USFS), Rebecca Reynolds (RRC) - facilitator

## **Symposium Day One Presenters**

John Battles (US Berkeley), Matthew Brooks (USGS), Ricardo Cisneros (USFS), David Graber (NPS), Nancy Grulke (USFS), Robert Klinger (USGS), Constance Millar (USFS), Mark Nechodom (USFS), Malcolm North (USFS), Scott Stephens (UC Berkeley), Nathan Stephenson (USGS), Jan van Wagendonk (USGS), Anthony Westerling (UC Merced), Robert York (UC Berkeley)

----- Forwarded by Alice Corrine Newton/LAME/NPS on 05/15/2009 02:31 PM -----



**Kent Turner/LAME/NPS**

05/07/2009 03:36 PM

To Rosie Pepito/LAME/NPS@NPS, Steve Daron/LAME/NPS@NPS, Mark Sappington/LAME/NPS@NPS, Ross Haley/LAME/NPS@NPS, Alice Corrine Newton/LAME/NPS@NPS, Curt Deuser/LAME/NPS@NPS, Bryan Moore/LAME/NPS@NPS, Michael J Boyles/LAME/NPS@NPS, Gary Karst/LAME/NPS@NPS

cc

Subject Fw: Annual Narrative Reports of Superintendents and Regional Director for FY 2008

All: I need input for the superintendents annual narrative report for fy2008, due June 30. See below of the memo, which also describes the nature of these reports. I need from each of you no more than a couple of sentences to a few paragraphs on the highlights - milestones and analytical, actions - of fy08 in your program. Note the hope that these reports are somewhat admin history.

please send me your info by June 2 COB

I've also attached last years report

[attachment "RM 2005 Annual Narrative Report.doc" deleted by Alice Corrine Newton/LAME/NPS]

----- Forwarded by Kent Turner/LAME/NPS on 05/07/2009 03:32 PM -----



**William K Dickinson/LAME/NPS**

05/06/2009 04:52 PM

To Gary Warshefski/LAME/NPS@NPS, Kent Turner/LAME/NPS@NPS, Kris Kirby/LAME/NPS@NPS, Andrew Munoz/LAME/NPS@NPS, Jim Holland/LAME/NPS@NPS, Lizette Richardson/LAME/NPS@NPS, Bobbie Antonich/LAME/NPS@NPS, Mary Hinson/LAME/NPS@NPS, Jennifer Haley/LAME/NPS@NPS

cc

Subject Fw: Annual Narrative Reports of Superintendents and Regional Director for FY 2008

All,

See below.

Andy, you have the lead in preparing this report... might check with Roxanne relative to past reports.... Division Chiefs/program managers will need to assist/provide input.

Bill D.

William K. Dickinson, Superintendent  
Lake Mead National Recreation Area

## GOAL 1: DETECTION, ATTRIBUTION AND INTERPRETATION

- In the next two years answer the following questions and update annually:
  - a) What is the best available status and trends information preparing us for uncertain future conditions? At a minimum synthesize information on:
    - i) the history of non-native species invasions, what makes areas vulnerable to invasion, and what preventative actions, and restoration techniques have worked;
    - ii) which “transformative” invasive plants and animals currently occur in the Sierra;
    - iii) what is the potential for emigration into the region by other invasives and which of these could be considered potentially “transformative;”
    - iv) the distribution, amount and quality of the hydrologic resources; and
    - v) existing, long-term change monitoring datasets for Sierra forest systems.
- What are the characteristics of the soils throughout the region?
- How do the basic components of the system (e.g., soil characteristics, water quality and quantity) and the system as a whole respond to changing precipitation patterns and water budget?
- How do we detect pathogens and other small organisms? How do you set up detection systems for these things?
- Can we detect landscape level changes? If so, what has changed and can these detected changes be attributed?
- What has changed in the extant ecosystems and why?
- How will the cumulative impacts of human-caused stressors affect wildlife phenology, reproduction, migration, and behavior?
- What are the cumulative effects of fire, air pollution and drought on public land resources?
- Which regional ecosystems are most vulnerable to one or more stressors and what makes each ecosystem vulnerable?
- What makes a system resistant/resilient to invasion by species that would cause transformation? What factors make a system more vulnerable to invasion?
- What gaps in knowledge exist concerning the following stressors?

### Rapid Climatic Change

- How have regional ecosystem components responded to changing precipitation patterns?
- How has the regional water budget changed?

### Transport and Deposition of Pollutants

- What is the spatial and temporal distribution of the various forms of pollutants and why?
- What is the relationship between ecosystem changes and human health problems caused by pollutants and why?
- How has the transport and deposition of pollutants changed over time?
- Has pollution impacted the region’s natural and cultural resources and if so when, where and how?
- What have been the effects of pollution on biotic diversity/integrity and ecosystem function?

601 Nevada Way  
Boulder City, NV 89005  
Phone: (702) 293-8920  
Fax: (702) 293-8936

- What is the threshold amount of little known contaminants/pesticides (such as mercury) that can cause biomagnified, persistent or toxic effects on native species integrity or ecosystem function? Can these thresholds be breached in this region?
- How has the regional air quality changed over time?
- Has degraded air quality adversely impacted the region's natural and cultural resources and if so when, where and how?
- What are the synergistic affects on humans and other resources from a variety of pollutants, i.e. ozone and particulate matter?
- How is smoke from management activities affecting the health and welfare of adjacent communities over both the short and long term?
- What have been the effects on water from nitrogen and other pollutants? Is the affect exacerbated by changing precipitation caused by climatic change?

#### Altered Natural Fire Regimes

- What areas are at risk of catastrophic natural or cultural resource value losses due to altered natural fire regimes, disease and/or drought?
- How has fire intensity, severity, seasonality, and burn pattern changed? And what are the effects of these changes at the landscape level and on localized sensitive, high profile resources?

#### Invasive Species Encroachment

- What is the ecological response to species additions and deletions, as well as management actions taken to control invasives?
- What makes a system resistant/resilience to invasion by species that would cause transformation (e.g., complexity)? What factors make a system more vulnerable to invasion?
- What are the interactive effects of the invasive species with other stressors? How do the other stressors (e.g., contaminants, fire, and climatic change) interact with species invasions?
- How do we identify invasions at any scale and in all systems (e.g., disease pathogens, snails, range expansions)?

#### Habitat Fragmentation

- When, where, how and why has the region's natural ecosystems been fragmented by human development and use?
- What are the habitat fragmentation thresholds for sensitive species and ecosystems?

#### Social values, ecosystem elements and stewardship

- Are certain southern Sierra Nevada resources and their function more important than others? What is the basis for this belief?
- What are the current levels and types of ecosystem services being used and how much are these services valued by society?"
- Are the sensitive and high profile resources in an acceptable condition?

project. Although even with these savings the project may be considered “expensive,” costs would be far higher if the project were conducted by an independent contractor.

## 8. Project Support

**Table 1. Project Support Cost Estimates**

Estimated volunteered salary costs are not consistent due to different overhead rates at different cost centers. A new electroshock boat would cost more than \$80,000. The boat we will be using is not new, so the estimate included below is approximately 7.5% of the cost of a new boat.

**Estimated By:**

USGS/LAME

**Date of Estimate:** 10/20/08

<b>Item</b>	<b>Description</b>	<b>Percent of Total Project Cost</b>	<b>Item Cost</b>
Volunteer Services Costs	Reynaldo Patiño: Research Fish Biologist, USGS GS-482-15: 4 weeks of time per year in years 1 and 2 and 2 weeks in year 3	6.20%	\$33,841
	Steve Goodbred: Research Fish biologist, USGS GS-482-14: 4 weeks of time per year	4.70%	\$25,652
	Jill Jenkins: Research Microbial Biologist, USGS GS-403-13: 5 weeks of time per year	4.95%	\$26,997
	David Alvarez: Research Chemist USGS GS-1320-13: 4 weeks of time per year	5.13%	\$28,000
	Michael Rosen: Research Hydrologist, USGS GS-1301-14: 4 weeks of time per year	9.53%	\$52,000
	Erik Orsak: Environmental Contaminant Specialist, USFWS GS-402-12: 4 weeks of time per year	7.15%	\$39,000
Donated Supplies Costs	Lab plasticware and stains	0.15%	\$800
	passive sampler field hardware	0.29%	\$1,600
	GC/MS supplies	0.09%	\$500
	Syringes, tinfoil, necropsy supplies, other misc. field supplies needed for fish processing	0.37%	\$2,000
Donated Equipment	Used electroshocking boat	1.10%	\$6000

- What options exist for cost effective stakeholder continuous learning and contribution?
- How can we prevent the loss of “legacy species” (e.g., sugar, white bark and foxtail pines, and giant sequoias)?
- What makes sensitive resources and systems resistant to unacceptable change? Is that state of resistance achievable in all or only in selected locations?
- What are the cumulative effects’ thresholds in the region’s sensitive and highly valued ecosystems?
- What can be done now and over the long-term to make the giant sequoia, wetlands, lakes, white bark pine, and meadow ecosystems resilient or resistant to change caused by anthropogenic stressors?
- What are the necessary ecological conditions to protect giant sequoia groves from undesired fire effects?
- When, where, how and why is recreational use causing stress to sensitive and high profile public land resources?
- How has the history of human use of the Sierra Nevada, particularly since the turn of century altered the biotic integrity and ecosystem function/processes of the resources at all scales?
- How have the cumulative and/or interactive effects of political and economic pressures affected the region’s natural and cultural resources?
- Which public values have changed relative to the Sierra Nevada natural resources and why?
- When, where, how and why does visitor use affect identified stressors?
- How is visitor use affected by identified stressors?
- What are the cumulative impacts of pollutants on natural and cultural resources and on people’s recreation preferences?
- Are demographic changes in the Sierra foothills caused by a growing retiree population significantly changing public expectations about clear air? Is the air quality in the foothills and mountains better than in the Central Valley?
- What changes in visitation have occurred and where? Can these changes be attributed?
- What are short term and long term impacts to human health from public lands management activities (including no action decisions).
- Do livestock and or packstock (for recreational purposes) cause Sierran meadows, wetlands, or other ecosystems to cross a critical transformative threshold and remain there despite management intervention?
- What are the social and ecological benefits of livestock use in meadow ecosystems?
- Do certain exotics have social value? If so, how is this balanced with potential ecological change?
- Can public land management agencies ensure an adequate supply of energy, water, timber, and other public land resources in the future? If so, what are the assumptions?
- When and where, and under what conditions can fire be used as a management tool to protect regionally sensitive and high profile resources?
- What affect do management actions have on pools and fluxes of carbon at the landscape scale? On water yield and snow hydrology?
- How are political and economic conditions affecting current ecological conditions?
- What is the current relationship between scientists, land-use managers, and citizen stewards?
- What land-use patterns increase and/or decrease ecosystem resilience?

Costs	FWS fish shocking boat rental	0.55%	\$3,000
	NPS boats	0.55%	\$3,000
	FWS seine nets	0.09%	\$500
	Flow cytometer preventative maintenance	0.55%	\$3,000
	GC/MS and UV/Vis plate reader preventative maintenance	0.18%	\$1,000
	Centrifuge, ultra-cold freezer, balances, fish board, live well, canopy (from previous studies)	1.93%	\$10,500
Non-NRPP Contributions	None		
Non-Federal Contributions	None		
Other Contributions	Lake Mead NRA contributed funding = \$21,000	3.85%	\$41,000
	USGS Nevada Science Center contributed overhead costs = \$20,000	3.67%	
<b>Project Support Cost Estimate Totals</b>		<b>51.04%</b>	<b>\$278,390</b>

## 9. Scientific merit

This multidisciplinary project applies cutting edge science using passive samplers and bioassays to assess estrogenicity and other toxic properties of water. New approaches to assess reproductive health in fish developed by one of the co-PIs will be applied, and the assessment of sources of organic contaminants will be a first for the lower part of LAME. A considerable amount of planning and consultation was applied to the development of this proposal. The team of PIs includes nationally and internationally recognized researchers with a combined experience in endocrine disruption and water quality studies of over 80 years. Their knowledge of LAME issues and water quality matters elsewhere in the country coupled with their scientific credentials provide a high level of assurance that the new findings generated from this study will help park managers assess and solve the issues surrounding endocrine disruption in Lake Mead.

### **Appendix B: Guidelines for Interpretive Component (this proposal is not interpretive)**

### **Appendix C: Project Budget**

#### **Table 2. Project Cost Estimates**

**Estimated By:** USGS/LAME

**Date of Estimate:** 10/20/08

**Estimate Good Until:** 09/30/2011

**Class of Estimate:**

USGS/LAME

## GOAL 2: FORECAST FUTURE CONDITIONS

- How is climatic change affecting giant sequoias?
- What are the consequences of changing climate on fire regimes, insect outbreaks, and hydrology? Can this information be used to calibrate physically based models?
- What are the effects of forest dynamics and management actions on water yield and snow hydrology?
- What makes a system resistant/resilient to invasion by species? What factors make a system more vulnerable to invasion?
- How does the Sierra Nevada water budget respond to changing precipitation patterns?
- How would giant sequoias change if a 10-year drought occurred?
- What is an expectable level of risk from fire effects to sequoia groves? Does the level of risk change based on specific grove characteristics such as past logging activities or slope?
- What is a possible range of management actions to increase ecosystem resistance and resilience to a broad range of possible futures?
- What is the spatial distribution and pattern of ozone, nitrogen, particulate matter and contaminants?
- Can future conditions be analyzed for both air pollution and climatic change simultaneously?
- How do management actions affect pools and fluxes of Carbon (particularly underground C) at large scales?
- What are the cumulative effects' thresholds in southern sierra meadows and giant sequoia groves?
- What are the cumulative effects of fire, air pollution and drought on ecosystem resilience?
- What does climatic change mean to the recreating public in the southern Sierras? Will recreation opportunities change?
- Does climatic change affect where people will live?
- How can we meet our management goals for cultural resources and sensitive species given certain fire effects, including: intensity, seasonality, and mosaic burn patterns?
- How do contaminants, fire, and climatic change interact with species invasions?
- How do we evaluate the ecological response to species additions and deletions?
- What linkages exist between ecological change and human health from pollutants (short & long term)?
- How can the relationships between scientists, land-use managers, and citizen stewards be improved?
- How do you detect pathogens and other small organisms?
- What makes a system resistant/resilient to invasion by species that would cause transformation (e.g., complexity)? What factors make a system more vulnerable to invasion?
- Does modification of existing land-use patterns increase and/or decrease ecosystem resilience: if so, how?
- How much time do we realistically have before critical transformative change occurs?
- At what point should we accept an ecologically novel or surrogate assemblage?
- Can we realistically mix up genomes to strengthen resistance? When, where and how?

Date of Estimate: 10/20/08

Item	Description	Qty	Unit	Unit Cost	Item Cost (System Calculated)	
Personnel Services Costs	Michael Rosen Research Hydrologist USGS GS-1301-14 12 weeks of time	1	project	45,000	45,000	
	Jill Jenkins Research Microbial Biologist USGS GS-403-13 5 weeks of time per year	2	1 year	23,000	46,000	
	USGS GS-1320-9 Chemist 4 weeks of time per year	2	1 year	8,000	16,000	
	Carla Wieser Fisheries Biologist USGS GS-0482-9 2 weeks of time per year (maybe more for lab setup)	2	1 year	3,775	7,550	
	D. Shane Ruessler Fisheries Biologist USGS GS-0482-11 2 weeks of time per year	2	1 year	3,775	7,550	
	Travel and Transportation Costs	Travel to LAME, travel to project meetings	15	1trip	2,500	37,500
	Supplies Costs	Laboratory supplies and equipment maintenance				17,000
	Chemicals, consumables		2	1,000	2,000	
Equipment Costs	Electroshockling boat parts	2,000	1	2,000	2,000	
Contractor And Cooperator Costs	Graduate Student Salary (Texas Tech University)	2	1	21,502	43,004	
	Arctic Slope Regional Corp. Scientific Technician II	2	1	3,000	6,000	
Other Costs (incl. Overhead)	Overhead			57,401	57,401	

### GOAL 3: TOOLS AND ACTION OPTIONS

- What tools currently evaluate *ecosystem* resilience, resistance, realignment, and response to known stressors?
- What tools currently evaluate *human* resilience, resistance, realignment, and response to known stressors?
- What diagnostic tools exist to show the probability of success?
- What tools need to be developed to evaluate *ecosystem* resilience, resistance, realignment, and response to known stressors under varied and uncertain conditions?
- What tools need to be developed to evaluate *human* resilience, resistance, realignment, and response to known stressors under varied and uncertain conditions?
- What are our high-value assemblages and what are they based on (define high value and who decides). What metrics should we use to assign value? What is the management threshold?
- How can scientists, land-use managers, and citizen stewards address adjustments to management actions based on monitoring results in a timely and consistent manner?
- How can science better integrate policy, procedures, and funding structures to improve responsiveness to both human and ecological needs?
- Do existing air quality warnings affect people's activities?
- Under what conditions are public land management activities likely to have unanticipated and adverse affects on sensitive and high profile resources?
- How are the agents of change (stressors) affecting society's perspective?
- How do we know that management actions are being effective? Are they succeeding anywhere? What are the cascading effects of these efforts?
- How do managers identify and define important management thresholds including when to start, stop, and expand management activities?
- How do you set up detection systems for identifying pathogens and other small organisms?
- What are the most resistant and resilient ecosystems? Should we focus on them?
- How is human action changing the landscape? How is human use changing in response to a changing landscape?
- How can science improve accountability in monitoring management actions?
- What are the positive/negative, acceptable/unacceptable, cost effective/not-cost effective risks of management actions to increase ecological and human resilience to a broad range of possible futures?
- How does Wildland Urban Interface (WUI) management affect community and ecosystem resilience?

Costs)					
<b>Component Funding Estimate</b>					<b>267,005</b>
<b>Total Project (requested plus in-kind)</b>					<b>545,395</b>

#### **GOAL 4: INFORMATION MANAGEMENT AND DELIVERY**

- What studies, inventories, and monitoring information is available and where is it currently located?
- What are our critical knowledge “gaps?”
- Where are the high-risk, sensitive resources located (hotspots of vulnerability)?
- How are desirable future conditions recorded and where are they located?
- Where would be a good physical location in terms of costs and access, to catalog, store, and disseminate information? How should information be organized and by whom?
- Who are the audiences we are trying to reach and for what purpose?
- What specific types of information/education do these targeted audiences need, want, and desire?
- What is the best way to synthesize, analyze, and interpret gathered information for a specific audience so that they can communicate and utilize this information amongst themselves and others?
- What existing and future products are available to help disseminate this information to targeted audiences?

## Proposed Project Focus Areas and Budget Guidelines

Total Available approximately \$1,425,000

### Continue Basic WQ and Limnological Monitoring

- |   |                                 |
|---|---------------------------------|
| 1) BOR Monthly Surface WQ and Quagga Veliger Monitoring | Estimated \$630,000             |
| 2) WQ Platform Data (3 to 5 Platforms)                  | Estimated \$350,000 - \$450,000 |
| 3) Tributary Inflow Monitoring                          | Estimated \$60,000              |

Total Estimate for Basic WQ and Limnological Data (and Veligers) Estimated \$1,090,000

Quagga Mussel Monitoring \$200,000

Twitchell, USGS: Completion of bottom profile data \$25,000

Adult monitoring by dives and ROV budgeted elsewhere and will be done (quarterly, 4 sites)

Additional? 18 sites within the IMAP?, additional invertebrate?, additional fisheries?

### Next Phase of Environmental Health Analysis

Suggested: Summary EDC findings and analysis paper with suggested next steps  
\$200,000

Other potential: Reanalysis of fathead minnow study \$100,000