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OFFICE OF
INTEGRATIVE
ACTIVITIES

Finding of No Significant Impact:

Academic Research Infrastructure - Recovery and Reinvestment Program

The National Science Foundation (NSF) has prepared an Environmental Assessment (EA) to evaluate the potential environmental effects that would result from the implementation of ten projects across the United States that NSF is considering for funding under its Academic Research Infrastructure – Recovery and Reinvestment (ARI-R2) program. The EA was prepared pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA), the President's Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] part 1500-1508), and NSF's regulations implementing NEPA (45 CFR Part 640). The EA is attached to this Finding of No Significant Impact and incorporated by reference.

Proposed Action

The proposed action consists of the funding under the ARI-R2 program of the ten projects shown in Table 1. Each of the ten projects is described in detail in Section 2.1 of the EA.

Purpose and Need

The purpose of the proposed action is to implement needed improvements and renovations to the research and education infrastructure of the institutions being considered for a grant and thereby contribute to the enhancement of the research and training infrastructure of the nation's academic institutions and non-profit research organizations, consistent with the intent of the ARI-R2 program and NSF's mission. The proposed action is needed because the infrastructure at each of the different institutions is either insufficient or in too poor a condition to adequately support current and future scientific research and research training activities.

Alternatives

The EA evaluates the impacts of the No Action Alternative (none of the projects would receive funding and be implemented) and the Proposed Action Alternative (all ten projects of the projects would receive funding and be implemented).

The proposed action includes projects that have been identified as both potentially qualifying for an ARI-R2 grant and requiring preparation of an EA pursuant to 45 CFR Part 640. The No Action Alternative would not meet NSF's purpose and need and, as such, is not a reasonable alternative. However, NEPA regulations require that an EA evaluate the impacts of the No Action Alternative to provide a baseline against which the impacts of the other alternative or alternatives can be evaluated.

Table 1 – Proposed Action

#	Name	Proponent	Summary Description	Location
1	Center for Ocean Biogeochemistry and Climate Change (COBCC)	Bigelow Laboratory for Ocean Sciences	Construct new 20,000-square-foot, three-story laboratory building	East Boothbay, Lincoln County, Maine
2	Renovation and upgrade of environmental change study infrastructure	Smithsonian Environmental Research Center (SERC)	Repair existing weirs, dams, flumes, and spillways; renovate existing laboratory building; construct 500-square-foot instrument shed; install seven radio towers	Edgewater, Anne Arundel County, Maryland
3	Murray Laboratory	Rocky Mountain Biological Laboratory	Replace existing laboratory with a new, 5,000-square-foot facility at the same location.	Gothic, Gunnison County, Colorado
4	Moe Pond Laboratory	State University of New York (SUNY)-Oneonta	Replace laboratory building at the SUNY Oneonta Biological Field Station Upper Research Facility at Moe Pond	Otsego, Otsego County, New York
5	Wawona Field Station Renovations	University of California (UC)-Merced	Renovate existing Building 4050 for use as research space	Wawona, Yosemite National Park, Mariposa County, California
6	Northwest Indian College Laboratory	Northwest Indian College	Construct 3,270-square-foot laboratory building on new campus	Lummi Reservation, Whatcom County Washington
7	Multi-site cyber-infrastructure improvements	UC Natural Reserve System (UCNRS)	Install new data transmission infrastructure in 17 reserves	Various locations, California
8	Microwave Relay Antennas	Lowell Observatory	Install microwave relay antennas at three existing sites	Flagstaff and other locations, Coconino County, Arizona
9	Greenhouse Replacement	UC Santa Barbara	Construct two new greenhouses (2,700 square feet and 700 square feet, respectively); demolish one existing building to build the larger greenhouse	Santa Barbara, Santa Barbara County, California
10	St. Anthony Falls Laboratory Renovations	University of Minnesota	Renovate existing laboratory building and construct instrument gantry in adjacent Outdoor Stream Laboratory	Minneapolis, Hennepin County, Minnesota

Public and Agency Review

The Draft EA was made available for public review and comment on NSF's website from August 6, 2010 through September 7, 2010. The Draft EA was also mailed to a total of 72 agencies or organizations.

Comments were received from four agencies: the Lummi Natural Resources Department; Anne Arundel County, Maryland; the Maine Department of Environmental Protection; and the City of Minneapolis Planning Division. NSF reviewed the comments and modified the EA, as appropriate, to address them. The comments and NSF's responses have been included in the final EA in Appendix J. In addition, a letter was received from the California State Clearinghouse indicating that no California State Agencies had comments on the EA.

Environmental Consequences

The potential environmental impacts of the EA are addressed in Chapter 3 of the EA and are summarized below.

Transportation: The proposed action has no potential to generate any noticeable impacts pertaining to transportation. The projects mostly consist of upgrades, renovations, or replacement of existing facilities and do not include any significant increase in the number of persons traveling to and from the project sites every day. In the long term, some of the projects may lead to a greater use of the improved facilities by researchers and students than would be the case under no action conditions. However, these increases would remain small in absolute terms and would also vary with the time of the year as well as other factors not related to the proposed action (e.g., availability of financial help or scholarships, popularity of certain programs, etc.). A partial exception is Project 1, which is part of a long-planned larger campus to be built on a new site currently undeveloped. Once complete, the campus will be the work-place of approximately 76 employees and will receive about 30 visitors every day. Under the Maine Site Location of Development Law, Chapter 374, projects that generate less than 100 passenger-car equivalents during peak travel hours are not subject to traffic review, indicating an expectation of *de minimis* impacts. While the projects would generate construction-related traffic, their small scale combined with the temporary character of construction-related traffic ensures that these impacts would be negligible.

Demographics, Community Facilities, and Utilities: None of the projects would result in any significant change in the permanent population of the areas where they are located. The proposed projects consist of the upgrade, renovation, or replacement of existing facilities and do not include or would not lead to a measurable increase in the working or residential population present on the sites. With regard to Project 1, the staff and visitors that would come to the new campus are already present on the existing campus in Boothbay Harbor, a short distance away. For the same reason, the proposed action has no potential to affect community facilities such as schools, hospitals, or emergency services. Finally, again for the same reason, none of the projects would result in a significant increase in the demand for utility services (e.g., water, electricity) relative to no action conditions.

Environmental Justice (Executive Order [EO] 12898): None of the projects included in the proposed action raise environmental justice issues. No project would disproportionately affect any minority or low-income populations protected under EO 12898.

Protection of Children (EO 13045): All project locations are either remote from population centers (Project 3, Project 4, and Project 7) or are located on campuses or facilities that are not accessible to unsupervised children. While several of the proponent institutions may temporarily host groups of children (for instance as part of a school's field trip), none of the proposed projects would create conditions that are likely to result in harm to these children. While construction activities may involve some risks, visitors would not be allowed near or in construction areas.

Recreational Facilities: None of the proposed projects has the potential to adversely affect recreational facilities such as public parks or trails. The site of the new Bigelow Campus in East Boothbay contains public walking/all-terrain vehicle trails. These trails will be preserved or adequately relocated as required by the Contract Zoning Agreement with the Town of Boothbay, though they will be designated for pedestrian use only; a public parking area will be provided. These actions are part of the overall plan for the campus and the proposed construction of the COBCC building under Project 1 would not affect them. All the other projects would take place on land that is not publicly accessible and/or would not materially affect any nearby recreational facilities.

Hazardous Substances: The projects included in the proposed action consist of the repair, renovation, upgrading, or replacement of existing research facilities. In the long term, while these projects would enhance the different proposing institutions' ability to fulfill their scientific and educational mission, they would not result in a substantial change in the type and scale of the activities conducted at the project locations. At those sites where hazardous substances are stored and used, the acquisition, storage, and disposal of those substances are, and would continue to be, conducted in compliance with applicable federal, state, and local laws and regulations. In the short term, any demolition and construction activities potentially involving the use or generation of hazardous substances also would be conducted in compliance with applicable laws and regulations.

Land Use: The construction activities associated with the proposed projects would require the temporary use of currently open areas on or near the project sites for staging and storing of construction equipment. Because of the modest scale of the projects, none would require the construction of temporary facilities or structures. After construction is complete, the staging/storage area would be restored to its previous condition. Therefore, in all cases, these short-term negative impacts on land use would be negligible. The proposed action would have long-term minor positive impacts on land use, as in every case it would enhance the existing functionality of each site as a research and educational facility. No land use incompatibilities would be created.

Historic, Archaeological, and Cultural Resources: Impacts to historic, archaeological, and cultural resources would range from none to minor adverse effect depending on the project. There are no such resources within the regions of influence of Projects 1, 4, 6, and 9. This is also the case for two of the three sites where antennas would be installed under Project 8. At the third site, the Lowell Observatory campus at Mars Hill (Flagstaff, AZ), a National Historic Landmark, an antenna would be set up on a water tank; the tank is a recent structure that does not contribute to the historic integrity of the site and none of the historic facilities would be directly or indirectly affected. Therefore, there would be no impacts.

For projects involving ground-disturbing work in areas with archaeological potential, the monitoring of these activities combined with the small size of the disturbance area for each project would ensure that any adverse impacts to archaeological resources are minor at most and not significant.

Three projects would directly affect historic buildings. Project 5 involves renovating a former garage that is a contributing element to the National Register-listed Wawona Historic District in Yosemite National Park, CA. The building is operated by UC-Merced under a special use permit from the National Park Service (NPS). The proposed renovation would be designed in accordance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* and reviewed by NPS pursuant to the Programmatic Agreements in place to address potential effects to historic properties under the Park's jurisdiction; any adverse impacts are expected to remain minor. One component of Project 7 involves setting up an antenna on the Shane Telescope Dome at the UC Observatory/Lick Observatory site on Mount Hamilton, CA, which is eligible for listing in the National Register. A determination of effect prepared by the project proponent (UC Santa Cruz) and reviewed by the California State Historic Preservation Officer (SHPO) established that this would have no significant adverse effect on the historic integrity of the building. Finally, Project 10 involves renovations and upgrades to the University of Minnesota's St. Anthony Falls Laboratory (SAFL) facility, a contributing element to the National Register-listed St. Anthony Falls Historic District in Minneapolis, MN. At the present time, the design of the proposed improvements is not sufficiently advanced to allow for a complete evaluation of their potential impacts on the SAFL facility and the historic district. Therefore, a Programmatic Agreement (PA) was executed between NSF, the University of Minnesota, the Minnesota SHPO, and the National Park Service that defines a process through which the PA signatories and other consulting parties will review the design of the proposed upgrades as they are further developed and, through this review, ensure that the proposed action results in no significant adverse impact to the historic integrity of the SAFL facility and the St. Anthony Falls Historic District.

Visual Quality: All projects involving more than a trivial amount of construction would result in negligible direct short-term negative visual impacts as construction equipment and activities would temporarily detract from the visual quality of the respective project sites. These impacts would cease after construction and would be negligible. In the long term, the proposed projects would result in no to minor adverse impacts to visual quality. The new facilities and structures to be constructed under Projects 1, 2, 3, 4, 6, 8, and 9 would be visually compatible with their surroundings and/or would not result in the obstruction or deterioration of valuable landscapes or vistas. Project 7 involves, among others, installing transmission antennas in the vicinity of California State Scenic Highways (State Route 74 and Highway 1). As shown by the photographic documentation presented in the EA, however, because of their limited heights, their remote locations, and the areas' topography, these structures would be nearly invisible from the roads; impacts, therefore, would be negligible. Project 10 in Minneapolis, which involves renovating the historic SAFL building and constructing a movable instrument-carrying bridge over an artificial stream in Wasteway 2, a historic structure visible from other portions of the surrounding St. Anthony Falls Historic District as well, may result in visual impacts. At this early stage, the design of the proposed improvements is not sufficiently advanced to allow for a full evaluation of these impacts. However, review of the project under the above-mentioned PA among NSF, the University of Minnesota, the Minnesota SHPO, and the National Park to address potential effect to the historic integrity of the SAFL facility and surrounding historic district would ensure that any adverse impacts are minimized and remain non-significant. Similarly, review by NPS of the renovations proposed under Project 5 for historic building 4050 in Yosemite Park and their implementation in a manner consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* would ensure that the project results in no significant adverse impacts to the building or the Wawona Historic District.

Air Quality: All projects would have negligible (Projects 2, 5, 7, 8, and 10) to minor (Projects 1, 3, 4, 6, and 9) short-term direct negative impacts because of the air emissions that would result from the construction activities associated with each project. The principal pollutants emitted during typical construction projects are PM_{10} and $PM_{2.5}$ from the fugitive dust created during clearing, grubbing, excavation, and grading; demolition of structures and pavement; vehicle travel on unpaved roads; and material blown from unprotected graded areas and stockpiles. A secondary source of pollutants during construction is engine exhaust from construction equipment generating precursors to O_3. However, construction-related emissions are, by definition, temporary and would cease after the work is completed. Additionally, they are unevenly distributed and generally highest during the early stages of construction while decreasing quickly after the earth-moving activities associated with site preparation and foundation work end. Finally, standard best management practices (BMP) – such as watering to control dust plumes, covering trucks when hauling dust, seeding dirt piles if not removed immediately, re-vegetating disturbed land as soon as possible, and limiting equipment and vehicle idling as much as possible – would be implemented to minimize impacts while they last. This, in conjunction with the modest to minimal size of the projects, ensures that construction-related adverse impacts on air quality remain minor for those projects involving building demolition and construction (Projects 1, 3, 4, 6, and 9) and negligible for those projects involving primarily renovation work or the installation of communication equipment (Projects 2, 5, 7, 8, and 10). In the long term, Projects 2, 5, 7, 8, and 10, which involve the renovation of existing facilities or the installation of communication equipment, would not result in the creation of new sources of air emissions or an increase in the use of existing sources. Therefore, they would have no long-term impacts on air quality. The other projects included in the proposed action, which involve the construction of new facilities that would have to be heated, cooled, and ventilated, would result in impacts to air quality ranging from none (for Projects 6 and 9) to minor (for Projects 1, 3, and 4) because of the small size of the buildings and project features (e.g., solar panels) designed to minimize non-renewable energy consumption.

Projects 2, 5, and 7 would take place in areas in non-attainment for one or more of the pollutants for which National Ambient Air Quality Standards (NAAQS) have been defined under the requirements of the Clean Air Act (40 CFR 50). The US Environmental Protection Agency has published final rules on general conformity (40 CFR Parts 51 and 93 in the Federal Register on

November 30, 1993) that apply to federal actions in non-attainment areas. The rules specify *de minimis* emission levels by pollutant to determine the applicability of conformity requirements for a project. A formal conformity determination is required when the annual net total of direct and indirect emissions from a federal action occurring in a nonattainment area equals or exceeds the applicable annual *de minimis* levels. If a federal action meets the *de minimis* requirements, it is exempt from further conformity analysis pursuant to 40 CFR Part 93.153 and is considered to have minimal air quality impacts. The EA includes a quantitative analysis of the emissions that would result from the implementation of Projects 2, 5, and 7. The analysis shows that these emissions are well below the applicable *de minimis* thresholds; therefore, a formal conformity determination is not required for these projects.

Noise: None of the projects included in the proposed action would result in any significant long-term increase in the amount or intensity of noise generated at the project sites. None would create a new noticeable source of noise. All the projects involving non-trivial amounts of construction work would generate noise from the operation of mechanical equipment and the movement of trucks and workers' vehicles to and from the site. These short-term impacts would range from moderate for Project 1 (blasting would be required to lay out the foundations of the complex of which the proposed building would be a part) to minor or negligible for the other projects, depending on the scale of the project and duration of the construction work. These impacts would substantially decrease after the initial stages of construction and cease entirely after construction is complete. They would not be significant.

Earth Resources: Impacts to earth resources would primarily result from the ground-disturbing activities, such as blasting, excavating, and grading, associated with those projects involving non-trivial construction. Projects involving no or trivial amounts of construction work would not result in any noticeable impacts. These include Projects 2, 5, 7, 8, and 10. The remaining projects involve non-trivial, though minor, construction. The primary concern, for such projects, is soil erosion during the early stages of work. However, erosion would be minimized through the use of BMPs, such as adding protective cover (for example mulch or straw), to exposed soils; implementing site-grading procedures that limit the time that soils are exposed prior to being covered by impermeable surfaces or vegetation; erecting erosion and sediment control barriers; and implementing temporary impoundments to catch soil eroded from the site prior to flowing into the drainage network. Therefore, impacts would not be significant. Risks of increased erosion are further reduced by the small scale of the projects and would cease entirely with construction. In the long term, none of the projects would result in significant impacts to earth resources.

Water Resources: With the exception of Project 2, none of the projects included in the proposed action would involve construction in surface waters, wetlands, or floodplains. Therefore, they would have no impacts on these resources. Project 2 includes the replacement of two existing boardwalks that serve tidal wetland research projects. Short-term impacts to these wetlands would be minimized because replacement would occur in winter, when marsh plants are dormant and the marsh surface is frozen. Any construction operations or machinery would be placed on "swamp mats" to distribute weight and minimize impact on the marsh surface. Under the same project, repair of three tidal flux stations and eight non-tidal stream weirs would affect existing streams. Impacts would be minimized by conducting the work at the end of summer, when the non-tidal streams normally do not flow, and flows are lower in the tidal streams. Because of the risk of thunderstorms, the excavation work in the streambeds would be accomplished quickly—normally within two days. Therefore, short-term impacts would be negligible. Because the new facilities would replace existing facilities in the same locations and within the same footprints, there would be no long-term impacts. It is estimated that the activities proposed under Project 2 would temporarily disturb 0.16 acres of tidal wetlands and 0.08 acres of non-tidal streams. Because less than one acre of wetlands would be disturbed, the proposed action would fall under a US Army Corps of Engineers General Permit for filling wetlands. In compliance with Sections 404 and 401 of the Clean Water Act, the project proponent (the Smithsonian Environmental Research Center [SERC]) would file a Joint Federal/State Application for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland with the Maryland Department of the Environment's Regulatory Services Coordination Office and the US Army Corps of Engineers. This permit would cover the proposed rebuilding of the boardwalks and rehabilitation of the stream weirs and tidal flux stations – all in their current locations. Construction would not start until the permitting process is complete. Project 2 would also involve the construction of a new storage shed within the 100-year floodplain. However, according to Anne Arundel County's Final Draft Article 16 Floodplain Management regulations, an uninhabited accessory structure, such as the proposed shed, can be built within the 100-year floodplain if it is less than 600 square feet in size (the proposed shed would be 500 square feet in size).

Several of the projects (Projects 1, 2, 3, 4, and 6) included in the proposed action would result in the creation of new impervious areas with associated local increases in stormwater runoff. In all cases, the additional runoff would be easily absorbed by existing or planned stormwater management systems (Projects 1 and 6) or percolate through the surrounding ground (Projects 2, 3, and 4) with no significant adverse impacts. Project 4 would have an impact on groundwater because it involves the construction of a well to supply the site with non-drinking water. Given the very modest size of the facility to be served, withdrawals are expected to be minimal and impacts negligible. Well construction in Otsego County, NY, where Project 4 is located, does not require a permit. None of the other projects has potential to affect groundwater.

Biological Resources: Projects 5, 8, 9, and 10 would not disturb or otherwise affect any significant amount of natural habitat and, therefore, have no potential to generate any noticeable impacts on biological resources. The other projects included in the proposed action would have negligible adverse impacts: small amounts of limited-value habitat would be lost to new construction under Projects 1, 3, 4, and 6. Under Projects 2 and 7, multiple communication antennas would be installed in unimproved areas with much higher potential as habitat. However, in addition to the very small footprint of the proposed structures, both project proponents – SERC for Project 2 and the UC Natural Reserve System for Project 7 – have the study of the natural environment as their primary mission and would take all due precautions when micro-siting the proposed structures to avoid or minimize impacts to any sensitive plants or animal species.

Cumulative Impacts: None of the proposed projects would result in significant cumulative impacts when considered in combination with past, present, and foreseeable future projects within their respective regions of influence.

Other Regulatory Reviews

Section 106 Review: NSF reviewed each of the ten projects included in the proposed action for potential effects to historic properties in compliance with Section 106 of the National Historic Preservation Act (NHPA). The findings of this review are presented in Section 3.5 of the EA. Associated correspondence and documentation is provided in appendices to the EA. For each project, resources listed or eligible for listing in the National Register of Historic Places in the area potentially affected by the project were identified and the effects of the project on these resources was evaluated in consultation with the SHPO and other consulting parties, as appropriate. The following projects would have no effect on historic properties either because there are no historic properties within the area of potential effect or because, although there are historic properties in the area of potential effect, the project would not affect them (36 CFR 800.4[d][1]): Project 1, Project 4, Project 6, Project 7, and Project 9. The following projects would have no adverse effects on historic properties (36 CFR 800.5[b]): Project 2, Project 3, Project 5, and Project 8.

The effects of Project 10 on the National Register-listed SAFL facility and St. Anthony Falls Historic District could not be fully evaluated because some of the proposed improvements to the SAFL facility cannot be designed to the level of detail required for a complete assessment until the project is funded. Therefore, pursuant to 36 CFR 800.14(b)(1)(ii), NSF, the University of Minnesota, the Minnesota SHPO, and the National Park Service have entered into a Programmatic Agreement (PA). The PA was executed on August 7, 2010. The City of Minneapolis Heritage Preservation Commission and the Minneapolis Riverfront Corporation signed the PA as Consulting Parties. The Advisory Council on Historic Preservation (ACHP) was provided an opportunity to comment on the PA and participate in its development. After reviewing the draft PA, the ACHP responded that its did not believe that its participation in the PA was necessary. The PA establishes a consultation and review process with public participation that will provide input to and feedback during the design phase that would be part of the project, if funded. The PA defines the procedures through which the proposed improvements will be reviewed and approved by the signatories and Consulting Parties prior to implementation to ensure that any potential adverse effects are avoided, minimized, or mitigated. Compliance with the procedures established by the PA satisfies NSF's Section 106 responsibility for Project 10 (36 CFR 800.14[b][2][iii]).

Section 7 Review: NSF reviewed each of the ten projects for potential effects to federally-listed threatened and endangered species in compliance with Section 7 of the Endangered Species Act. For each project, NSF obtained a list of the listed species known to occur in or near the project area from the US Fish and Wildlife Service and, when appropriate, the National Marine Fisheries Service (NMFS). For each project, NSF evaluated the potential effects of the proposed action on these species. This review is documented in Section 3.11 of the EA. Based on a review of the species potentially present in the area and the character and scope of the proposed projects and their locations, NSF found that none of the ten projects would have any effects on species protected under the Endangered Species Act. Therefore, the proposed action does not require formal consultation under Section 7.

Coastal Zone Management Act: Project 1 is in Maine's designated Coastal Zone; however, under the state's Coastal Zone Program, federal assistance to an independent 501(c)(3) non-profit research institution such as Bigelow Laboratory does not require the preparation and filing of a federal consistency determination. Projects 7 (for some of the reserves) and 9 are within the California Coastal Zone. However, under California's Coastal Zone program, federal assistance to state or local governments or agencies (in this case, the University of California system) does not require a federal consistency determination. Project 2 is located within the designated coastal zone of Maryland. As explained in Section 3.9.2.2 of the EA, Project 2 would have negligible impacts on water resources and the EA includes a Negative Determination statement (Section 3.1.1.1) pursuant to 15 CFR 930.35. The other projects were located outside designated state or tribal coastal zones and do not require consideration under the Coastal Zone Management Act.

Conclusion

Based on the findings of the EA and the comments received on the Draft EA, NSF has determined that implementation of the proposed action with the project features and best management practices described in the EA and in compliance with the terms of the PA for Project 10 would result in no significant impacts to the human environment. Therefore, a Finding of No Significant Impact fulfills NEPA requirements for the proposed action and preparation of an environmental impact statement (EIS) is not required.

W. L. Haworth 9/16/2010

Dr. W. Lance Haworth, Date
Director,
Office of Integrative Activities

Executive Summary

This environmental assessment (EA) evaluates the impacts on the human environment that would result from the implementation of ten projects across the United States that the National Science Foundation (NSF) is considering for funding under the Academic Research Infrastructure – Recovery and Reinvestment (ARI-R2) program. The EA was prepared pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA), the President's Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] part 1500-1508), and NSF's regulations implementing NEPA (45 CFR Part 640).

Funded under the American Recovery and Reinvestment Act of 2009 (ARRA), the ARI-R2 program is a one-time funding opportunity to enhance the existing research and training infrastructure of the nation's academic institutions and non-profit research organizations in order to provide scientists, educators, and students with next-generation research infrastructure.

Proposed Action

The proposed action consists of the funding under the ARI-R2 program of the ten projects shown in Table ES-1 below.

Purpose and Need

The purpose of the proposed action is to implement needed improvements and renovations to the research and education infrastructure of the institutions being considered for a grant and thereby contribute to the enhancement of the research and training infrastructure of the nation's academic institutions and non-profit research organizations, consistent with the intent of the ARI-R2 program and NSF's mission. The proposed action is needed because the infrastructure at each of the different institutions is either insufficient or in too poor a condition to adequately support current and future scientific research and research training activities.

Alternatives

The EA evaluates the impacts of the No Action Alternative (none of the projects would receive funding and be implemented) and the Proposed Action Alternative (all ten projects would receive funding and be implemented).

There are no reasonable action alternatives that NSF could be considering: the proposed action includes all the projects that have been identified as both potentially qualifying for an ARI-R2 grant and requiring preparation of an EA pursuant to 45 CFR Part 640. For each project, the proposed action is the only alternative that meets the proponent's needs and is compatible with its mission, its ongoing activities and plans, and known operational, technical, and environmental constraints.

Table ES-1 – Proposed Action

#	Name	Proponent	Summary Description	Location
1	Center for Ocean Biogeochemistry and Climate Change (COBCC)	Bigelow Laboratory for Ocean Sciences	Construct new 20,000-square-foot, three-story laboratory building	East Boothbay, Lincoln County, Maine
2	Renovation and upgrade of environmental change study infrastructure	Smithsonian Environmental Research Center (SERC)	Repair existing weirs, dams, flumes, and spillways; renovate existing laboratory building; construct 500-square-foot instrument shed; install seven radio towers	Anne Arundel County, Maryland
3	Murray Laboratory	Rocky Mountain Biological Laboratory	Replace existing laboratory with a new, 5,000-square-foot facility at the same location.	Gothic, Gunnison County, Colorado
4	Moe Pond Laboratory	State University of New York (SUNY)-Oneonta	Replace laboratory building at the SUNY Oneonta Biological Field Station Upper Research Facility at Moe Pond	Otsego, Otsego County, New York
5	Wawona Field Station Renovations	University of California (UC)-Merced	Renovate Building 4050 for use as research space	Wawona, Yosemite National Park, Mariposa County, California
6	Northwest Indian College Laboratory	Northwest Indian College	Construct 3,270-square-foot laboratory building on new campus	Lummi Reservation, Washington
7	Multi-site cyber-infrastructure improvements	UC Natural Reserve System (UCNRS)	Install new data transmission infrastructure in 17 reserves	Various locations, California
8	Microwave Relay Antennas	Lowell Observatory	Install microwave relay antennas at three existing sites	Flagstaff and other locations, Coconino County, Arizona
9	Greenhouse Replacement	UC Santa Barbara	Construct two new greenhouses (2,700 square feet and 700 square feet, respectively); demolish one existing building to build the larger greenhouse	Santa Barbara, Santa Barbara County, California
10	St. Anthony Falls Laboratory Renovations	University of Minnesota	Renovate existing laboratory building and construct instrument gantry in adjacent Outdoor Stream Laboratory	Minneapolis, Hennepin County, Minnesota

Impacts

The findings of the impact analysis are summarized in Table ES-2. The impacts of each project considered for funding were evaluated separately. For each resource area, the impacts of the proposed action as a whole are those of the project with the greatest impacts on the resource in question.

Conclusion

Following agency and public review of the draft EA, NSF has determined that the proposed action would have no significant impacts on the human environment.

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Table ES-2 - Summary of Impact Evaluation

	Land Use	Historic Resources	Visual Quality	Section 106 review	Air Quality	Noise	Earth Resources	Water Resources	Biological Resources	T&E Species Section 7
Proposed Action Alternative										
Project 1	ST: Neg. - LT: Min. + C: Min. +	ST: None LT: None C: None	ST: Neg. - LT: None C: None	No historic properties affected	ST: Min. - LT: Min. - C:Min. -	ST: Mod. - LT: Neg. - C: Min. -	ST: Min. - LT: Min. - C: Min. -	ST: Neg. - LT: Neg. - C: Mod. -	ST: Neg. - LT: Neg. - C: Mod. -	No effect
Project 2	ST: Neg. - LT: Min.+ C: Min. +	ST: None LT: Min. - C: Min. -	ST: Neg. - LT: Neg. - C: Neg. -	No Adverse effect	ST: Neg. - LT: None C: one	ST: Neg. - LT: None C: None	ST: None LT: None C: None	ST: Neg. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Min. -	No effect
Project 3	ST: Neg. - LT: Min. + C: Min. +	ST: None LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. + C: Min. +	No adverse effect	ST: Min. - LT: Neg. - C: Min. -	ST: Min. – LT: Neg. – C: Neg. -	ST: Neg. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Min. -	No effect
Project 4	ST: Neg. - LT: Min. + C: Min. +	ST: None LT: None C: None	ST: Neg. - LT: Neg. + C: Neg. +	No effect	ST: Min. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Neg. -	ST: Neg. - LT: Neg. - C: Neg. -	ST: Neg. - LT: Neg. - C: Neg. -	ST: Neg. - LT: Neg. - C: Neg. -	No effect
Project 5	ST: Neg. - LT: Min. + C: Min. +	ST: Neg. - LT: Min. - C: Min. -	ST: Neg. - LT: None C: None	No adverse effect	ST: Neg. - LT: None C: None	ST: Min. - LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	No effect
Project 6	ST: Neg. - LT: Min.+ C: Min. +	ST: None LT: None C: None	ST: Neg. - LT: None C: None	No historic properties affected	ST: Min. - LT: None C: None	ST: Min. - LT: None C: None	ST: Neg. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Mod. -	No effect
Project 7	ST: Neg. - LT: Min.+ C: Min. +	ST: None LT: Neg. - C: Min. -	ST: Neg. - LT: Min. - C: Min. -	No effect	ST: Neg. - LT: None C: None	ST: Neg. - LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	ST: Neg. - LT: Neg. - C: Neg. -	No effect
Project 8	ST: Neg. - LT: Min.+ C: Min. +	ST: None LT: None C: None	ST: Neg. - LT: Neg. - C: Neg. -	No Adverse effect	ST: Neg. - LT: None C: None	ST: Neg. - LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	No effect
Project 9	ST: Neg. - LT: Min.+ C: Min +	ST: None LT: None C: None	ST: Neg. - LT: None C: None	No historic properties affected	ST: Min. - LT: None C: None	ST: Min. - LT: None C: None	ST: Neg - LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	No effect
Project 10	ST: None LT: Min.+ C: Min. +	ST: Neg. - LT: Min. - C: Min. -	ST: Neg. - LT: Min. - C: Min. -	No adverse effect	ST: Neg. - LT: None C: None	ST: Neg. - LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	No effect
Proposed Action	ST: Neg. - LT: Min. + C: Min. +	ST: Neg. - LT: Min. - C: Min. -	ST: Neg. - LT: Min. - C: Min. -	No adverse effect	ST: Min. - LT: Min. - C:Min. -	ST: Mod. - LT: Neg. - C: Min. -	ST: Min. - LT: Min. - C: Min. -	ST: Neg. - LT: Neg. - C: Mod. -	ST: Neg. - LT: Neg. - C: Mod. -	No effect

	Land Use	Historic Resources	Visual Quality	Section 106 review	Air Quality	Noise	Earth Resources	Water Resources	Biological Resources	T&E Species Section 7
					No Action Alternative					
Project 1	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 2	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 3	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 4	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 5	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 6	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 7	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 8	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 9	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 10	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	
No Action	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-

Key:
ST = Short term   Neg.= Negligible   + - Positive
LT = Long term   Min. = Minor   - = Adverse
C = Cumulative   Mod. - Moderate

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1. Purpose and Need for the Proposed Action

1.1 Introduction

This environmental assessment (EA) evaluates the impacts on the human environment that would result from the implementation of ten projects across the United States that the National Science Foundation (NSF) is considering for funding under the Academic Research Infrastructure – Recovery and Reinvestment (ARI-R2) program. The EA was prepared pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA), the President's Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] part 1500-1508), and NSF's regulations implementing NEPA (45 CFR Part 640).

1.1.1 The National Science Foundation

NSF is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…" NSF is the funding source for approximately 20 percent of all federally-supported basic research conducted by America's colleges, universities, and other research institutions. The agency's annual budget is approximately $7 billion.

NSF primarily fulfills its mission by issuing limited-term grants to fund specific research proposals that have passed a rigorous and objective review process. NSF also funds the acquisition of equipment and infrastructure that is needed by scientists or engineers but is too expensive for any individual researcher or group of researchers to afford. Examples include optical and radio telescopes, high-end computers, or very large bandwidth network connections.

1.1.2 The ARI-R2 Program

Funded under the American Recovery and Reinvestment Act of 2009 (ARRA), the ARI-R2 program is a one-time funding opportunity to enhance the existing research and training infrastructure of the nation's academic institutions and non-profit research organizations in order to provide scientists, educators, and students with next-generation research infrastructure. The program's goals are to:

- Update research facilities at institutions of higher education (including graduate and undergraduate institutions) and other, non-profit research organizations (e.g., independent research museums, independent research laboratories, and research consortia) in order to support research that can address the challenges of the 21st century.

- Enable academic departments, disciplinary and cross-disciplinary units, or multi-organization consortia to renovate research facilities through the addition or augmentation of cyber-infrastructure other than general-purpose computing systems or data storage systems, to create environments that enhance research and integrate research with education.

- Improve access to and increase the use of next-generation research facilities for researchers, educators, and students.

- Assist research organizations, including those that have historically received limited federal research and development funds, to improve their science and engineering research environments.

In fiscal year 2009, NSF issued a call for grant proposals under the ARI-R2 program. Grants under the program must be issued before the end of the current fiscal year (2010).

1.1.3 NEPA Requirements for NSF Awards

NEPA requires the preparation of an environmental impact statement for "*proposals for legislation and other major federal actions significantly affecting the quality of the human environment…*" (Section 102[2][c]). Most NSF awards are not such actions "*except in the sense that the long-term effect of the accumulation of human knowledge is likely to affect the quality of the human environment. However, such long term effects are basically speculative and unknowable in advance; thus they normally do not provide a sufficient basis for classifying research as subject to NEPA (See 40 CFR 1508.8) and are categorically excluded*" (45 CFR 640.3). However, in some cases, the activities enabled by NSF's grants may have potential environmental effects, for instance, if they involve the construction of new facilities or major ground disturbance. These activities generally require the preparation of an EA to determine whether their potential effects would be significant. If the EA determines that the impacts would indeed be significant, preparation of an environmental impact statement (EIS) is required.

1.1.4 Proposed Action

Among the projects that NSF is considering for funding under the ARI-R2 program, ten have been identified as falling in the category of projects requiring preparation of an EA per 45 CFR 640.3. They are listed in Table 1-1 below and are described in more detail in Chapter 2. The location of each project is shown in Figure 1-1. The funding of these projects through an ARI-R2 grant, which would enable their implementation, constitutes the proposed action evaluated in this EA.

1.2 Purpose and Need

1.2.1 Purpose of the Proposed Action

The purpose of the proposed action is to allow the institutions listed in Table 1-1 to implement needed improvements and renovations to their research and education infrastructure and thereby to contribute to the enhancement of the research and training infrastructure of the nation's academic institutions and non-profit research organizations, consistent with the intent of the ARI-R2 program and NSF's mission.

Project Locations

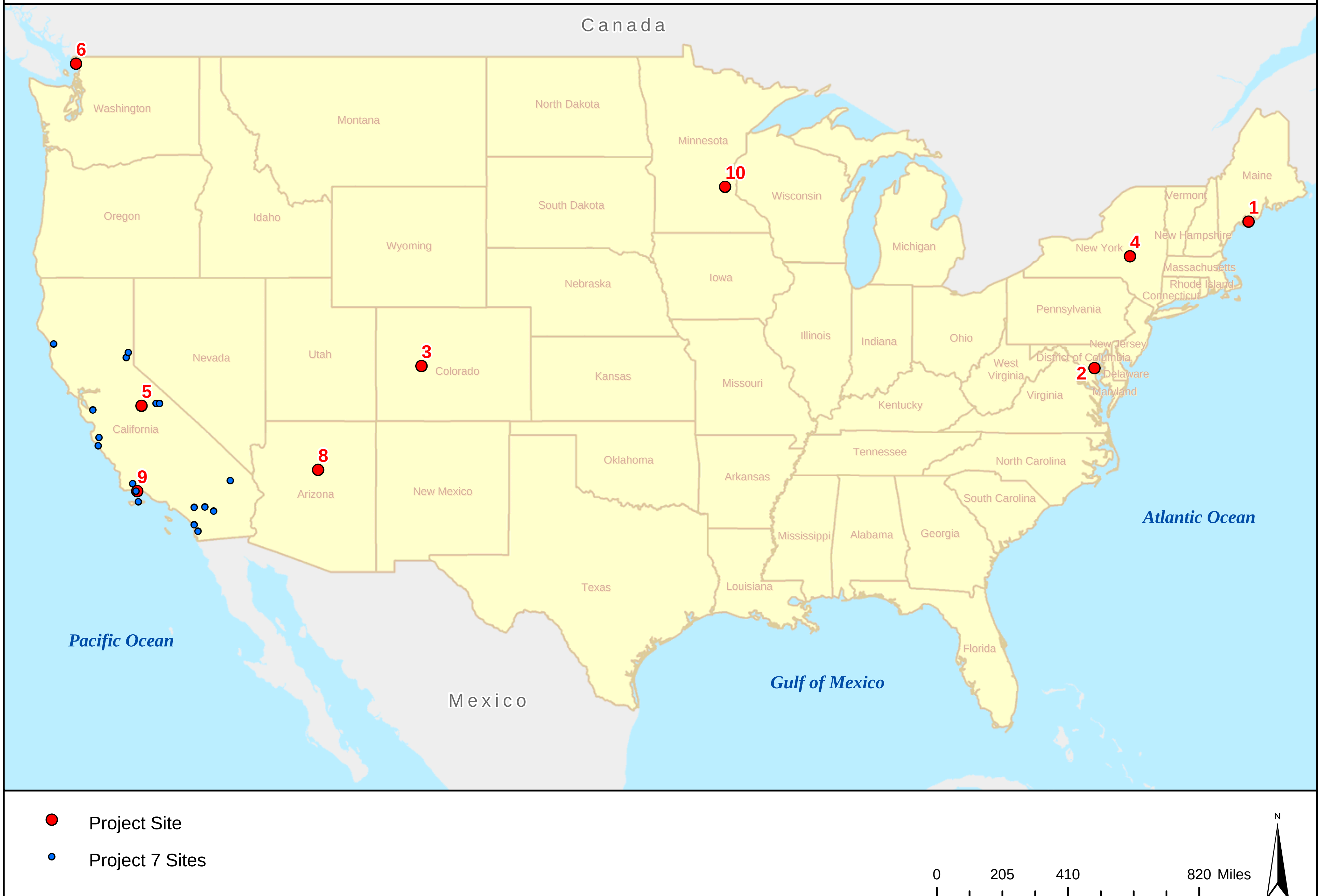

Figure 1-1

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Table 1-1 - Summary of the Projects Included in the Proposed Action

#	Name	Proponent	Summary Description	Location
1	Center for Ocean Biogeochemistry and Climate Change (COBCC)	Bigelow Laboratory for Ocean Sciences	Construct new 20,000-square-foot, three-story laboratory building	East Boothbay, Lincoln County, Maine
2	Renovation and upgrade of environmental change study infrastructure	Smithsonian Environmental Research Center (SERC)	Repair existing weirs, dams, flumes, and spillways; renovate existing laboratory building; construct 500-square-foot instrument shed; install seven radio towers	Anne Arundel County, Maryland
3	Murray Laboratory	Rocky Mountain Biological Laboratory	Replace existing laboratory with a new, 5,000-square-foot facility at the same location.	Gothic, Gunnison County, Colorado
4	Moe Pond Laboratory	State University of New York (SUNY)-Oneonta	Replace laboratory building at the SUNY Oneonta Biological Field Station Upper Research Facility at Moe Pond	Otsego, Otsego County, New York
5	Wawona Field Station Renovations	University of California (UC)-Merced	Renovate existing Building 4050 for use as research space	Wawona, Yosemite National Park, Mariposa County, California
6	Northwest Indian College Laboratory	Northwest Indian College	Construct 3,270-square-foot laboratory building on new campus	Lummi Reservation, Washington
7	Multi-site cyber-infrastructure improvements	UC Natural Reserve System (UCNRS)	Install new data transmission infrastructure in 17 reserves	Various locations, California
8	Microwave Relay Antennas	Lowell Observatory	Install microwave relay antennas at three existing sites	Flagstaff and other locations, Coconino County, Arizona
9	Greenhouse Replacement	UC Santa Barbara	Construct two new greenhouses (2,700 square feet and 700 square feet); demolish one existing building to build the larger greenhouse	Santa Barbara, Santa Barbara County, California
10	St. Anthony Falls Laboratory Renovations	University of Minnesota	Renovate existing laboratory building and construct instrument gantry in adjacent Outdoor Stream Laboratory	Minneapolis, Hennepin County, Minnesota

1.2.2 Need for the Proposed Action

The need for the proposed action is specific to each of the projects considered for funding. It is directly related to the mission of each of the project proponents and the current condition of their research- or education-supporting infrastructure, as described in the following paragraphs. The descriptions largely draw on the grant proposals submitted by the project proponents as well as on general information available on the proponents' websites.

1.2.2.1 Project 1: COBCC Building

Bigelow Laboratory is an independent 501(c)(3) non-profit research institution overseen by a board of trustees whose members include scholars and scientists, representatives of business and industry, and community leaders. The Laboratory's mission is to understand the key processes driving the world's ocean ecosystems, their evolution, and their fundamental relationship to life on Earth. Bigelow Laboratory investigates the molecular, microbial, organismal, and biogeochemical processes affecting the world's ocean ecosystems, and the interactions between ocean ecosystems, biogeochemical cycles, and the natural and anthropogenic variability of global climate.

The research programs of the Ocean Biogeochemistry and Climate Change (OBCC) group are central to the Laboratory's overall research agenda. OBCC scientists use observation, measurement, analysis, and modeling to examine:

- The interconnected processes by which essential elements are cycled through the ocean by marine biota.
- The key interactions between sunlight, water, atmosphere, sediments, and ice that determine basin-wide plankton ecology and biogeochemistry at the interfaces of the ocean.
- The impact of a changing global climate on ocean biogeochemistry.

The OBCC group requires diverse, specialized laboratory facilities that can adequately support all aspects of its work and be shared between investigators, thus stimulating collaboration and enabling the cost-efficient consolidation of operating expenses. However, Bigelow Laboratory's existing infrastructure does not effectively meet this need.

The Laboratory's existing campus is located at McKown Point in Boothbay Harbor, Maine. It includes eight buildings. The Laboratory also uses two off-site facilities for administrative functions and storage. All buildings are leased from the State of Maine and the lease is due to expire in 2020, with no guarantee that it will be renewed.

Photo 1-1 View of the exterior of the main laboratory building at existing Bigelow Laboratory campus

The Laboratory's research and research training facilities are headquartered in four aging and deteriorating buildings, several modular units, and a truck garage. The negative impact on communication, collaboration, and safety caused by the inefficient physical separation of the existing laboratories is compromising Bigelow Laboratory's ability to successfully conduct leading-edge research, thus holding back the Laboratory's ability to contribute the research tools needed to advance the scientific understanding of global ocean processes. The existing facilities cannot accommodate the collaborative research and training activities required for the integrated ocean biogeochemistry and climate change research at the microbial through global scales the OBCC group is conducting. These limitations are restricting the Laboratory's ability to secure research grants that require specialized instrumentation.

Specific examples of the limitations caused by the current conditions of the Laboratory's research facilities include (but are not limited to) the following:

- The lack of central air conditioning and inconsistent temperature control severely hampers the operation of gas chromatography and mass spectrometry instrumentation for gas-phase measurements; the current residential window air conditioning unit cannot provide the level of temperature control needed.
- Inadequate bench space necessitates instrument rotation causing inefficiencies and delays.
- Insufficient and badly configured space forces the staging of research cruises in corridors or in disparate and scattered locations far removed from the research laboratories from which equipment is assembled.
- Microscopy spaces are unventilated.
- The trace-metal clean room is housed in a portable "double-wide" trailer, with no vestibule, air-conditioning, or supply of filtered outside air. Use of the fume hood in the clean room requires that windows be opened—even in winter—to supply "make-up" air in the laboratory.

- The ad-hoc clean room constrains research activities for a number of essential sample digestion and preparation procedures, and is too small to fit necessary instruments, including voltammetric, chemiluminescence, and imaging technology.
- The walk-in, temperature-controlled culturing facility suffers from excess air moisture due to inadequate ventilation, resulting in mold on walls in summer.
- The aging double-wide trailer housing the ocean acidification laboratory is inadequate for experiments with compressed gases needed for acidification research.
- In its current location, the high-resolution liquid chromatography-mass spectrometry facility lacks space for sample preparations, tank storage, and training.
- High-performance liquid chromatography instruments must share space with other equipment and cannot be used for analyzing light and temperature-sensitive compounds such as phytoplankton pigments.
- The distance from the radiation laboratory to the central laboratory facilities requires that sensitive samples be carried out-of-doors in winter temperatures below 10 degrees Celsius.
- Space constraints only permit using one each of the Laboratory's two gas chromatographs and two environmental incubators.
- Frost heaves obstruct entry and exit in the double-wide trailer laboratory in winter; excessive heat in summer limits controlled experimentation.
- The front entrance to the main laboratory building has been condemned by the State of Maine as a safety hazard and is closed.

Replacing the deteriorating and inadequate leased facilities is essential if Bigelow Laboratory is to respond effectively to the critical need for front-line research on biogeochemical cycling and ocean acidification, ocean-atmosphere interactions, satellite remote sensing and optical algorithm development, and application of advanced methodologies in addressing climate change over various temporal and spatial scales. The proposed new COBCC laboratory would provide Bigelow Laboratory's research and training teams with an energy-efficient, state-of-the-art facility capable of meeting this need while complying with the latest state and federal health and safety standards. It would catalyze collaborative synergy by combining all aspects of COBCC research under one roof. The new COBCC building would bring Bigelow Laboratory's biogeochemistry and climate research programs to an improved level of functionality, increasing scientific coherence by linking field work, laboratory analysis, and modeling to advance knowledge of the ocean's role in global change.

1.2.2.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

Since 1965, the Smithsonian Environmental Research Center (SERC) has been operating an outdoor laboratory within the Rhode River's 7,410-acre watershed and 1,450-acre sub-estuary on the western shore of the Chesapeake Bay, in Anne Arundel County, Maryland. The Smithsonian Institution was established by an Act of Congress in 1846 following a bequest by British scientist James Smithson of his estate to the United States to promote "*the increase and diffusion of knowledge among men*." Another bequest is at the origin of SERC: in 1964, Robert Lee Forrest of Baltimore bequeathed his 365-acre Java dairy farm and other holdings on the Rhode River to the Smithsonian Institution. This property became the nucleus around which SERC developed. Today, it comprises 2,650 acres.

SERC's mission is to "[lead] *the Nation in research on linkages of land and water ecosystems in the coastal zone and provides society with knowledge to meet critical environmental challenges in the 21st century*." SERC uses the Rhode River's watershed and sub-estuary as a model system to measure the environmental responses of linked ecosystems in a coastal landscape to climate change and human impacts. SERC comprises the lower third of the watershed, including the stream discharge points for all of the component watersheds, and 43 miles of shoreline with tidal wetlands. SERC also owns small parcels located at strategic positions for sampling along the upper watershed.

The Rhode River watershed is an excellent model system for studying ecosystem and landscape responses to environmental change, and to climate change in particular, because it is a "perched watershed" that sits atop an impervious clay layer. The clay layer prevents water and chemicals of the Rhode River's watershed from exchanging with the deeper aquifers that are fed by other parts of the larger Chesapeake watershed. As a result, changes in the volume of water and its chemical characteristics directly reflect the effects of local climate, atmospheric deposition, and land use activities within the watershed. Such measurements across the linked ecosystems reveal the landscape-scale response to climate or land use management. In this model landscape, SERC has developed an integrated monitoring facility to track long-term environmental changes as water and materials move from the atmosphere or the land through terrestrial, wetland, and estuarine ecosystems.

SERC's Environmental Change Research Facility (ECRF) supports the study of environmental change and the forecasting of the responses of ecosystems to such changes. ECRF consists of four separate, but integrated, components arrayed across the landscape and estuary:

- Atmosphere: two meteorological towers measuring atmospheric inputs and fluxes.
- Watersheds: a network of 11 stream gauges and water flux stations.
- Wetland: a coastal wetland site for ecosystem monitoring experimentation.
- Estuary: an estuarine water quality monitoring station and dock facility.

The individual components of the facility are essential for monitoring the flux of air, water, and materials through the linked ecosystems of the model landscape. Air pollutants such as nitrogen, sulfur, carbon dioxide, and mercury enter the landscape as precipitation, aerosols, and dust.

Chemicals and materials then move downhill from uplands to wetlands and estuaries as water-borne particles or solutes. In addition, water in the Chesapeake Bay enters and exits the system with diurnal tides.

The ECRF was built over the past 2 to 40 years. While two of the components have been upgraded since, many elements of the other two – the watersheds component and the wetland component – have not and are in need of renovation and upgrade. These two components of the facility are used to quantify the transmission of upstream perturbations (e.g., forest harvesting) to downstream ecosystems such as wetlands and estuaries through their hydrologic connections. Without renovation, they will soon cease to fulfill their function and to effectively support SERC's research.

Watersheds Component

The watersheds component uses a system of automated sampling stations to measure discharges of water, sediment, and chemicals from sub-watersheds that vary in land use. The system consists of eight stream weir stations for measuring one-way stream water flow on non-tidal streams and three flux stations for measuring two-way tidal flow. Most of this system was constructed in the 1970s and it has never undergone major repair or replacement.

The stream weir stations are located on non-tidal streams. Each consists of four standard elements varying in size to accommodate the dimensions of the monitored stream:

- A dam extends across the floodplain of the stream to channel the flow past the monitoring point. The top of the dam is above maximum flood level; the bottom is dug through the sediment bed into the impervious Marlborough Clay layer (typically less than, or about, three feet below sediment surface). This insures that both ground and surface water passes across the monitoring station. Generally, the dam is made of concrete or masonry blocks, sometimes combined with metal sheet piling. In streams with wide floodplains, the dam may be extended with earthen berms.

- A V-notch metal plate is built into the dam at the center of the stream channel. The plate is designed to intersect the stream flow with a known cross-sectional area. By measuring the height of water behind the V-notch, the flow can be calculated.

- An instrument shed and a stilling well sit next to the V-notch plate. The stilling well consists of a rectangular concrete or masonry foundation connected by an open pipe to the stream just above the dam; water moves freely between stream and the well. The foundation of the well also serves as the foundation of the instrument shed. The shed houses automated instruments for recording the stream level in the stilling well and for pumping water samples at flow-dependent intervals into a sample container. Every week, the samples are retrieved for laboratory analysis of sediments, nutrients, and other materials.

- A horizontal concrete spillway is poured just below the V-notch to dissipate the water's energy and prevent it from undercutting the dam.

All eight of the weirs are in poor condition and need significant repairs if they are to continue providing useful and accurate measurements. Portions of all eight dams are cracked, leaking, and structurally unsound. In four of the dams, the soil berms are failing and need to be replaced with poured concrete or metal sheet-piling. All instrument sheds need to be replaced or undergo significant repairs to roofs, doors, and walls. All spillways are undercut and need to be repaired.

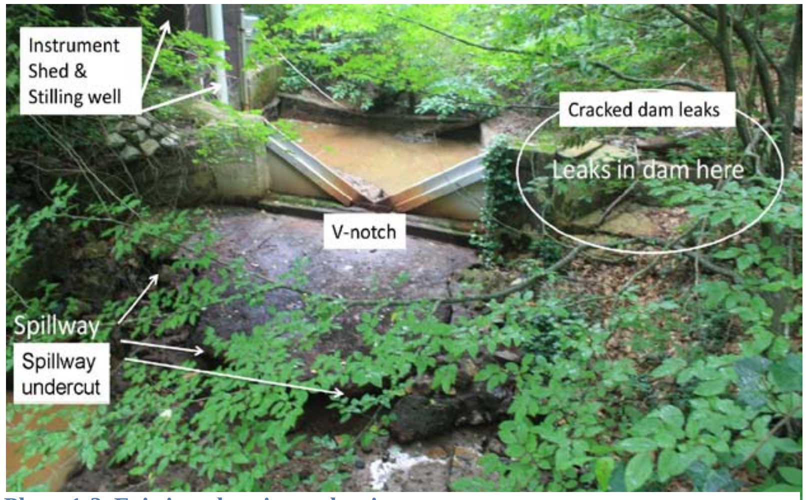

Photo 1-2 Existing, deteriorated weir

The tidal flux stations are located in tidal creeks. They consist of three standard components:

- A flume in the stream channel, which serves to constrain and define the cross-sectional area across which water flows through the creek. The flumes are made of concrete or masonry (on firm-sediment bottoms) or of salt-treated wood (on soft-sediment bottoms). Flume width is adjusted to average current speeds so that neither sediment scouring nor deposition occurs over time.

- Wings, which extend from the edge of the flume into the adjacent tidal wetland or upland to prevent tidal and stream water from circumventing the flume.

- An instrument shed atop the flume, which houses current meters, recording instruments, and pumps that monitor fluxes and take water samples.

Photo 1-3 Existing, deteriorated flux station

Like the weir stations, the flux stations have never been repaired or upgraded and need significant repairs if they are to continue fulfilling their function and providing useful measurements. Two flumes need to be replaced; two sets of wings need to be repaired or extended; the three instrument sheds are in very poor condition and need to be replaced. Additionally, the electric power supply to two of the flux stations, which are adjacent to each other, is an elevated utility power line strung along an unpaved support road to the station. Wind and ice storms knock down branches and trees onto the electric cable four to six times every year, causing hazards and loss of data.

Wetland Component

Tidal wetlands are perhaps the coastal ecosystem most sensitive to global change. The tidal wetland component of ECRF supports studies of coastal zone wetland responses to climate change and related perturbations. One of these studies is a field manipulation of atmospheric carbon dioxide (CO_2) concentration that began in 1986 and is now the world's longest running CO_2 experiment. This and other related experiments are conducted in the salt marsh area of SERC.

The wetland component has several elements that need repair or renovation without which it will not be able to continue adequately supporting the ongoing experiments or to support new work.

One of these elements is a small (1,295 square feet) laboratory building located on the edge of the salt marsh, which houses instruments and computers that control and record the 23-year CO_2 experiment. This small laboratory provides workspace for a full-time technician and for student training. While the building is structurally sound, the interior configuration does not adequately accommodate the instruments and controls for several new experiments and activities at the site and it needs to be updated; the power supply infrastructure, put together piecemeal over the years, needs to be consolidated; there are no bathroom facilities other than an ageing portable toilet.

Storage is another area in need of attention. CO_2 containers are currently stored in three small sheds, the walls and roofs of which have suffered major weather- and tree-damage – one of them has lost its roof to a falling tree branch and is now covered with a large piece of tarp – making them unsafe and ineffective at keeping the elements out. They need to be replaced.

Photo 1-4 Collapsed boardwalk

Finally, three boardwalks allow SERC staff and visitors to access the different experiment and data collection locations in the salt marsh with minimal impact to the surface. The boardwalks also carry data and gas transmission lines, which they keep above tide and storm surge levels. While one of these boardwalks has recently been replaced, the other two are deteriorated and have become unsafe. One recently dropped by one foot under the weight of a small group of visitors. It is imperative to replace these boardwalks if safe access to the salt marsh area is to be maintained.

Data Collection

Finally, timely and quick collection of data from the weir stations, flux stations, and CO_2 experiment sites, among others, is essential to SERC's research work. Currently, the data collected at the individual monitoring stations are downloaded manually each week by a technician visiting each of the weir or flux stations and the wetland experimental sites. The data are manually transferred to SERC's main laboratory/office facilities and entered into computer files on central servers. This procedure does not allow for real-time monitoring and is overly labor-intensive and subject to the vagaries of the weather. Faster and more reliable data transmission capability is needed for effective, real-time data collection that can be immediately transmitted anywhere in the world via the internet.

These deficiencies and needs must be addressed so SERC can continue generating the unique long-term data sets that are crucial for observing and forecasting ecosystem responses to environmental change, particularly climate change. Several of these datasets are among the longest in the world, making ECRF a facility of growing national and international significance. Repairs and upgrades are also needed for SERC to remain able to effectively support new research. Finally, repairing the ECRF infrastructure is also needed if SERC is to continue and expand its role in providing resources for the scientific community outside of its own scientists, attracting visiting scientists, and producing environmental data to share for modeling and comparative studies.

1.2.2.3 Project 3: Murray Laboratory

Founded in 1928 as a non-profit corporation, the Rocky Mountain Biological Laboratory (RMBL) is an independent field station located in Gothic, Colorado. RMBL's mission is *"to advance the deep scientific understanding of nature that promotes informed stewardship of the Earth*." The laboratory serves scientists and student researchers from approximately 100 higher learning institutions, including some from international locations, and other learning institutions such as high schools.

RMBL is a hub for research on plant-animal interactions and butterflies, including some of the earliest work integrating selection, genetics, and biochemistry. Other significant areas include mutualisms, physiological ecology, and social behavior. Research has explored the biological consequences of climate change. Due to its long history and diversity of scientists, RMBL is a leading institution for long-term studies of ecological and organismal biology.

RMBL performs three critical functions:

- It provides access to protected research sites, including areas where to conduct long-term experiments. In addition to the 1,300 acres it manages, RMBL has a permit for scientists to work on the millions of acres of adjacent public lands.

- It provides access to accumulated knowledge about the ecosystem. Working at the station provides opportunities for scientists to glean information from other scientists to design and implement efficient field experiments, as well as to identify questions that can only be framed based on a sophisticated understanding of the ecosystem.

- It provides access to research facilities that are needed to perform field research effectively. These facilities serve as a bridge between the home institutions of scientists and the natural systems on which they work.

There has been in recent years an explosion in the tools that field scientists have available to explore the world and it is vital that RMBL keep pace. RMBL needs facilities that can both accommodate the needs of its current researchers and look toward the future of science. For instance, ecosystem and global change biologists require space to process soils, plant material, and soil microbial communities. These procedures require a diversity of facilities - from "dirty" labs where soils can be sieved and processed to areas where physiological measurements can be taken, to clean areas where soil microbial and precise nutrient data can be processed. This type of facility is particularly important for RMBL because local ambient nutrient levels are low and unlike many other field stations, the laboratory has no access to nearby university facilities. To accommodate this research, RMBL needs spaces that are flexible, clean, temperature-controlled, and relatively draft free. As another example, scientists using genetic techniques as part of field work require special processing and storage of samples immediately upon collection. The remote location of RMBL requires that samples be properly stored in order to ensure data quality. The importance of sensors making automated measurements and the need to manage associated data-streams is also growing.

RMBL manages 71 buildings representing approximately 45,000 square feet of space (not counting outhouses), most of which are living facilities. For the past 20 years or so, RMBL has been aggressively upgrading its physical plant to meet the changing needs of scientific research. Originally, RMBL utilized buildings left over from the area's mining days in the late 1800s, five of which are still in use. Within a year of its foundation in 1928, scientists themselves were building cabins and laboratories using materials scrounged from older structures. Increasing demand for RMBL's facilities over the decades led to the development of the existing physical plant, including 54 cabins and an additional 17 structures such as laboratories, administrative buildings, and a classroom. Now, the existing laboratory space has become inadequate to the needs described above and must be upgraded if RMBL is to continue successfully performing its scientific and educational mission.

Existing laboratory space is divided between two facilities: the Murray Building and the Willey Building. Both have serious short-comings. The Murray Building was constructed in 1962. It is a one-story, 1,248-square-foot, pre-fabricated log structure. It contains ten research labs, including an animal care facility. It has not been renovated or upgraded since its construction. Major deficiencies include:

- The building was designed for limited use in mid-summer and has very little temperature control. It has limited electric resistance heating through baseboards, but the system is in poor condition. The roof has become leaky and the insulation has settled, resulting in inadequate thermal performance.

- Cleanliness and control of the space are problematic. The floor slab has cracks. The exterior doors and hardware are in poor condition and the building is not protected from unwanted intrusions: for example, on August 19, 2009 a bear smelled an experiment involving dead mice and burying beetles, destroyed the door, and devastated the experiment; the animal returned two days later through a window that cannot be secured.

- The building lacks basic systems such as chemical fume hoods and water. It used to have water, but the plumbing system failed in 2009 and it had to be shut off. Other amenities commonly associated with laboratory space are missing, including counter tops or storage for materials, equipment, and apparatus. There is no air, gas, or vacuum service. The building was constructed less than 10 years after Watson and Crick deduced the structure of DNA, at a time when field biology was just starting to move from a focus on the description of nature to a more experimental emphasis. The rooms are just large enough to have a sink, some shelf space for field materials, and for a scientist to set up a microscope. The need to accommodate computers, environmental sensors, and the extensive use of chemicals in a field setting was not envisioned.

Photo 1-5 Non-functional sink used for storage in Murray Building

- Existing systems are inadequate. The electrical system is old and there is neither a fire alarm nor a fire suppression system, except for portable extinguishers.

The Willey Building was constructed in 1982 and is directly adjacent to Murray. It has two stories and is approximately 3,700 square feet in size. It has eleven offices/laboratories, a shower, and an area that holds research supplies and two incubators. The bathroom was converted to chemical storage in 2005 and a dark room was converted to a communications center in 2006. Willey was renovated in 2007: the leaky roof was repaired and rotting walls and windows were replaced. However, building systems are still inadequate. With no cooling system and electrical heating through baseboards, to adequately control the temperature is impossible. The windows have been heavily damaged by the area's severe weather and some no longer close properly. New roof leaks have developed; the plumbing has been damaged by freezing, making water delivery problematic in some laboratories. The electrical system is not sufficient for the loads currently placed on it, largely because of the introduction of the general use of computers and environmental sensing devices since the construction of the building. Both the wiring and the electrical service equipment fail to meet current electrical codes and the only fire suppression equipment involves portable extinguishers. Lighting is inadequate, as is ventilation. The floors are covered with tile that contains asbestos and are in poor condition.

Willey is not adapted to modern scientific techniques. This is the only RMBL laboratory designed for the use of chemicals. However, fume hoods were not designed to allow airflow that is up to current chemical hazard codes. The lack of hoods is particularly problematic given the increasing number of researchers and students who are interested in conducting biogeochemical and ecosystem studies that require the use and storage of chemicals. The building cannot support modern telecommunications. It currently uses a converted dark room as server space but because this is a makeshift solution, proper provisions for the maintenance of a computer network are lacking and the space cannot be adequately temperature-controlled.

The current lack of access to adequate research space at RMBL causes substantial inefficiencies (e.g., driving long distances for access to hoods and/or sending samples through overnight mail for processing back at home institutions) and decreases the ability of students to learn new techniques in ecology. RMBL needs to remedy these serious deficiencies and provide itself with laboratory space that meets the needs of its scientists and students with respect to the use of chemicals, access to running water, work outside the summer season in acceptable climatic conditions, internet access, and dedicated space for microbalances and the use of precise techniques (e.g., genetic analysis, stable isotopes, nutrient analysis).

1.2.2.4 Project 4: Moe Pond Laboratory

The State University College at Oneonta (SUNY Oneonta) is a public university owned and operated by the State of New York. The campus is located in Oneonta, New York. The mission of the state university system is "*to provide to the people of New York educational services of the highest quality, with the broadest possible access, fully representative of all segments of the population in a complete range of academic, professional and vocational postsecondary programs including such additional activities in pursuit of these objectives as are necessary or customary*." These services and activities are offered through a comprehensive system of diverse campuses with differentiated and designated missions. SUNY-Oneonta has an enrollment of about 5,900 full- and part-time, undergraduate and graduate students. It offers 69 undergraduate majors, 57 undergraduate minors, 7 pre-professional programs, and 9 graduate programs as well as several cooperative programs with other institutions that lead to advanced degrees.

The College maintains a Biological Field Station at Cooperstown on Otsego Lake. The lake and more than 2,500 acres of woodlands, bogs, marshes and ponds provide resources for research in field biology to students in the College's academic programs. Five local field stations are associated with the Otsego Lake Biological Field Station. One of them is the 366-acre Upper Research Site on Moe Pond, west of the lake's south end.

Since 1967, the Upper Research Station has been supporting a range of research activities, including, currently, work on the bionomics of anthropophilic mosquitoes, a pilot study in water quality management, and studies on the life cycle of fish parasites. However, the current condition of the laboratory at the Upper Research Station imposes severe limits on research efforts. As a result, even though the mesic forested areas on the Upper Research Station are unique among the Biological Field Station's terrestrial resources and Moe Pond, its entire watershed, and more than 40 years of datasets provide significant potential for important long-term studies, this potential remains largely untapped.

Photo 1-6 Existing Moe Pond laboratory

The laboratory is a simple, wood-frame structure that has been in use since 1967. It is little more than a wood shack, about 16 feet by 40 feet in size, divided into two workspaces – an analytical/bench area and a curatorial/office area. It was the first facility built for the Biological Field Station. Now, it is the most primitive of all the Field Station's research and research training facilities and it typically serves as little more than an area to coordinate activities. The building is without permanent utilities: electricity is provided by portable generator; water is hand carried to the site; propane gas is used for heat and Bunsen burners. As a result, although it is logistically challenging, many researchers currently find it much more efficient to use the more modern laboratories at other Biological Field Station locations, though they are already fully utilized for other research efforts.

SUNY Oneonta needs to remedy this situation if ongoing research at Moe Pond is to productively move forward and if emerging research is to be adequately supported. An example of work that upgrading the Upper Research Station would enable is the continuation of the ongoing research on mosquito populations and their modifications in relation to local environmental changes (e.g., fluctuations in beaver activity). On-site storage of trapping and holding cages as well as the preparation of baiting supplies, which are currently not possible, would greatly benefit the research. On-site facilities for the temporary storage of specimens, necessary optical equipment, and temperature-controlled holding facilities would also greatly help, as it would save much time currently used to transport specimens off-site and would reduce the hazard of damage to the specimens during transit. Adequate on-site facilities for rearing larval specimens from particular collection sites would also be of significant value; this requires suitable containers for the aquatic immature stages, located within cages for the collection of emerging adults. The current laboratory cannot support such installations. As another example, upgrading the Upper Research Station laboratory would also support ornithological research at a location particularly rich in diverse avian habitats and species. It would also make it possible for the Research Station to once again support the teaching-related activities – such as pre-college field trips – that it used to accommodate but which were discontinued years ago because of the poor condition of the laboratory building.

1.2.2.5 Project 5: Wawona Field Station Renovations

The University of California-Merced (UC-Merced) is the tenth and most recent (2005) component of the University of California system. UC-Merced's mission includes to "*achieve excellence in carrying out the University's mission of teaching, research and service, benefiting society through discovering and transmitting new knowledge and functioning as an active* *repository of organized knowledge*." The Sierra Nevada Research Institute (SNRI) is one of UC-Merced's Organized Research Unit. SNRI's mission is to discover and disseminate new knowledge that contributes to sustaining the ecosystems of California, and related regions worldwide, through integrated research in natural science, socia1 science, and engineering, with a focus on the Sierra Nevada ecological region, including the Central Valley and adjacent areas. General areas of interest include climate and hydrology; ecology and ecosystem science; air pollution and public health; environmental economics, policy, and management; and environmental education and creative communication of science.

SNRI currently maintains three field stations that provide facility and logistic support for programs and projects that help achieve the broader mission of the Institute. One of these is the Yosemite or Wawona Field Station, in Yosemite National Park. This station supports interdisciplinary research on regional-scale environmental issues at the interface of science and resource management. Three current research programs integrate traditional field data with ground-based sensor data, broad-scale remotely sensed data, and geospatial or genomic data in virtual libraries:

- Mountain hydrology of the Sierra Nevada, which focuses on understanding mountain hydrology processes at multiple scales to facilitate water planning for the entire region.

- Mountain ecosystem responses to climate change, which characterizes spatial variation among mountain meadows in their vulnerability to climatic change in order to predict hotspots where meadow flora and fauna are likely to exhibit dramatic shifts.

- Biodiversity, genetics, and conservation, which focuses on the application of genetic tools to characterize hidden hotspots of biodiversity in the Sierra Nevada, to identify early warning signs of catastrophic biodiversity loss, and to target conservation efforts for declining and threatened species such as the Yosemite toad (*Bufo canorus*).

SNRI researchers use the Wawona Field Station for computationally intense synthesis, analysis, and visualization of remote sensing data, spatially explicit field data, temporally rich sensor network data, and other remote data libraries (e.g., genome sequence data). During the extended winter season, when field research is limited, the station is well-located to host small collaborative work groups focused on data synthesis, interdisciplinary collaboration, and conceptual integration. Thanks to the Wawona Field Station's unique location in Yosemite National Park, the research that is conducted there has direct, real-life impacts on resource management decision-making.

The Wawona Field Station has been in existence since 2004. Its facilities are owned by the National Park Service (NPS) but operated by UC-Merced under special use permits and a 25-year renewable cooperative agreement. The station's main office building (a former park ranger house, obtained in 2004) and the detached classroom/workshop building (a former detached garage for the ranger house – Building 4050 – obtained in 2006) were built in 1934. The seven remaining facilities are part of the approximately 400 vacation homes and cabins in Wawona built on land that was privately-owned before Yosemite became a national park. Almost all of the structures assigned to SNRI by NPS had significant deferred maintenance issues that needed to be addressed before they could be occupied. Today, all the facilities are usable; however, deficiencies remain, particularly with regard to the availability of research space and network connectivity.

Technological advances, the increase in research activities at UC-Merced, and the greater availability of housing for students and researchers at the field station have rendered the existing research facilities inadequate. The main office building can accommodate five researchers and Building 4050 has added another three to four work spaces. However, this is far from sufficient and in the summer, students and day visitors must often work at tables on the porch or at guest houses because of the lack of available work space. Additionally, the existing work spaces in the old garage are far from providing optimal working conditions. The building is drafty and has no insulation; the roof is in need of replacement. Working areas are overly cold in the fall and winter and too hot in the summer. Most detrimental to the buildings' users' work, there is no dedicated phone line and the existing internet access is too slow to allow for the real-time processing of data stored on campus servers. The station currently has two T1 lines that connect directly to the UC-Merced campus network. The realized connection speed is approximately 750 Kb per second, which further slows down when many researchers are on site; it is insufficient for remote data access. These shortcomings severely limit the field station's potential to foster the kind of large-scale, interdisciplinary research that requires real and virtual collaborations.

If the Wawona Field Station is to realize its full potential as a scientific research center, UC-Merced needs to upgrade its research spaces and cyber-infrastructure to (1) enable the integration of field data with remote sensing, virtual data libraries, and geospatial data stored on remote servers as required by its ongoing and future research programs; (2) address interdisciplinary environmental questions at landscape scales that require that field data be tightly coupled in real time with data synthesis and visualization to help refine and target subsequent field sampling; and (3) facilitate more direct collaborations between academic and agency scientists as well as maintain virtual communication through data sharing and video conferencing.

1.2.2.6 Project 6: Northwest Indian College Laboratory

The Northwest Indian College (NWIC) is the only accredited tribal college in the states of Washington, Oregon, and Idaho. As such, it serves as the gateway to higher education for 250,000 American Indians/Alaskan Natives. NWIC's mission statement is: "*Through education, NWIC promotes indigenous self-determination and knowledge*." The college is located within the Lummi Nation Indian Reservation, near Bellingham, Washington, and has campuses at four other reservations in Washington and one in Idaho. NWIC also serves 25 other Washington tribes through distance learning modalities.

NWIC began in 1973 as the Lummi Nation School of Aquaculture. In 1983, the Lummi Nation recognized the need for a more comprehensive college and chartered the school as Lummi Community College. In 1988, in recognition of a broader mandate to serve all Northwest tribes, it was renamed Northwest Indian College. It was accredited in 1993. During the 2008-09 academic year, NWIC provided academic courses to 1,254 students, approximately 31 percent of whom attended the main campus. The student body had representatives of 101 tribes and First Nation bands from across the United States and Canada. About 90 percent of the students are first-generation college students and come from low-income families.

Since 2007, NWIC's Bachelor of Science in Native Environmental Science (NES) program balances traditional ecological knowledge with a western science approach, focusing on applied research issues deemed a high priority by the leadership of tribes served by the college. The program is an example of NWIC's philosophy of embedding high-quality academic programming within a tribal context that supports the identity of Native students. The NES program combines western and Native ways of knowing while maintaining the inherent integrity of each.

The geology and ecological history of what has been called the Salish Bioregion (after the Coast Salish people that have inhabited the region for centuries) are well documented and offer formidable challenges for scientific research. The history of the indigenous people of the Pacific Northwest is intertwined and inseparable from the ecosystems where they flourished before contact with Europeans. Pre-contact indigenous societies developed sustainable survival strategies and successfully co-adapted with their landscapes for thousands of years. The knowledge that underlay these strategies became lost in the post-contact disruptions of tribal life. NWIC exists to help the Coast Salish and other indigenous people recover this lost knowledge. In this context, two major research projects are ongoing at NWIC:

- Bellingham Bay and Nooksack River: historically, the sea has provided the Coast Salish people with food and a route for trade and cultural exchange. The salmon symbolizes the connection between the sea and the Coast Salish tribes. In recent decades, salmon populations have declined precipitously. Similarly, shellfish, a historically important food source, has suffered from pollution and environmental degradation. Much of NWIC's research is designed to gather information that will lead to a greater understanding of the problems that led to these declines and the steps that can be taken to reverse them. This research focuses on the following areas: Bellingham Bay hypoxia and water quality; phytoplankton community dynamics; and water quality monitoring during annual tribal canoe journeys.

- Wetland and Shoreline Ecology/Salmon Habitat Restoration/Sea Level Rise: NES faculty, researchers, and students are working with the Lummi Nation Natural Resources Department and others on a baseline study of tidal and non-tidal tributaries and distributaries of the Nooksack River that are on or adjacent to the Lummi Reservation. These assessments will provide a baseline for a project to return historical flow to Smuggler's Slough, a four-mile branch of the Nooksack River that historically provided valuable habitat for juvenile salmon but has been diked and drained to meet agricultural needs. This baseline study will also provide relevant information for longer-term assays of the effects of sea-level rise on coastal habitats that are of economic and ecological value to the Lummi.

Laboratory facilities at NWIC are not adequate to support the ongoing research just summarized and need to be upgraded. The college's laboratories occupy 2,850 square feet in a 6,000-square-foot modular building, one of twelve such buildings that comprise most of the college's historic campus. These structures were acquired during the 1980s or early 1990s, when the US Department of Defense declared them surplus and no longer usable.

Photo 1-7 Rotting wall in existing NWIC laboratory building

The laboratory building is flat-roofed, which makes it a challenge to maintain in the rainy northwestern climate. Windows and doors are no longer air and water tight. Insulation is poor. Electrical wiring snakes up the walls and down the hallways. Plumbing and electrical capacity are stretched to the maximum and the heating system is both inadequate and expensive to operate. The building has no foundation and is supported by concrete blocks on piers. Following sagging and settling, shims had to be inserted between the stacks of concrete blocks and the floor joists in an attempt to keep the floors in the buildings reasonably level. In places (especially on the north wall), the siding on the building has rotted.

In addition, the existing laboratory space is poorly configured to serve the needs of its users. There are two main laboratories, approximately 900 square feet each, one used primarily for chemistry-related activities, the other primarily for biology-related activities. In addition, there is also a smaller (290 square feet) analytical laboratory, a chemical storage room of similar size, and a microscopy room of approximately 200 square feet. Major unmet needs are as follows:

- Storage capacity is inadequate for field equipment, herbarium collections, glassware, chemicals, benchtop workspaces for research, etc.

- Dirty field equipment, chemicals, and analytical equipment currently all commingle in the same area for storage and transit. There is a serious need of areas in which analytical work, field equipment, chemistry, chemical storage, and biological incubations can be separated from one another. A “mud room” -type staging area for the storage, cleaning, and mobilizing of field sampling and water quality equipment is also greatly needed to efficiently conduct equipment mobilization for field work and equipment maintenance.

- Also needed is a properly light-controlled room for microscopes. The microscopes currently used for the identification of phytoplankton, aquatic bacteria, and microzooplankton in field samples require a light-controlled environment. Currently these microscopes (and the accompanying computers with imaging software) occupy a benchtop next to the area where fecal coliform analyses are performed.

- There is no storage space for the College’s growing collection of native plants that is climate-controlled and adequately protected from moisture accumulation and pest intrusion. Appropriate space is required where plant samples can be sorted, identified, pressed, and ultimately stored in a more suitable environment if NWIC is to preserve and continue building on this important resource.

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- More room is needed for analytical equipment, which, because of the lack of space, cannot be safely, reliably, and optimally used.

A substantial upgrade to NWIC's laboratory facilities is needed for the continuation and success of NWIC's ongoing research and educational programs.

1.2.2.7 Project 7: Multi-site Cyber-infrastructure Improvements

The University of California Natural Reserve System (UCNRS) is a network of 36 reserves that encompasses approximately 135,000 acres of natural land across the state of California. The mission of UCNRS is "*to contribute to the understanding and wise management of the Earth and its natural systems by supporting university-level teaching, research, and public service at protected natural areas throughout California*." Initiated in 1965 as the Natural Land and Water Reserve System, it is the largest university-operated system of natural reserves in the world. UCNRS makes relatively undisturbed samples of California's natural ecosystems available to UC students, teachers, and researchers as well as to other qualified users across the world.

While for decades research at the reserves was founded on unique field-based discoveries, unsystematic direct observations, and diligent, annual measurements, the recent rise of automatic data recording by data-loggers and wireless sensing systems has created new opportunities and new needs for UCNRS. Most reserves are or will soon be equipped with automated climate-recording systems; many support networked imagers that generate real-time and serial views used to monitor and study plant phenology and animal activities. Field research stations are being transformed into networked ecological observatories through the use of global environmental monitoring cyber-infrastructure that makes possible a better understanding of the effects of land use and climate change on our world's natural resources. Several UCNRS sites are test grounds for the development of new ecological sensing and observing systems.

However, the successful transition of the system to a global, networked ecological observatory requires reliable, low-cost broadband internet access. Over the last decade, individual reserve staff have developed ways to provide limited network access to the research users. However, many of the approaches taken have been highly constrained in bandwidth (dial-up or early DSL systems), expensive (satellite service), and/or prone to failures from weather or wildlife damage as are all wired systems. Accordingly, they are inadequate to current needs.

UCNRS needs to upgrade its cyber-infrastructure to manage the necessary transition to the new methods of data collection and sharing and to improve the reserves' capacity to stream live data and to control and coordinate multiple monitoring instruments. To this end, UCNRS must take full advantage of available wireless technologies to set up high-capacity data transmission networks that are reliable and cost effective.

An example of the rapid transition from low to high bandwidth requirements that generates this need is provided by the Blue Oak Ranch Reserve (BORR), on the western slope of Mount Hamilton in the San Jose area. BORR is within the line of sight of the UC-owned Lick Observatory. Shortly after the addition of BORR to the reserve system, in 2007, an interim wireless network between BORR and Lick Observatory was set up, using available hardware and electronics from the UCNRS Network Office. The Lick Observatory to BORR network consists of a 6.7-mile wireless radio link operating at 5.8 gigahertz (GHz) that extends the Lick Observatory computer network on the summit of Mount Hamilton to a solar-powered radio relay tower in the reserve, where another radio redirects a 2.4 GHz 802.11 WiFi signal to the headquarters building. The Lick Observatory to UC Santa Cruz network is completed by four leased T1 circuits providing 5.5 Mbits/sec of network capacity for the entire observatory complex, including BORR.

However, at the Lick Observatory facility, a new telescope called the Automated Planet Finder has just come on line. At the same time, environmental and ecological researchers at BORR are deploying high-resolution digital imagers to monitor wildlife and plant phenology, climate monitoring sensor networks above and below ground, hydrological and aquatic sensing systems, and plant physiological sensors that are remotely controlled by investigators and continuously upload data to off-site servers. All of these new systems require continuous network connections and significantly more bandwidth than is available at present.

As another example, at the System's Angelo Reserve and the Central Sierra Field Research Stations, several major projects investigate the ecological links between rivers and uplands with regard to hydrology, nutrients, and energy movements. This research depends on high-resolution LIDAR maps, hundreds of sensors recording rainfall, well water depth and chemistry, stream flow and stream water chemistry, as well as overall evaporation, transport and use by plants. Improving the cyber-infrastructure at these reserves is needed so the quantity, reliability, and quality of the data are adequate to the hundred of involved researchers' needs.

1.2.2.8 Project 8: Microwave Relay Antennas

Lowell Observatory is a private, non-profit research institution founded in 1894 by astronomer Percival Lowell in Flagstaff, Arizona. The Observatory's staff includes 19 PhD-level astronomers, three postdoctoral research fellows, and three graduate students. Major ongoing research areas include the discovery and characterization of planets around other stars; surveys for potentially Earth-impacting asteroids; the structure and composition of objects in the outer solar system; and the long-term variations of the sun and their implications for terrestrial climate.

The Observatory consists of three separate sites:

- The Mars Hill Campus, just west of Flagstaff, is the location of the original, historic facility: The oldest structure there is the 1896 dome housing Percival Lowell's 24-inch refracting telescope. The Hendricks Center for Planetary Studies, the Steele Visitor Center, the Discovery Channel Telescope headquarters, and supporting facilities including water tanks, and several staff residences are also present on the site.

- The Anderson Mesa site was established in 1959 about 12 miles southeast of Flagstaff because the gradually increasing lighting in Flagstaff diminished the usefulness of the Mars Hill facilities. The main telescopes there are a 1.8-meter and a 1.1-meter reflectors. There is also a 0.6-meter telescope used for asteroid surveys and a 0.9-meter telescope and planet search facility. Finally, in partnership with the US Naval Observatory and the Naval Research Laboratory, at this site, Lowell operates the Navy Prototype Optical

Interferometer (NPOI), a specialized instrument with a Y-shaped array of mirrors that is capable of extremely high-resolution observations.

- The Happy Jack site, about 40 miles southeast of Flagstaff, is where the Observatory's newest facility is located: the 4.2-meter Discovery Channel Telescope. The telescope is in the final stages of construction and the first images are expected in mid 2011.

In spite of their geographical separation, Lowell Observatory's three sites function as an integrated research facility. The telescope sites at Happy Jack and Anderson Mesa are devoted to data collection. No significant data analysis takes place at these sites, which are remote and have no or minimal space for work or rest after a night of observation. Conversely, little data collection now takes place at the Mars Hill site; rather, it is where all the post-data collection work is done and where Lowell's central computing facilities, meeting rooms, library, machine shop, administrative offices, and the researchers' offices are located. In particular, this is where the datacenter is located, occupying a 25-foot-by-20.5-foot space in the Hendricks Center for Planetary Studies.

Therefore, a major requirement for Lowell Observatory is effective data and information transfer between Mars Hill and the Anderson Mesa and Happy Jack sites. Indeed, one of the most important conditions for any successful astronomical research is the availability of robustly networked computers that can handle the extremely large amounts of data generated by modern telescopes. In this respect, Lowell's needs are about to substantially increase with the commissioning of the new Discovery Channel Telescope at the Happy Jack site. The current cyber-infrastructure is not adequate and it must be upgraded if Lowell Observatory is to continue performing its scientific mission and, more particularly, take full advantage of the new telescope.

The Anderson Mesa site is currently equipped with a T1 line. In recent years, the demand on this connection has been steadily increasing and it often becomes saturated during daily transfers of the previous night's observational data. Connectivity failures are common, resulting in compromised robotic operations and lost observing time. The connection to the Happy Jack site is an entirely inadequate satellite link with low bandwidth and significant delay between issuance and receipt of commands from Mars Hill. This situation will become even more unacceptable as the new telescope is completed and brought on line and could result in unnecessary delays. Remote observing is a common practice in astronomy and during routine operations at the new telescope, astronomers must be able to use it from their offices in Flagstaff or elsewhere. Lowell Observatory expects to have many distant guest observers.

Additionally, the datacenter room is now over capacity and cannot accommodate the continuously growing server and storage needs of the Observatory. Equipment is so crowded in the existing narrow space that thermal control is a problem in the summer. The air conditioning must be run at maximum intensity and, as it serves the entire space, the building must be kept uncomfortably and expensively cold. The general lack of room has created a disorganized, noisy, and unsafe environment that is detrimental to all building users. The datacenter needs to be reconfigured to resolve these issues.

1.2.2.9 Project 9: Greenhouse Replacement

Established in 1944, the University of California-Santa Barbara (UCSB) is one of the ten campuses making up the University of California system. As noted in its mission statement, UCSB is a research institution that also provides a comprehensive liberal arts learning experience. It offers more than 200 majors, degrees, and credentials through five schools and the Graduate Division. The 1,055-acre campus is located in Santa Barbara, about 100 miles northwest of Los Angeles.

UCSB is a research university with a leading biological sciences program and a strong commitment to plant sciences. In addition to being a source of food, fuel, fiber, medicines, and other natural products, plants provide critical ecosystem services such as water and nutrient storage, protection from erosion, and moderation of local weather conditions. However, these services are being threatened by climate change, urbanization, and pollution with expected adverse effects on agricultural yields and biodiversity. Predicting the timing and extent of these changes, as well as mitigating their impacts, require the integration of knowledge across a broad array of scientific disciplines including ecology, genetics, evolution, and development. UCSB plant scientists are at the forefront of these fields.

Plant research projects at UCSB combine studies of the molecular and physiological basis of plant form and function with studies of plant interactions with the biotic and abiotic environment. This multifaceted approach makes possible an in-depth understanding of the conditions of plant survival and reproduction. Specifically, UCSB's scientists study how environmental factors (i.e., nutrients, temperature, light, soil moisture, pollination, pests, fire, and competing species) influence plant populations and evolution.

UCSB's plant scientists benefit from the university's easy access to a wide range of natural environments both off and on campus. In addition to seven off-site natural reserves, including salt marsh, island, oak woodland, and mountain habitats, UCSB has seven on-campus natural areas that cover more than 200 acres and are used for ecological restoration, research, and educational opportunities. The diversity and proximity of these natural areas allow plant biologists at UCSB to conduct experimental manipulations, comparative studies, and monitoring programs that are not easily available to most researchers. However, the lack of modern greenhouse facilities largely precludes UCSB scientists from conducting highly-controlled experiments in which specific-factor hypotheses are rigorously tested. While this deficiency has not kept UCSB plant biologists from conducting and publishing important research, it does need to be remedied for the various programs to realize their full potential.

The research greenhouses at UCSB were constructed nearly 50 years ago and have never undergone any significant renovation. They are too small: currently, the average available research space per plant biology researcher at UCSB is a little more than 300 square feet, or less than half the median space available at a sampling of eight other major research institutions (i.e., six other UC system campuses, the University of Connecticut, and Duke University). Additionally, the greenhouses are in very poor condition. The wooden frame has rotted in places; many glass panes are broken or completely missing; roof leaks commonly short out electrical outlets; temperature control and ventilation are unreliable; most benches are wooden and rotting;

Photo 1-8 Existing greenhouse

and supplemental lighting is missing from most areas. In 2008, the Department of Ecology, Evolution, and Marine Biology's external review noted that:

> *The worst facilities we saw were the greenhouses. The greenhouses are heavily used and widely needed, but they are a disgrace. They are so run down that world-class research is nearly impossible. In fact, threats to the safety of the people working in the greenhouses are so serious that the university should take steps to replace them immediately. The fact that the greenhouses are fully used and that people are conducting high-quality work in them attests to the need for a greenhouse facility.*

Several faculty members have given up conducting experiments or studies that would require using the existing greenhouses because they either lack the necessary space or because the lack of reliable climate control and other physical deficiencies mean that experiments would most likely fail. Remedying this situation is needed to adequately support the work of UCSB's plant biology faculty, realize the full potential of the university as a leading plant research center, and properly train the next generation of plant scientists.

1.2.2.10 Project 10: St. Anthony Falls Laboratory renovations

The St. Anthony Falls Laboratory (SAFL) is an interdisciplinary fluid mechanics research and educational facility of the Institute of Technology at the University of Minnesota. It is located on an island in the Mississippi River in central Minneapolis, Minnesota. SAFL opened in 1938 as the St. Anthony Falls Hydraulic Laboratory, a traditional hydraulics laboratory dedicated to basic and applied research in hydraulic structures and engineering with a focus on hard structures (spillways, locks, intakes, harbor structures, etc.). Over time, SAFL has evolved to take a broader approach to its mission, emphasizing restoration and sustainable management, working with natural factors rather than ignoring them or trying to control them, and understanding how energy can be harvested from the natural environment (wind, water, and biofuels) without damage. These developments have led to much closer ties between engineering and the natural sciences, especially the earth sciences and ecology. To reflect its current, broader identity as an interdisciplinary research facility focused on engineering and environmental, biological, and geophysical fluid mechanics, SAFL recently dropped "hydraulic" from its name. In 2002, the establishment at SAFL of the National Center for Earth-surface Dynamics (NCED), an NSF Science and Technology Center devoted to quantitative, interdisciplinary study of the surface environment, was a major step in this transformation.

However, SAFL's infrastructure has not kept pace with the evolution of the personnel, mission, and goals of the Laboratory. Upgrades are needed for SAFL to complete its transition to a modern, interdisciplinary laboratory in environmental science and engineering, and perform the research and training activities that it must, but currently cannot adequately, support. This includes adapting the Laboratory's equipment and expertise in turbulence and atmospheric boundary layers to wind-power optimization; adapting the existing facilities and expertise in fluid-biota interaction to biofuels research focusing on the optimization of algal bioreactors under variable environmental conditions; enhancing indoor and outdoor laboratory capabilities in environmental restoration and management, including streams, rivers, and deltas; and allowing researchers, practitioners, and a broad spectrum of learners to experience and participate in SAFL through cyber-collaboration, visualization, and virtual experiments.

Photo 1-10 Exterior of SAFL building

In its current condition, SAFL is a 66,500-square-foot concrete building. Two channels of river water have been diverted through the building, allowing access to a continuous, high-volume supply of natural surface water for research purposes. The building has five levels, including a basement:

- Level 4 is the site of the wind tunnel used for research in atmospheric fluid mechanics and wind energy. Level 4 was added in 1987.
- Level 3 houses the administrative offices of SAFL and NCED; faculty, post-doc, and student offices; and an auditorium and conference room.
- Level 2 has research and non-research space as well as the Supply Channel. The north side contains the Model Floor, Delta Basin 1, Delta Basin 2, and the Granular-Flow Laboratory. The south side of Level 2 houses office space for faculty and applied research staff. The south side also has the Ecofluids Laboratory and Wireless Sensor Electronics Laboratory.
- Level 1 houses the majority of facilities used for water-related research. The 275-foot long Main Channel is located along the north side. The Main Channel is used for experiments that cannot be scaled down. It is equipped for bed-load flux measurement and gravel re-circulation; it has a wave generator. Additionally there are ten smaller, multi-purpose flumes, channels, and tanks located on Level 1. The south side includes the Fabrication Shop used by research and technical staff to support research and instrumentation.

- The Basement Level is general research space. A mezzanine is located above the basement. The High-Speed Water Tunnel and Experimental EarthScapes (XES) Basin are located on the mezzanine. The Basement also houses the Debris Flow Tank and the Weigh-Tank system used to calibrate water discharge.

A recent (2005) addition is the Outdoor StreamLab (OSL). Located between the SAFL building and the Mississippi River, the OSL was designed to study interactions among a channel, its floodplain, and vegetation. The facility can produce a large range of flow rates, including overbank floods. Dams and bridge piers placed within the OSL allow study of dynamic human-river interactions. The OSL was built in a spillway channel adjacent to SAFL's main building on top of several feet of river sediment fill. A computer-operated weir controls water surface elevation in the lab and the design allows for impounding water to study reservoir, lake, or ocean processes, including delta dynamics.

The SAFL building has never undergone systematic renovation, though piecemeal improvements have been made. Over the years, normal wear-and-tear as well as exposure to moisture and varying temperatures have damaged and corroded many structural elements. Mechanical (HVAC), electrical, and plumbing systems are beyond their service life, inefficient, and undersized for current and projected occupancy and site activities. These basic deficiencies need to be addressed before any further modernization can take place. Beyond this, many of the existing research facilities need upgrading to be able to effectively support current and future research programs.

For instance, SAFL is well positioned to develop research programs that address energy independence and clean energy concerns in those areas where fluid flow is an important factor such as wind power or water power. SAFL's wind power tunnel is a major research asset in this area, as it allows for the study of the effects of temperature variation on turbines and air flow, a critical issue for wind power sites that undergo strong daily and seasonal temperature fluctuations. However, a number of problems keep SAFL from making optimal use of this resource: ambient humidity levels on Level 4, where the wind tunnel is located, affect research instruments and experiments are not possible during humid periods. Level 4 is poorly insulated, resulting in heat loss during research and potentially compromising experimental results. The turning vanes used to route airflow are difficult to remove or install. The power supply is insufficient.

Similarly, the Main Channel has the potential to be a major hydrokinetic and hydropower research facility. However, the current setup does not allow for the placement of large devices such as turbines; the wave generator is old and no longer functional; the water intake is operated manually and does not allow for smoothly varying discharge; and the volumetric tanks are in a state of disrepair and must be operated manually.

SAFL has also begun conducting research on biofuels, focusing on adapting its researchers' expertise in fluid-biota interaction to the use of microalgae for biodiesel production. This requires developing a mechanistic understanding of algal physiology at the cellular level in dynamic environments. However, the following deficiencies prevent the full development of this line of research: SAFL has insufficient space for microbiological and biochemistry analyses; the space currently used for biofuel pilot studies must be shared with incompatible research activities; and SAFL lacks flumes illuminated by natural sunlight with controllable temperature and nutrient conditions.

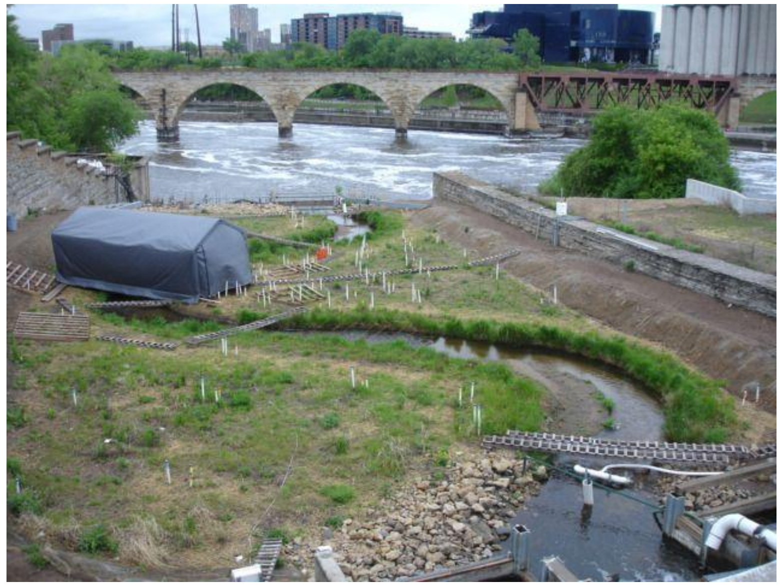


Photo 1-11 OSL, showing existing setup for instruments

The OSL play a major part in supporting SAFL's work on environmental restoration and sustainability of the earth-surface environment, which is centered on water and how it interacts with sediment, organisms, landscapes, and the built environment. The OSL is part of a three-pronged research agenda for science-based restoration and management: the other two components are the Indoor StreamLab (ISL), which uses existing SAFL channels and basins; and the Virtual StreamLab (VSL), which features advanced computational fluid dynamics tools for simulating flow, sediment, and biota interactions across multiple scales. Several upgrades are needed to bring the StreamLab triad to its full potential, however. The OSL, in particular, lacks the ability to produce comprehensive, precisely-located measurements: the monitoring of its riverine portion is currently performed with instruments mounted on a frame that is manually moved, as needed, from place to place along the stream; the manual maneuvering of the instruments severely limits the quantity and quality of data collection.

SAFL has also pioneered experimental studies of depositional systems by creating the XES system to study the effect of variable subsidence and other controls on stratigraphy, a work that is given additional relevance by the growing realization of the vulnerability of low-lying depositional coasts, especially river deltas that are home to hundreds of millions of people, to land subsidence and sea-level rise and the emerging possibility of using subsurface reservoirs like those from which hydrocarbons are extracted to sequester CO_2. Yet, because the XES basin in its present configuration can only run one experiment per year and is not equipped to produce waves or tides, it cannot be used to its full potential.

Finally, interdisciplinary collaboration would greatly benefit from enhanced capacities for real-time visualization, computation, and wireless sensing and control of experimental processes that could allow researchers and other stakeholders to follow or control experiments remotely and obtain data without delay. However, SAFL lacks the infrastructure for such cyber-collaboration with scientists, engineers, and students across the nation and the world.

These multiple deficiencies need to be addressed for SAFL to continue functioning as a safe, accessible, and first-rank national laboratory in environmental science and engineering and to successfully complete its necessary transition from a hydraulics laboratory to an interdisciplinary laboratory focusing on renewable energy and environmental restoration and management.

1.3 Scope of this EA

This EA addresses the potential environmental impacts of the ten projects listed in Table 1-1, which are being considered for funding under the ARI-R2 program. Three of these projects are components of larger, ongoing undertakings that are not being proposed or considered for funding under the program. They are:

- Project 1: COBCC Building – The new COBCC would be built on the new Bigelow Laboratory campus, presently in development in East Boothbay, Maine. This new, purpose-built campus consists of a 62.8-acre property owned by the Laboratory, approximately eight miles from the existing facility in Boothbay Harbor. The fully-built-out campus will include a modular building complex, a dormitory, visitor housing, and education buildings along with parking areas, internal roads, and waterfront facilities, including a fixed L-shaped pier for docking research vessels, floating dock to support diving operations, and a marine operations building. The COBCC would be one of the wings of the modular, four-wing building complex. It is the only portion of the new campus project that is being proposed for funding through the ARI-R2 program. Planning for the new campus preceded the availability of the program by many years and the implementation of the larger project is not dependent on obtaining the requested grant. Development of the campus would proceed even if ARI-R2 funding were not obtained from NSF, although the complex would likely remain without the COBCC facility for the foreseeable future. Therefore, this EA considers the potential impacts from the construction of the proposed COBCC only.

- Project 6: NWIC Laboratory – The proposed laboratory would be built on the College's new campus. The new campus (South Campus) is being developed on a 30-acre parcel of land acquired in 2003 and located just south of the existing campus (North Campus). Initial master planning for the South Campus envisaged the construction of 170,000 square feet of new facilities over a period of 15 years. Phase 1 of the plan is almost fully implemented: four new buildings (Natural Resources Laboratory, Center for Student Success, Child Care Center, and Student Dormitory) have been constructed. NWIC recently moved forward with Phase 2, which will include a 16,000-square-foot library, the 11,000-square-foot Coast Salish Institute, and a 2,000-square-foot traditional long house. The new laboratory proposed for funding under the ARI-R2 program would be constructed in the Phase 2 area of the campus. It is an additional facility, the construction of which would neither enable nor impede the planned development of Phase II of the new NWIC campus, which would proceed even if the grant were not obtained. Therefore, this EA considers the potential impacts from the construction of the proposed new laboratory only.

- Project 9: Greenhouse Replacement – In addition to the greenhouses proposed for ARI-R2 funding and considered in this EA, UCSB has nearly completed the construction of a third structure, a 1,800-square-foot, three-bay greenhouse (Technical Greenhouse) to address the shortcomings of the existing greenhouse space. Funding was secured to construct the foundation, the outer greenhouse 'shell', bring utilities and drainage to the site, and fully fit out one bay with infrastructure (benches, lighting, shading, cooling/heating and controls). Funding was not secured to outfit the two remaining bays with equipment such as benches and lighting. UCSB is requesting ARI-R2 funding to complete the outfitting of the Technical Greenhouse. Because the acquisition of the needed equipment is not a condition for the construction of the Technical Greenhouse, which has already taken place, and has in itself no significant potential to generate environmental impacts, this component of the project is not considered in this EA.

Conversely, several of the projects include elements that are not proposed for funding through the ARI-R2 program because program funds are to be used exclusively for improvements directly related to research and research training infrastructure. However, these elements, which must be funded separately by the proponent institution because they do not directly support research or research training functions, are nevertheless included in the proposed action analyzed in the EA because they are not separable from the ARI-R2-funded elements and do not constitute a separate, independent undertaking. For instance, the proposed construction of a new laboratory at Moe Pond includes the renovation of the existing facility and its conversion into a storage structure. This component of the project is not proposed for funding by NSF but it is considered a part of the proposed action because it is not a separate action from the NSF-funded construction of a new building: that is, it would not happen if ARI-R2 funding were not made available for the new laboratory. Similarly, the proposed NWIC laboratory building includes spaces not used for research or research training, such as restrooms, and therefore, not proposed for funding through ARI-R2. However, these spaces obviously would not be built if the ARI-R2 funded research and training component of the building were not constructed. Therefore, the building in its entirety, rather than just the research spaces, is considered part of the proposed action.

1.4 Project Locations

1.4.1 Project 1: COBCC Building

The Project 1 site is located on approximately 63 acres owned by Bigelow Laboratory in East Boothbay, Lincoln County, Maine, as shown on Figure 1-2. The COBCC site is currently undeveloped and forested. It is about 6,450 square feet in area (with another 9,650 square feet for landscaping).

1.4.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

The Project 2 sites are located on the 2,650-acre SERC facility in Anne Arundel County, Maryland, on the western shore of the Rhode River, approximately 15 miles south of Annapolis, MD and 40 miles east of Washington, DC. SERC is shown in Figure 1-3. With the exception of the sites considered for the proposed communication towers and part of the site of the proposed new storage facility, the sites are occupied by the structures and facilities to be repaired and upgraded. The potential tower sites are open; the site of the proposed storage building is partially occupied by movable storage shed, partially open and used for parking.

1.4.3 Project 3: Murray Laboratory

The Project 3 site is located in the town of Gothic, Gunnison County, Colorado, about 280 miles southwest of Denver, CO. RMBL is the only occupant of the town. The project location is illustrated in Figures 1-4a and 1-4b. The site covers about 5,000 square feet and is presently partly occupied by the existing Murray Building and partly unbuilt and used for experiments.

1.4.4 Project 4: Moe Pond Laboratory

The Project 4 site is located approximately two miles to the northwest of Cooperstown Village in Otsego County, New York, about 70 miles west of Albany, NY. The general location is shown in Figure 1-5. The site is adjacent to the existing laboratory and open. It covers about 700 square feet.

1.4.5 Project5: Wawona Field Station Renovations

The Project 5 site is located in the village of Wawona in Yosemite National Park, Mariposa County, California (see Figure 1-6a). It consists of Building 4050 and its immediate surroundings (Figure 1-6b). The building is used by UC-Merced under a special use permit from NPS.

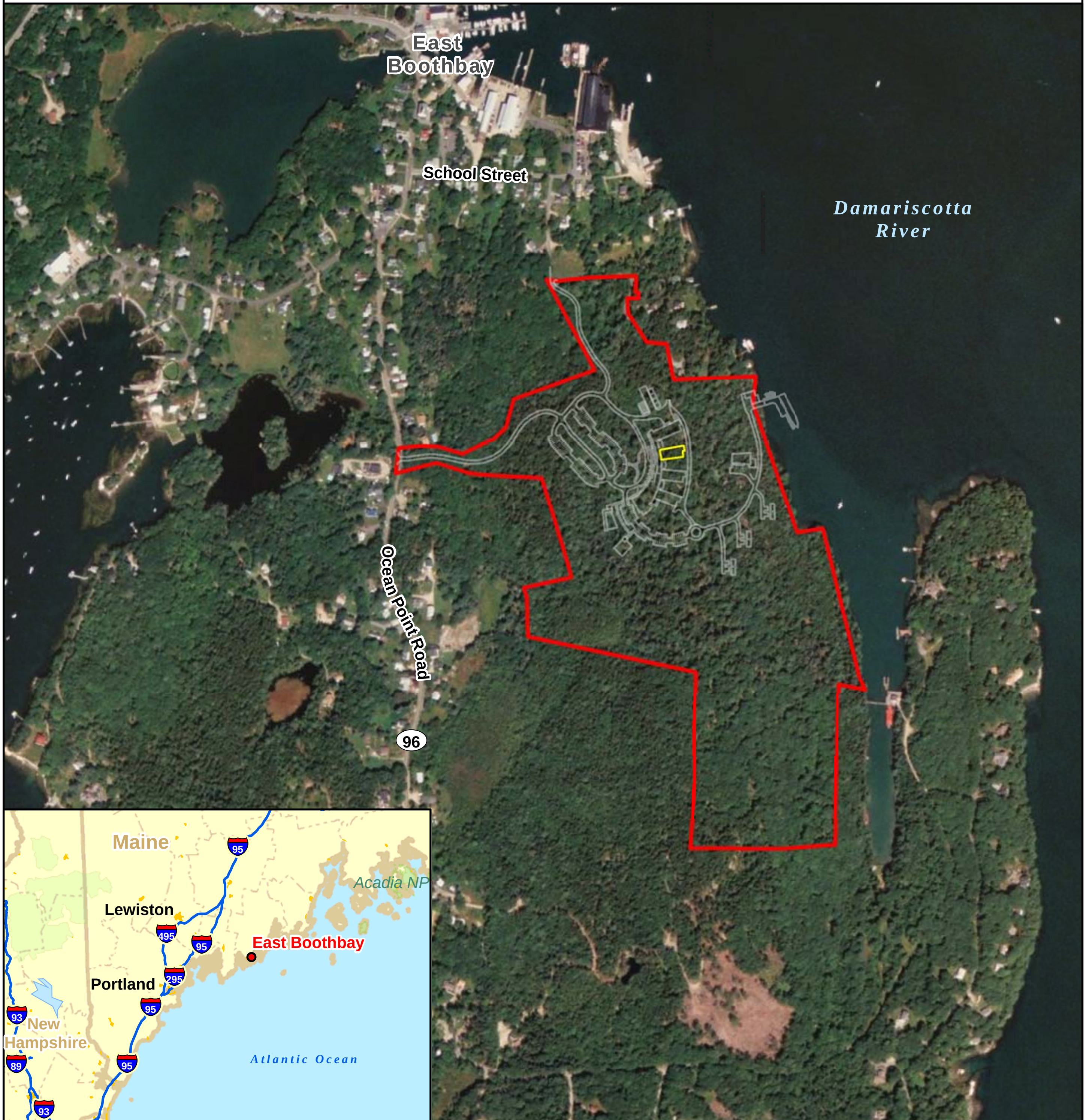
1.4.6 Project 6: Northwest Indian College Laboratory

The Project 6 site is within the Phase II area of NWIC's new South Campus on the Lummi Reservation, just west of Bellingham, Whatcom County, WA, as illustrated in Figure 1-7. The site is currently undeveloped and covers approximately 2,700 square feet.

1.4.7 Project 7: Multi-site Cyber Infrastructure Improvements

The locations of the 17 reserves proposed for cyber-infrastructure improvements are shown on Figure 1-8. Table 1-2 lists the counties within which the reserves are located. Depending on the reserve, the proposed structures or radios would be placed on currently open sites or on existing buildings and towers. The footprint of each would not exceed a few square feet.

Project 1 Location



Proposed COBCC Site

Property Boundary

Future Bigelow Laboratory Campus

0 500 1,000 2,000 Feet

N

Figure 1-2

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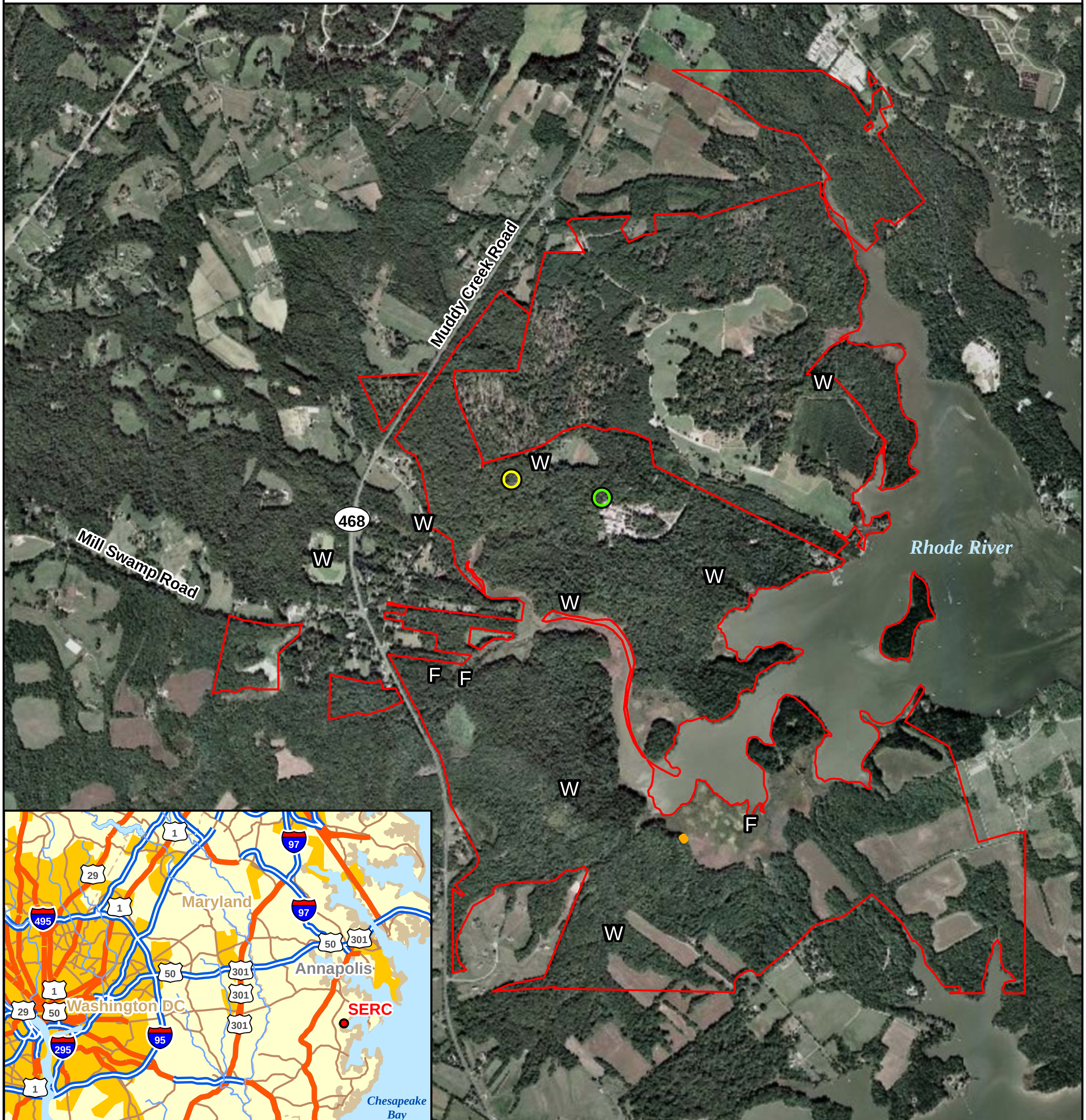
Project 2 Location



W Stream Weir
F Tidal Flux Station
Existing Meteorological Tower
Existing Data Tower
Existing CO2 Laboratory Building (not to scale)
SERC Boundary

N

0 1,500 3,000 6,000 Feet

Figure 1-3

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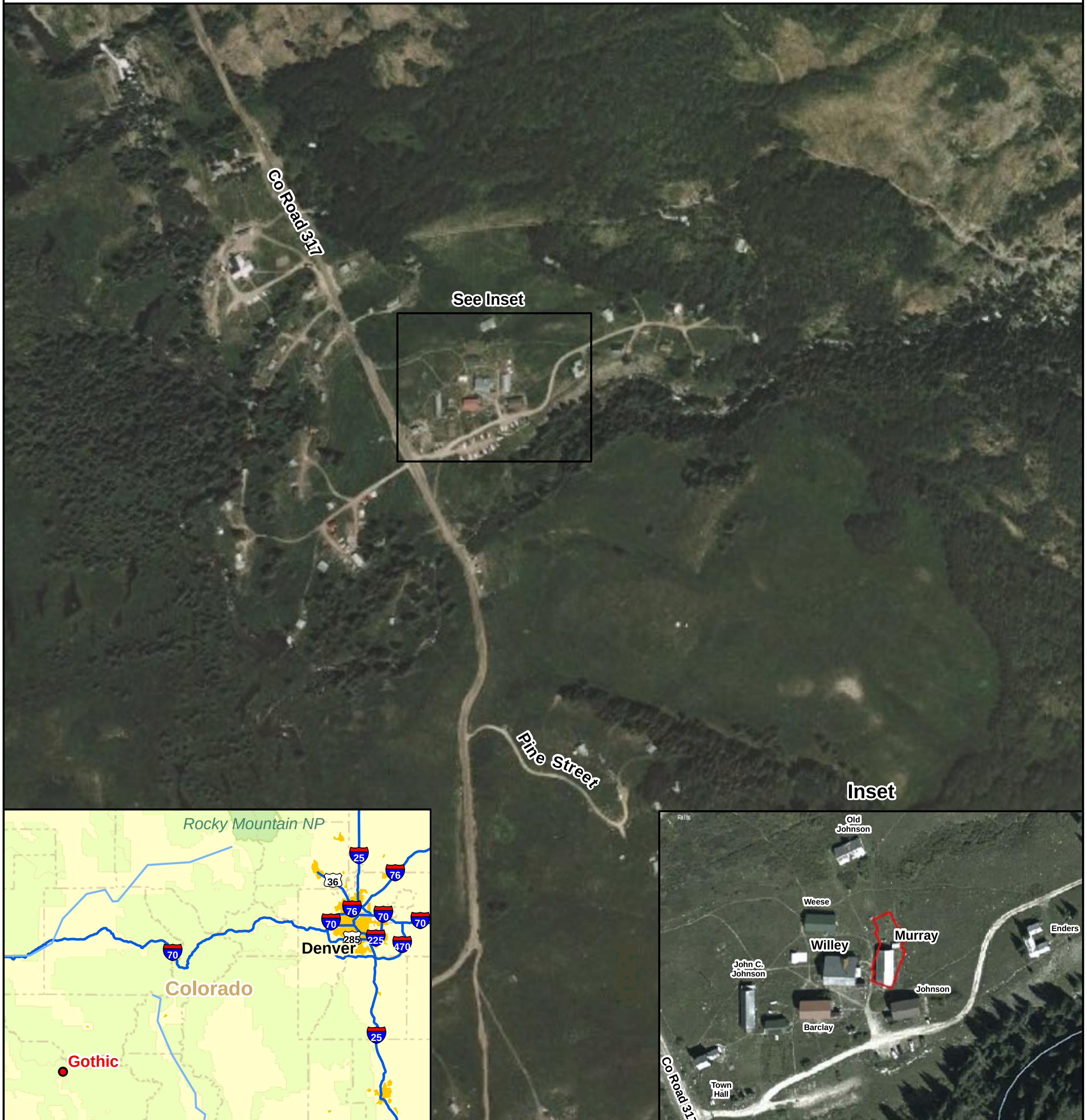
Project 3 Location



Proposed New Murray Laboratory Footprint

N

0 300 600 1,200 Feet

Figure 1-4a

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Project 3: Existing Laboratories

Figure 1-4b

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Project 4 Location

Figure 1-5

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Project 5 Location

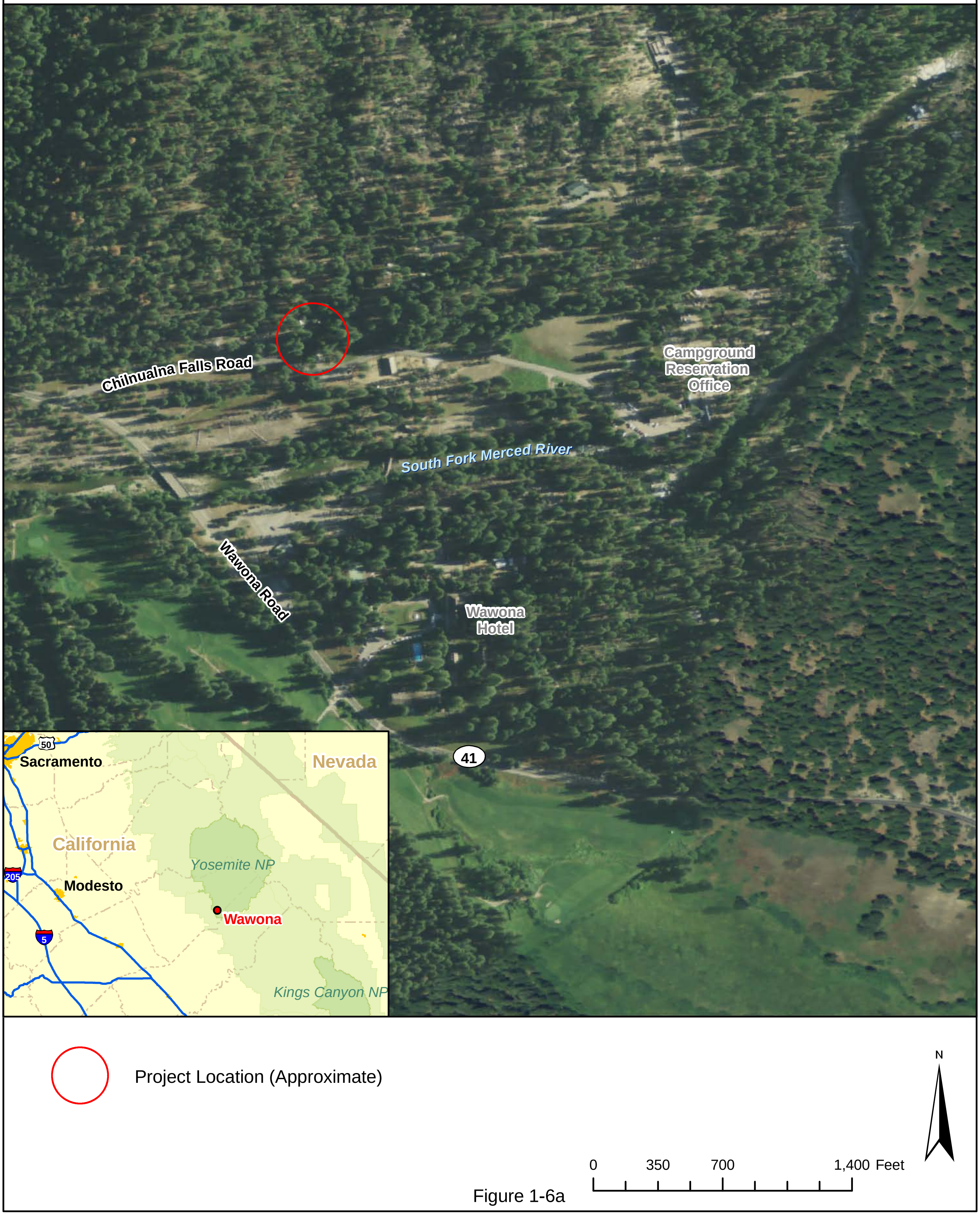

Figure 1-6a

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Project 5: Building 4050

Figure 1-6b

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Project 6 Location

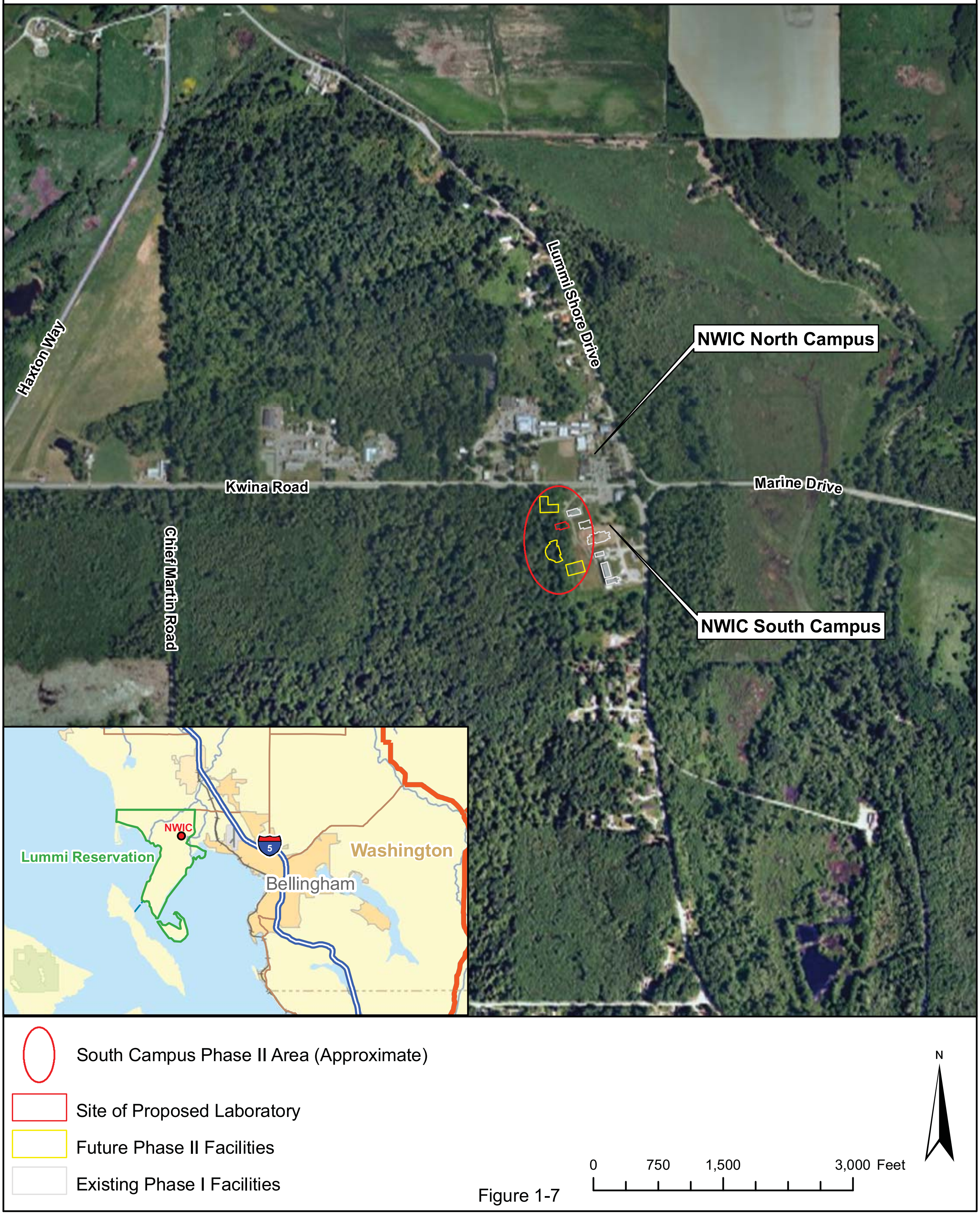

Figure 1-7

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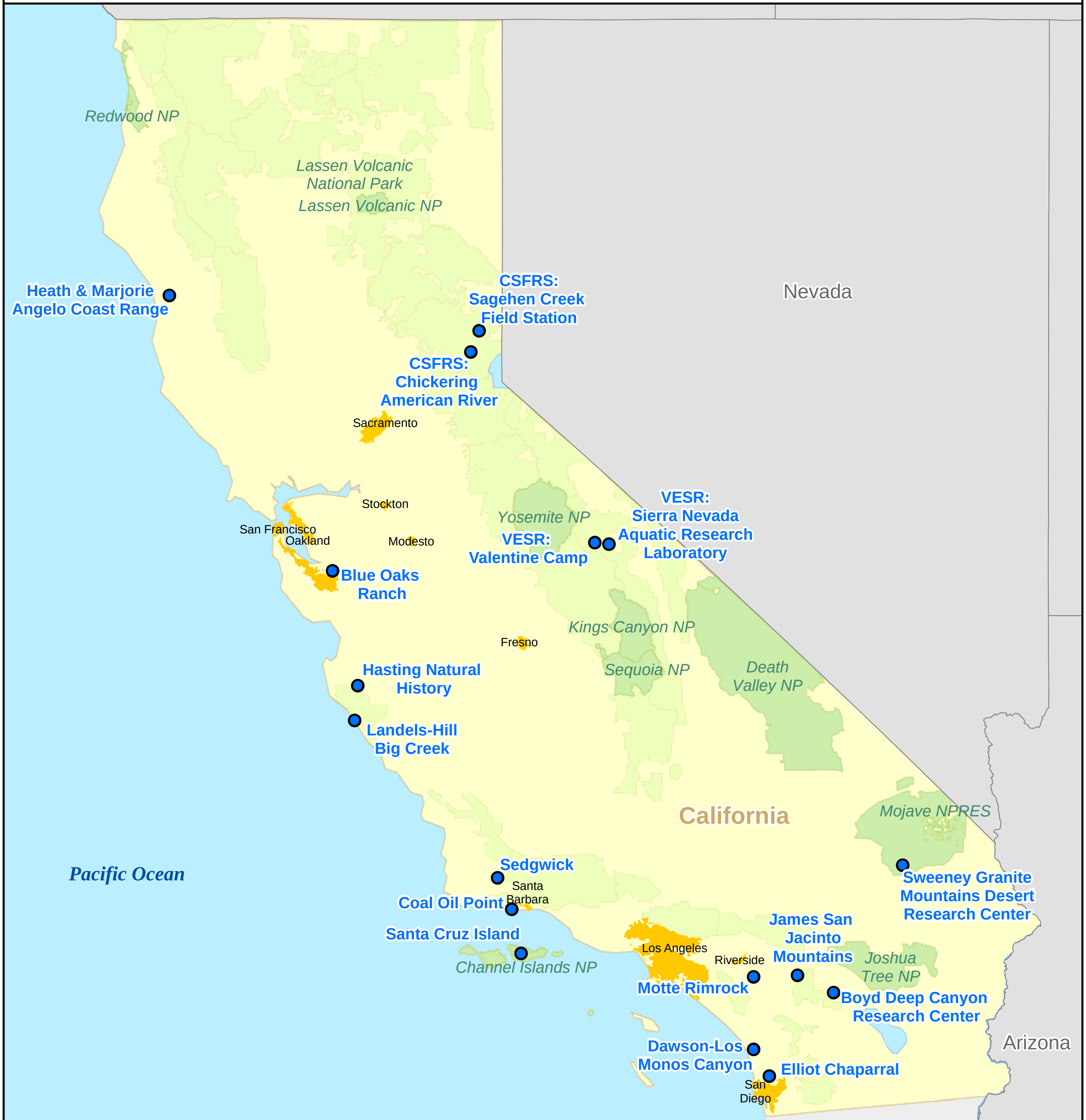
Project 7 Locations



UCNRS Reserve proposed for cyber-infrastructure improvements

N

0 55 110 220 Miles

Figure 1-8

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Table 1-2 - Reserves Proposed for Cyber-infrastructure Improvements

Reserve	Location
Heath and Marjorie Angelo Coast Range	Mendocino County, on the South Fork of Eel River, 150 miles north of San Francisco.
Blue Oaks Ranch	Santa Clara County, 7 miles east of downtown San Jose
Coal Oil Point	Santa Barbara County, on UCSB's West Campus, overlooking Santa Barbara Channel.
Central Sierra Field Research Station: Sagehen Creek Field Station	Nevada County, 8.4 miles north of Truckee on Highway 89.
Central Sierra Field Research Station: Chickering American River	Placer County, 5 miles southeast of the Donner Pass on the North Fork of the American River
Dawson-Los Monos Canyon	San Diego County, 30 miles north of San Diego
Elliot Chaparral	San Diego County, 10 miles northeast of UC San Diego campus
Hastings Natural History	Monterey County (upper Carmel Valley), 26 miles southwest of Carmel
James San Jacinto Mountains	Riverside County, 9 miles north of Idyllwild on State Highway 243
Landels-Hill Big Creek	Monterey County, Big Sur Coast, 50 miles south of Monterey
Motte Rimrock	Riverside County, 1 mile northwest of Perris
Santa Cruz Island	Santa Barbara County, in the Santa Barbara Channel
Sedgwick	Santa Barbara County, in the Santa Ynez Valley; 35 miles north of Santa Barbara
Sweeney Granite Mountains Desert Research Center	San Bernardino County, East Mojave Desert, 80 miles east of Barstow
Valentine Eastern Sierra Reserves: Valentine Camp	Mono County, on the eastern slope of the Sierra Nevada next to the town of Mammoth Lakes
Valentine Eastern Sierra Reserves: Sierra Nevada Aquatic Research Laboratory	Mono County, on the eastern slope of Sierra Nevada; 8 miles east of the town of Mammoth Lakes
Boyd Deep Canyon Research Center	Riverside County, 5 miles south of the city of Palm Desert

1.4.8 Project 8: Microwave Relay Antennas

This project involves work at Lowell Observatory's three locations in Coconino County, AZ: Mars Hill, in Flagstaff, AZ; the Anderson Mesa site, about 12 miles southeast of Flagstaff; and the Happy Jack site, approximately 40 miles south-southeast of Flagstaff, as shown in Figures 1-9a through 1-9d. At Mars Hill and Happy Jack, the proposed antennas would be affixed to existing structures; at Anderson Mesa, the proposed antenna tower would replace an existing, tower at the same location. The Anderson Mesa site and Happy Jack site are within the Coconino National Forest and are operated under special use permits from the US Forest Service.

1.4.9 Project 9: Greenhouse Replacement

The Project 9 site is situated in the eastern portion of the Main Campus of UCSB in Santa Barbara, CA (see Figure 1-10a). The site of the proposed 2,700-square-foot greenhouse is currently occupied by Building 539, an administrative facility, and surrounding pavements. The site of the proposed Alpine Greenhouse is a paved vehicle storage area. The new Technical Greenhouse stands between the two (Figure 1-10b).

1.4.10 Project 10: St. Anthony Falls Laboratory Renovations

The Project 10 site is located on an island in the Mississippi River in central Minneapolis, MN (see Figure 1-11a). It is occupied by the SAFL facilities to be renovated and is adjacent to the Xcel Energy hydroelectric plant. Wasteway 2, where the OSL is located, is used by SAFL under lease from Xcel (Figure 1-11b).

Project 8 Locations

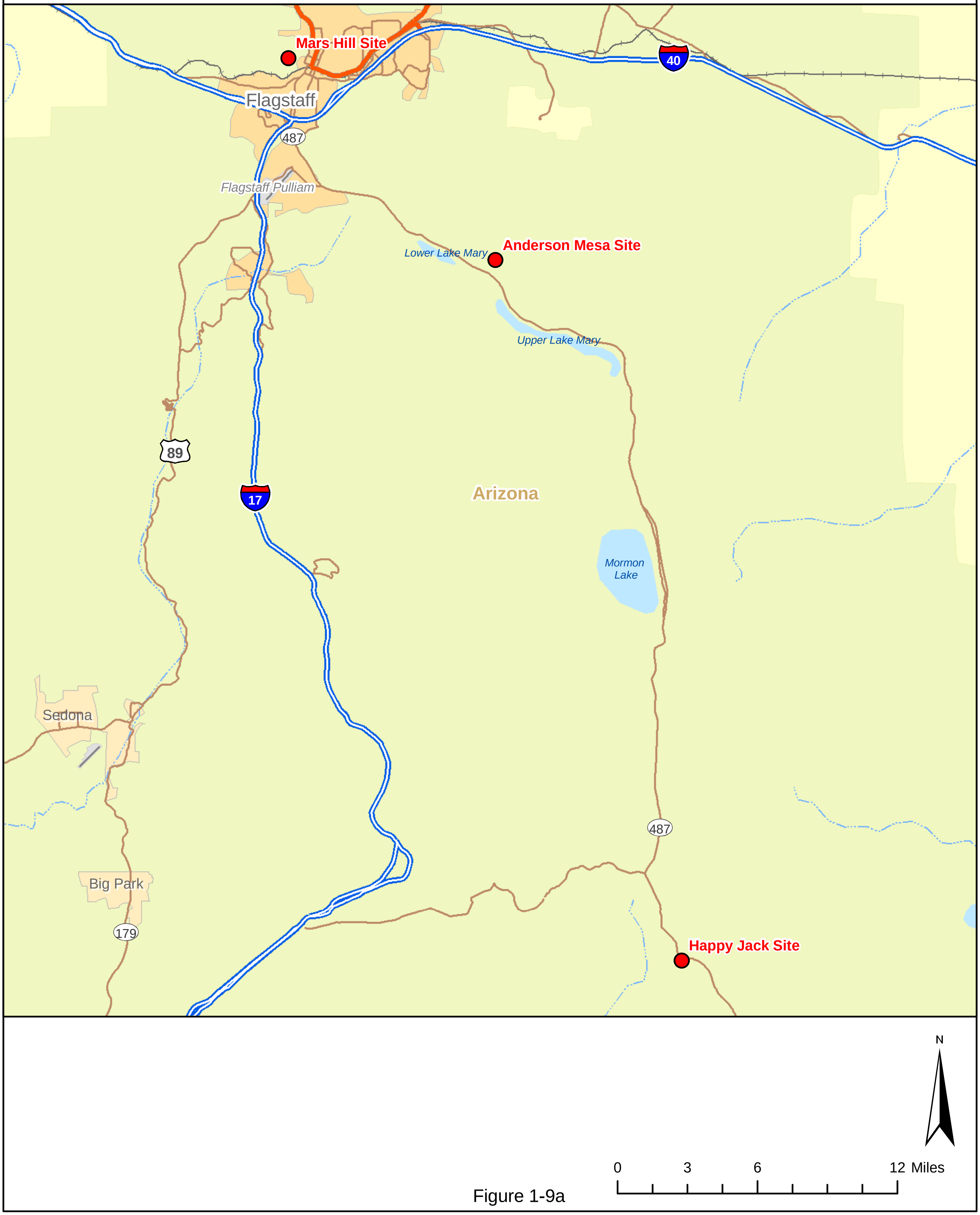

Figure 1-9a

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Project 8: Mars Hill Site

● Proposed Antenna Location

N

Not to scale

Figure 1-9b

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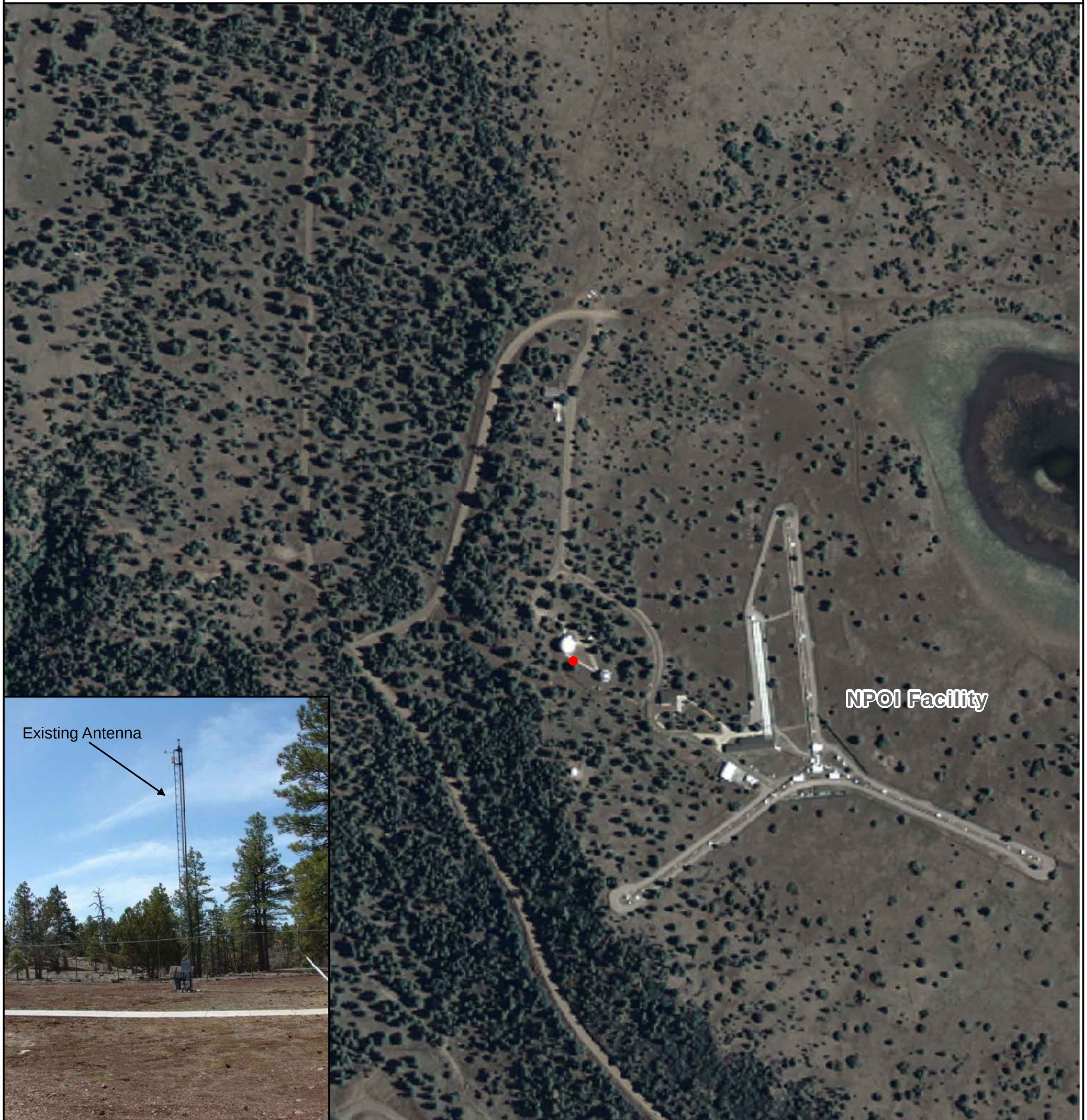
Project 8: Anderson Mesa Site



● Location of existing and proposed antennas

N

Not to scale

Figure 1-9c

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Project 8: Happy Jack Site

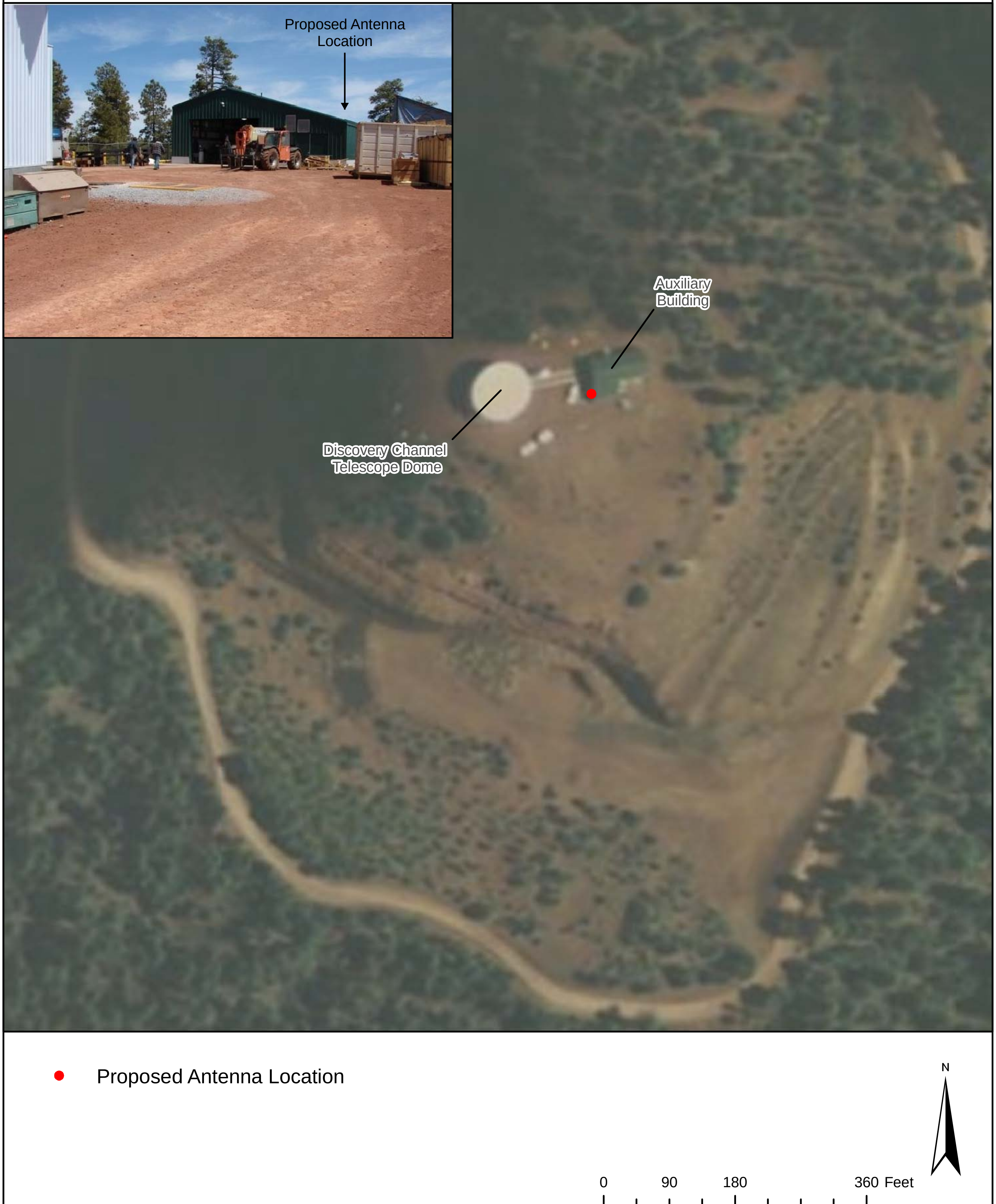

Figure 1-9d

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Project 9 Location

Site of Proposed Greenhouses (Approximate)

0 500 1,000 2,000 Feet

N

Figure 1-10a

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Project 9: Site of Existing and Proposed Greenhouses

Site of proposed 2,700-square-foot greenhouse

Site of proposed Alpine greenhouse

N

Figure 1-10b

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Project 10 Location

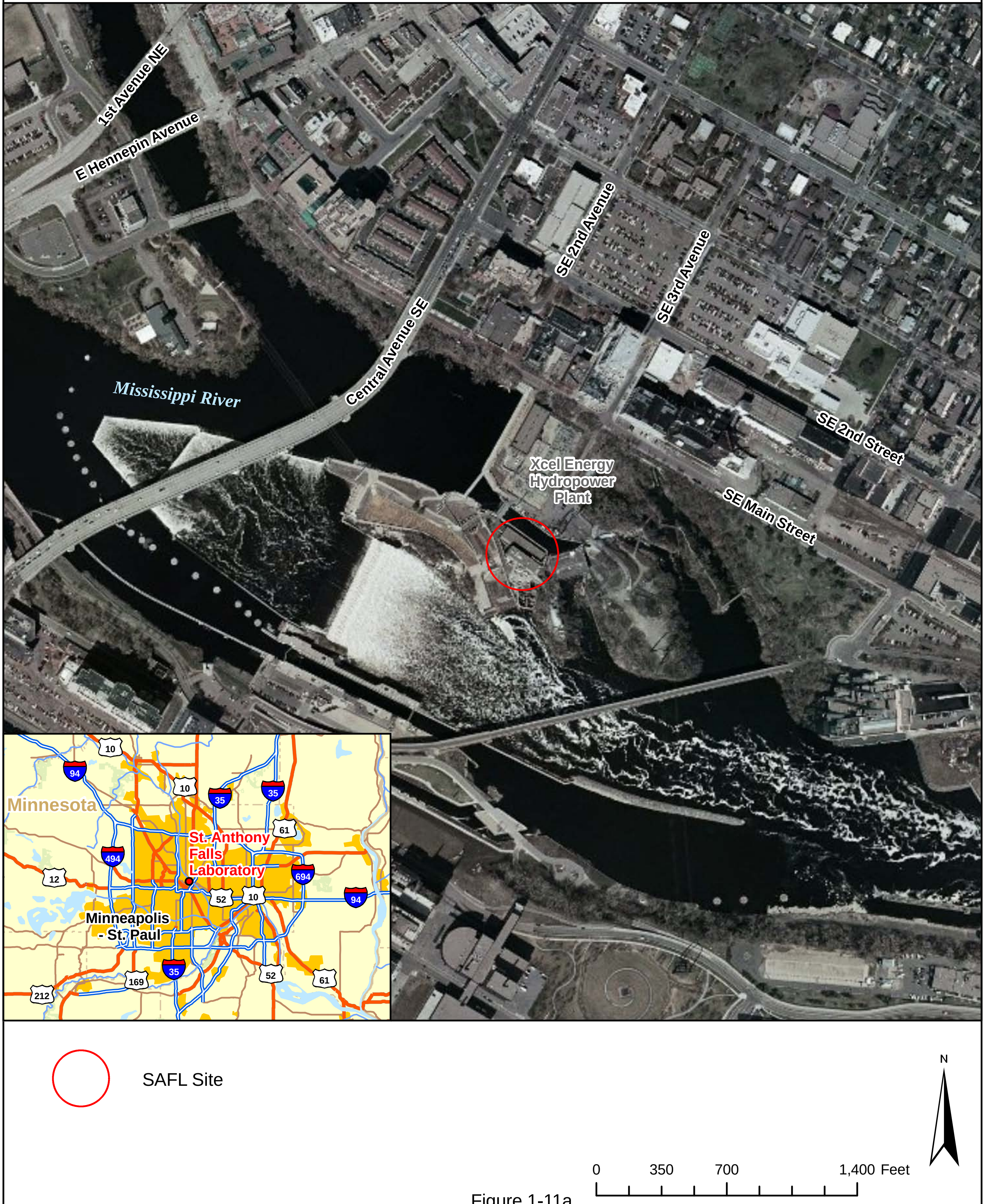

Figure 1-11a

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Project 10: SAFL Site

N

Figure 1-11b

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2. Proposed Action and Alternatives

CEQ regulations require an EA to contain a brief description of the proposed action's features as well as a description of alternatives to the proposed action, consistent with Section 102(2)(e) of NEPA. Agencies are directed to use "…the NEPA process to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the environment" (40 CFR 1500.2[e]). Alternatives found not to be reasonable (other than the no action alternative, see Section 2.2.3) do not need to be evaluated in the EA. This chapter describes the various activities associated with the proposed action and addresses alternatives, including the No Action Alternative.

2.1 Description of the Proposed Action

The proposed action evaluated in this EA consists of the funding through the ARI-R2 program of the ten following projects. Each project is designed to address the deficiencies, shortcomings, and needs described in Section 1.2.2.

2.1.1 Project 1: COBCC Building

Project 1 involves the construction of a new laboratory, the Center for Ocean Biogeochemistry and Climate Change (COBCC) to adequately accommodate the current needs of Bigelow Laboratory's OBCC research group and eliminate the shortcomings of the existing facilities outlined in Section 1.2.2.1. The COBCC would be built on the new Bigelow Laboratory campus, presently in development in East Boothbay, Maine.

This new, purpose-built campus consists of a 62.8-acre property owned by the Laboratory, approximately eight miles from the existing facility in Boothbay Harbor. The fully-built-out campus will include a modular, multi-wing building complex; the proposed COBCC would be one of the wings of this complex (see Figure 1-2). Altogether, the COBCC building would have a footprint of approximately 5,450 square feet, with an associated lawn area of approximately 9,650 square feet. The building would comprise three floors, totaling about 16,350 square feet of space. Laboratory and office space would be located on the first and second floors; the lower floor would house building support systems. The COBCC building would be connected to the rest of the complex via a curved glass corridor on the west side of the complex.

The proposed COBCC building would be a steel-framed structure braced for wind and seismic resistance. The use of concrete composite decking for the upper levels would minimize vibration and achieve a minimum of 100 pounds per square foot (psf) floor loading, as required for laboratory functionality. Floor-to-floor heights would be 16 feet. The foundation would be cast-in-place concrete. The basement-level mechanical rooms would have slab-on-grade construction for the supply air handling system. The supply air system would be equipped with high-efficiency particulate filtration and year-round humidity control. The HVAC system would incorporate energy recovery technology for both winter heat recovery and summer pre-cooling and dehumidification. Bigelow Laboratory would incorporate sufficient Leadership in Energy and Environmental Design (LEED) principles in the design of the building to achieve a "Gold" rating.

The COBCC building would be connected to the central utility plant that will be serving the larger complex. Electricity; telecommunications; drinking water; wastewater; fire protection; emergency power generation and distribution; and heating and cooling would be common to the entire complex. The central utility plant will be constructed as part of Phase 1 of the overall campus development, along with supporting infrastructure such as roads, parking areas, and underground utility lines. Phase 1 – not proposed for funding under, or dependent on, the ARI-R2 program and, therefore, not part of this proposed action – is due to be implemented between September 2010 and September 2011. Construction of the COBCC would be part of Phase 2, between July 2011 and April 2012. Also part of Phase 2 but not included in the proposed action for the reasons previously stated, is the completion of the Bigelow Center for Blue Biotechnology (BCBB) building.

2.1.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

Project 2 consists of the activities described below (See also Figure 2-1).

2.1.2.1 Watershed Component

Stream Weirs

The facility's eight stream weirs, their functions, and their current deteriorated condition are described in Section 1.2.2.1. All eight weirs would be repaired. The damaged dams would be repaired by digging a trench in the sediment down to the footers on the up-stream side of the dam (from 1 to 5 feet below grade) with a small trenching machine; constructing concrete forms with rebar; and pouring in concrete. In four of the dams, the failing soil berms would be replaced with poured concrete or metal sheet-piling. The instrument sheds would be replaced with similar but new wood sheds on the existing foundations. The spillways would be repaired by pouring concrete into the undercut. To minimize any potential impacts, all work would be performed over a two-month period in late summer (most likely 2011), when the streams are completely or almost dry.

Tidal Flux Stations

All three of the flux stations (described in Section 1.2.2.1) would undergo significant repairs. The two adjacent stream flux stations on Muddy Creek would be rebuilt with aluminum sheet-piling inserted to the clay layer and back-filled with concrete. The wings of these two stations would be reconstructed in the same manner as the weir station dams by using a small mechanical trenching machine to dig a ditch, lining it with aluminum sheet piling, and pouring in concrete. The electric supply line to the two stations would be buried using directional boring (directional boring is a steerable and trenchless method to install underground pipes that minimizes impacts to sensitive resources such as surface waters, wetlands, or vegetation: surface disturbance is mostly limited to the vertical entry and exit points at each end of the line.) The drilled "tunnel" would be approximately 2.5-inches in diameter and run under approximately 950 feet of forest. At the Marsh Creek flux station, two marine salt-treated pilings would be placed on one side of the mouth of the creek and four on the other side to support a wooden catwalk across the salt creek, anchor the wooden flume and wings, and support the instrument shed atop the 4 pilings.

Project 2: Proposed Improvements

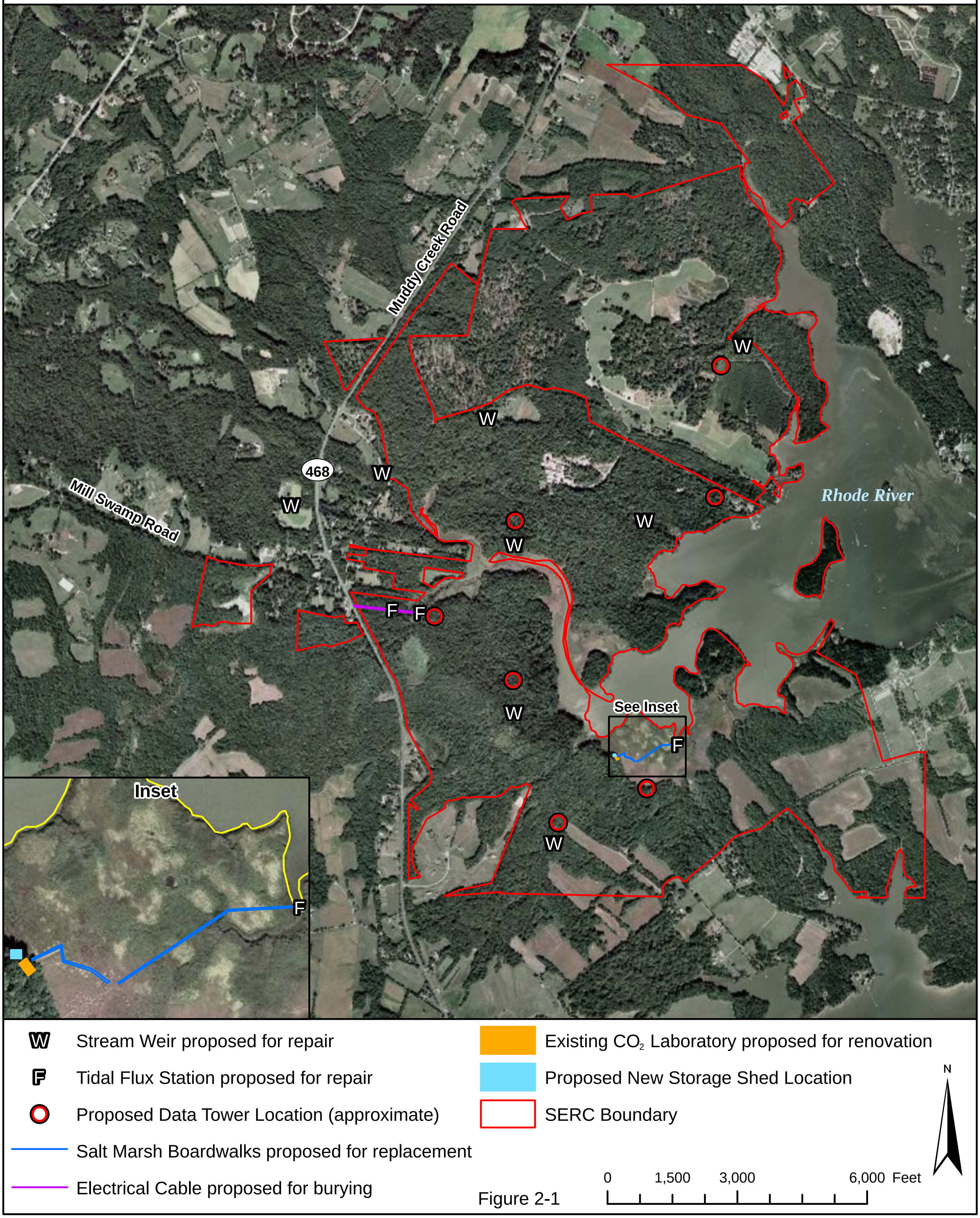

Figure 2-1

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Old pilings and materials would be cut off below sediment level and hauled away for disposal. Like the weir repairs, these operations would take place in late summer (most likely 2011), when stream flow is at its lowest.

2.1.2.2 Wetland Component

CO_2 Laboratory Building

The CO_2 Laboratory building would undergo interior renovations (interior walls would be reconfigured for a more optimal use of the available space), energy efficiency improvements (additional insulation), and stormwater runoff improvements (downspouts would be refurbished, rain barrels and a drywell for runoff would be installed).

Storage Shed

The existing, inadequate storage sheds would be replaced with one, consolidated structure, approximately 500 square feet in size, to be erected on a floating concrete slab on gravel base next to the CO_2 Laboratory Building. The site is currently a graded, heavily compacted driveway serving the CO_2 Laboratory. It is partially occupied by two of the existing sheds. The new shed would house a composting toilet to replace the existing portable facility and an electrical panel.

Boardwalks

Photo 2-1 A recently rebuilt boardwalk at SERC: the proposed new boardwalks would be of similar construction

The two ageing boardwalks that are used to access experimental and monitoring plots in the salt marsh and the Marsh Creek flux station would be replaced along the exact same alignment with new boardwalks. One of the boardwalks is 200 feet long and four feet wide; the other is 700 feet long and two feet wide. Both boardwalks would be built of salt-treated wooden structural framing with decking made of durable fiberglass grid sheets that allow light to reach the marsh surface underneath. To minimize any impact on the marsh vegetation from construction, the work would be performed in winter, when marsh plants are dormant and the marsh surface is frozen hard.

2.1.2.3 Data Collection

To automate and facilitate data collection, seven triangular, latticed communication towers, each approximately 120 feet in height, approximately three feet in base width, and supporting an antenna that would extend just slightly above the height of surrounding trees, would be set up to transmit the data acquired at the stream and tidal flux monitoring stations to the existing central meteorological tower. Signals from the monitoring equipment at each station would be relayed by Wi-Fi routers to the new towers, obviating the need for cables. A poured-concrete footer, 3x3x3.5 feet, would support each tower; footers of similar size would serve as underground anchors for three stabilizing guy wires that would be arrayed about 85 feet from the tower.

The exact location of each tower has not yet been exactly determined. Although each would have to be in the vicinity of the station or stations it would cover, there is a fairly large degree of flexibility with regard to its exact location. Therefore, if the project moves forward, SERC plans to micro-site each tower in a manner that avoids adverse effects to any sensitive resources. The towers and guy wires would be adjusted so no trees have to be cut; at the most, a few branches may have to be trimmed. Each spot where one of the 3x3x3.5-foot footers would be set up would be scrutinized for sensitive vegetation and an archaeologist would examine the excavation spoil for artifacts.

2.1.3 Project 3: Murray Laboratory

Under this project, the research functions currently inadequately housed in the Murray and Willey buildings (described in Section 1.2.2.3) would be consolidated in a new facility, the new Murray Laboratory, to be constructed on the site of the existing Murray Building, which would first be demolished. If possible, components of the building would be salvaged for reuse in other RMBL facilities; off-site recycling or reuse would also be considered. Following the removal of the existing building, the new Murray Laboratory would be constructed. This would be an approximately 5,000-square-foot structure, the footprint of which would include, and extend within the immediate vicinity of, the existing building's.

The new laboratory would be designed in a style and using materials that are consistent with those of the existing RMBL facilities (see Figure 2-2). It would contain large laboratory spaces (about 400 square feet each), including space for processing field samples and other specialized uses (e.g., genetics, wet labs, and isotope work). There would also be an approximately 100-square-foot room to house a server and equipment to manage telecommunications, including downloading and processing data from RMBL's new weather station array. Another space of the same size would be used to manage the Global Positioning System, survey equipment, and environmental sensors. A balance room, approximately 125 square feet in size, would be placed at the center of the building for microbalances sensitive to temperature, vibrations, and static. The building would have a mechanical ventilation system that allows the cleaning as well as conditioning of indoor air; it would have a slight positive pressure that pushes air out when the doors are opened: these features are intended to facilitate keeping the building clean. There would be three animal care rooms capable of accommodating research groups working on a range of organisms. Finally, the new facility would have a series of smaller laboratories that would provide private spaces for research groups to process field samples, do microscope work, conduct lab experiments, and stage field experiments.

Project 3: Concept for Proposed Murray Laboratory

Figure 2-2

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Research activities conducted in the existing Murray and Willey buildings would move into the new facility. Administrative functions would move into the Willey Building, which is not proposed for demolition or major renovation.

If possible, demolition of the existing Murray Building would take place in fall 2010 and the new facility would be constructed in 2011. If needed, work could extend into the following construction season (2012) as well. A nearby parking lot would be used as a staging area during demolition and construction operations.

2.1.4 Project 4: Moe Pond Laboratory

This project consists of the replacement of the existing, inadequate Upper Research Station laboratory with a new laboratory built on a full concrete basement foundation directly south of the existing building (Figure 2-3). The new laboratory would be an approximately 635-square-foot, open post-and-beam wood structure with a shake or shingle peaked roof. As much as possible, green building materials would be used. The new building would feature a full bank of exterior windows for observation purposes and include office space and a bathroom (with composting toilet and sink). Power and heat would be delivered by a 6-kilowatt propane-powered fuel cell. Potable water would be brought on site in containers; non-potable water would be obtained from a groundwater well to be drilled near the building.

The existing laboratory would be renovated and converted to storage space. This would involve lifting the structure off its supporting foundation pilings, temporarily moving it to the west (onto a dirt roadway), installing new, poured concrete foundation pilings, and resetting the structure on this fresh foundation. Minor renovations would be performed to make it into a usable boat garage and storage space. It would be connected to the new building. The project is scheduled for implementation in 2011.

2.1.5 Project 5: Wawona Field Station Renovations

Project 5 consists of interior and exterior renovations and upgrades to the Wawona Field Station (WFS)'s garage building (Building 4050) so it can provide adequate research and research training space, including enhanced internet connectivity. The building is a contributing element to the National Register of Historic Places-eligible Wawona Historic District. It was originally built as a garage for the adjacent ranger residence (also used by the WFS). The building is a rectangular one-story, timber-framed structure approximately 20 by 41 feet in size, with a gabled roof that retains its original wood shingles (see Figure 1-6b). The building originally had two bays with hinged carriage doors along its southern façade; however, the western bay's automotive carriage doors was replaced with a set of pedestrian double doors in 1969, when the western wing of the building was retrofitted from a garage and storage area with dirt floors into an office with linoleum tile floor. In 1991, the east wing was modified from a garage with dirt floor into a search-and-rescue cache with concrete floor. The building was permitted by NPS to WFS in 2006.

2.1.5.1 Exterior Work

Exterior work would include:

- Replacing the existing, aged roofing shingles.
- Replacing the existing residential-grade double doors with an exterior barn door matching the existing, adjoining original barn door.
- Cleaning and repainting the exterior wood siding and trim.
- Installing new energy efficient dual-pane windows.

Exterior work would also be needed to enhance and upgrade the electrical, communication, and networking systems serving the building. A solar photovoltaic array, approximately 25 feet long by five feet tall, would be installed on a rack set on the exposed, south-facing hill slope immediately behind the building. A solar water heating array consisting of two four-by-eight-foot collectors would be installed on a separate, adjacent rack. Neither installation would be visible from the road or the front of the building. To minimize any soil disturbance, each rack would be set on four one-square-foot pillar blocks, one at each corner.

Wiring from the solar electric array would require digging a small trench (approximately six inches wide, 36 inches deep, and ten feet long). No trenching would be needed to connect the water heating array to the existing radiant heating system.

An existing secondary propane tank would be removed and the building would be connected to the primary tank located next to the nearby office building. The primary tank would be upgraded to a larger tank to accommodate this additional demand. The larger tank would fit on the existing concrete pad. Laying out the new gas supply line would require digging a trench approximately six inches wide, 36 inches deep, and 20 feet long along the side of the building in an area disturbed during prior construction projects.

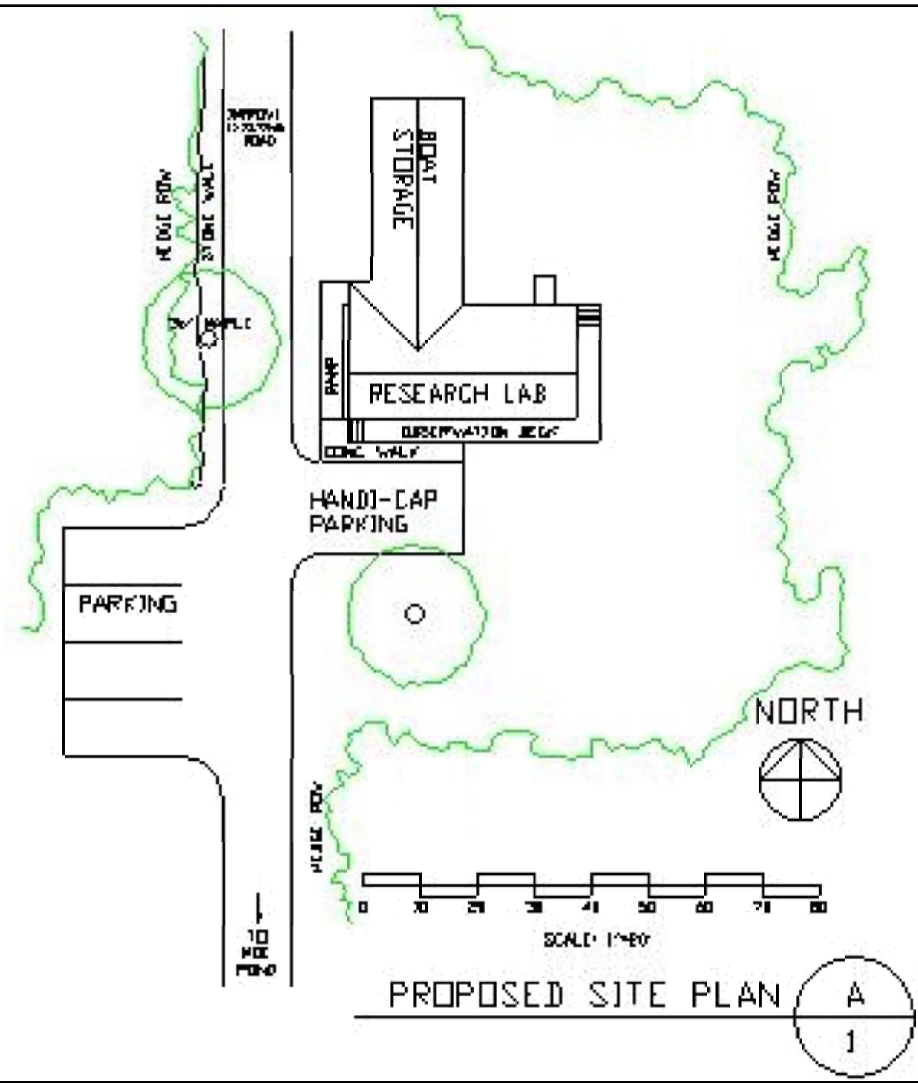
To eliminate the need for new electrical panels on the exterior of the building, electrical and communication upgrades would be tied into the adjacent office building's systems. The required wiring would be pulled to the historic stable using existing PVC conduit and require no trenching.

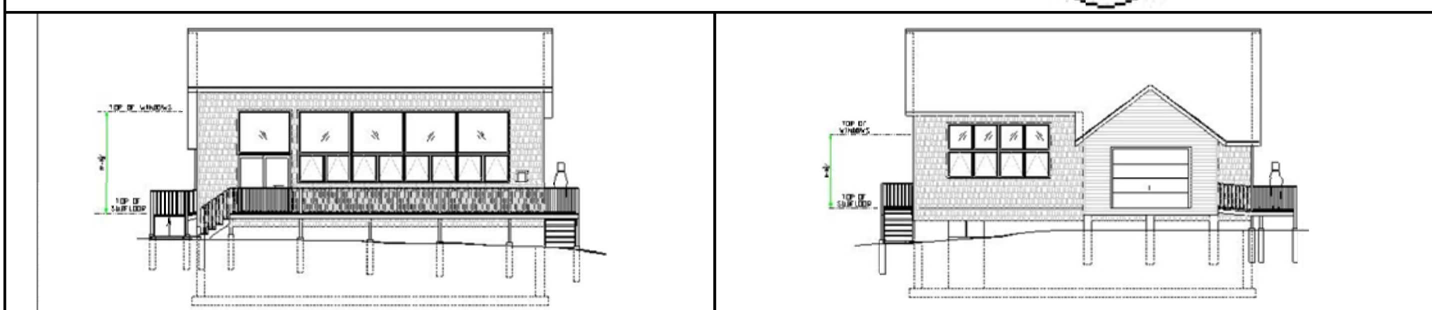
2.1.5.2 Interior Work

Interior work would include:

- Removal of the non-original gypsum and plywood sheathing from all interior walls, support posts, and ceilings; the non-original propane wall heater; and the non-original, raised floor.
- Installation of blown-in recycled cellulose insulation in the ceiling and walls.

Project 4: Proposed Moe Pond Laboratory





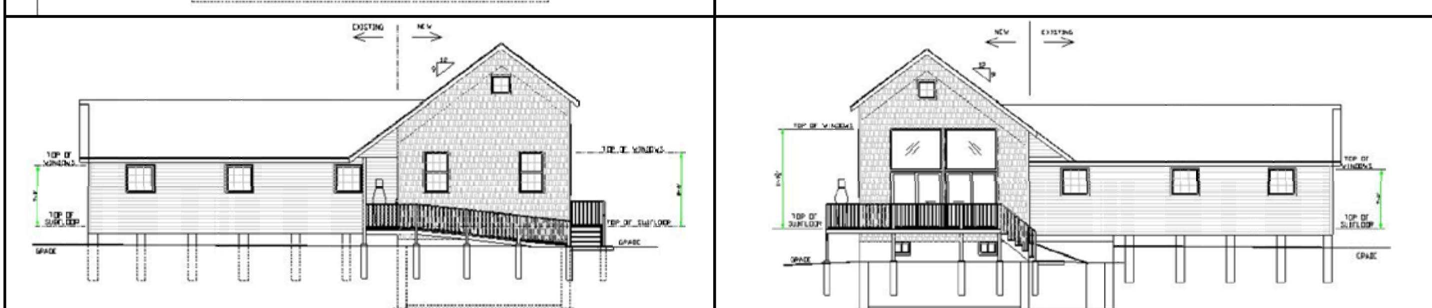


Figure 2-3

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- Re-surfacing of all interior walls with gypsum wallboard, taped, sanded, and painted/finished with an acoustical surface; some walls may receive historically appropriate wood surfacing.
- Installation of a new, historically appropriate wood ceiling.
- Installation of a new fire-rated interior door at the north-side equipment room.
- Installation of a new fire-rated interior door to provide access between the building's two adjoining research/conference rooms.
- Installation of a fire suppression sprinkler system complying with NFPA 13 and a fire alarm system complying with NFPA 72.
- Construction of a new, stained concrete slab floor with encased tubing for radiant heating/cooling. The tubing would tie into the outside solar collector for heating and the cold water line for cooling.
- Installation of sliding glass doors on the inside of the exterior barn doors to provide a weather-tight and rodent-proof seal.
- Extension of communication lines to a mini-computer-room conditioned network and system enclosure located in the building's north-side equipment room.
- Installation of new network equipment and a dedicated uninterrupted power source.
- Connection of data cabling to six workstations in each of the building's two research/conference rooms and to video-conferencing equipment.

Implementation would be during the 2011 construction season. All renovations and enhancements would be conducted in a historically sensitive manner, consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and in coordination with NPS, which would review and approve the proposed designs before work can proceed. Only those elements approved by NPS would be constructed.

2.1.6 Project 6: NWIC Laboratory


Photo 2-2 NWIC South Campus Phase I buildings southeast of the project site. The proposed new laboratory would be designed in a similar style

Under this project, NWIC would construct a new, single-story laboratory building within the Phase II area of its new South Campus (see Figure 1-7). The building would be approximately 3,270 square feet and designed in a style similar to the style of the existing facilities. Although too small to qualify for LEED certification, it would incorporate LEED principles. It would have a shed roof that would support a 26-kW photovoltaic system generating a sufficient amount of electricity to operate the building and leave a surplus available for other uses. Construction materials low in toxins and chemicals would be used. Other sustainable features would include reclaiming water for use in toilets, urinals, and, when possible, research activities; maximizing the use of natural lighting; emphasizing natural ventilation to eliminate the need for an air cooling system; and using natural gas radiant floor heat. Site work would include sidewalks and landscaping.

The building would provide 2,650 square feet of research space, including a chemistry lab; a biology lab; a herbarium/herbology room; a microscopy room; a chemical storage room; a mud/receiving/washdown room; an electrical room; and a mechanical room. Construction would take place in 2011.

2.1.7 Multi-site Cyber-infrastructure Improvements

This project consists of improvements to the cyber-infrastructure of 17 of UCNRS's 36 natural reserves (see Table 2-1 for a list and summary characterization of each of the 17 reserves), including the upgrade of existing equipment and installation of new infrastructure. Although network architecture and the number and type of transmitting devices used would vary from reserve to reserve, most would involve the same basic elements in the configuration best adapted to the needs and available infrastructure of the reserve.

Each system would begin at a source, typically a branch of the UC system or a local Internet Service Provider (ISP), which has broadband. Broadband uses radio frequency (RF) at a rate of oscillation in the range of about 30 kilohertz (kHz) to 300 gigahertz (GHz), the frequency of electrical signals normally used to produce and detect radio waves. Backhaul radios with licensed frequencies (5.0 and 11 GHz) would be used to transmit the broadband internet access to a central point in each reserve. From the central point on the reserve, the broadband would then be taken and distributed on a mesh network of radios. Each radio in this network is smaller than the backhaul radios (about ten by ten inches) and uses an upright antenna, about eight inches long.

The radios in the mesh network would send or receive signals using lower frequencies, typically 900 megahertz (MHz), which can travel through forests and other places with no clear line of sight. Any instruments and/or computers within reception distance of one of these radios can access the internet using 802.11 wireless technology (the same technology as used for home networks). Some of the mesh radios would be installed on buildings, where AC power is available. Others would be located in areas where there is no power and, therefore, require their own power supply. For these, a power supply kit consisting of a single battery in a protective box and two small solar panels attached to an eight- or ten-foot tall post would be used (see Diagram 2-1). The batteries would be gelled electrolyte, absorbed glass mat lead-acid batteries, which use much less electrolyte (battery acid) than traditional lead-acid batteries and cannot spill it, even if inverted or cracked. This is the type of battery used for powering wheelchairs because of the low risk they represent. The only ground disturbance associated with this setup is the digging of a small hole, about three feet deep, by hand or using an auger.

Photo 2-3 Typical mesh network radio

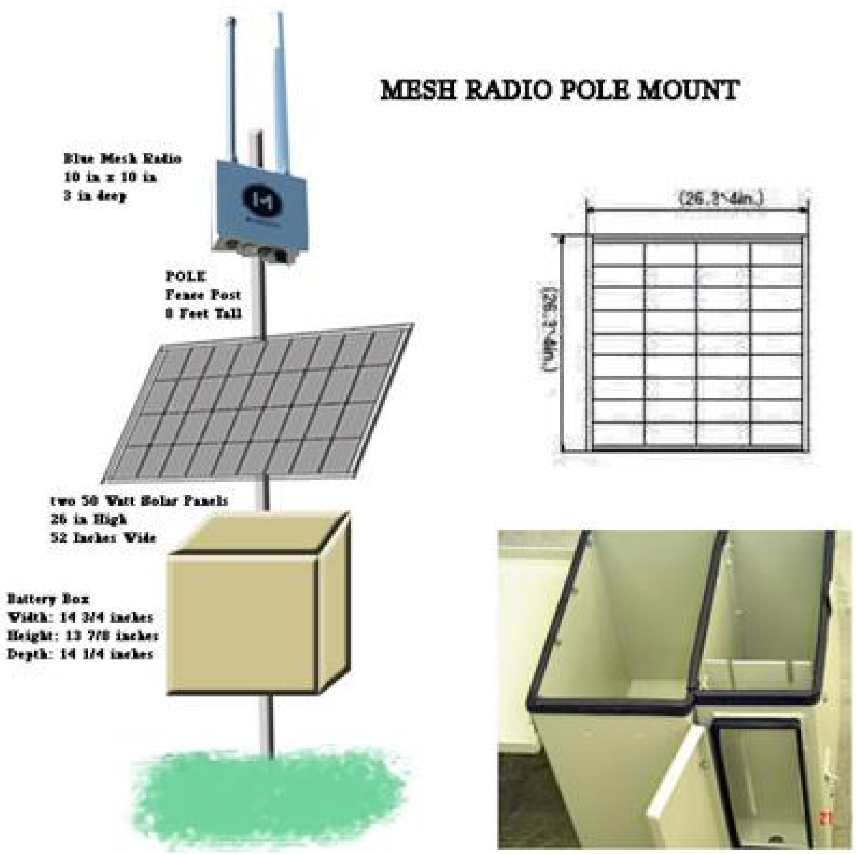

Diagram 2-1 Low-profile mesh network radio with solar panels

Table 2-1 - UCNRS Reserves Proposed for Cyber-infrastructure Improvements

Reserve	Area (acres) /Elevation(feet)	Summary Description
Heath and Marjorie Angelo Coast Range	4,320 ac 1,240 to 4,231 ft	The reserve encompasses four aquatic and at least 26 terrestrial habitat types, including redwood groves, mixed conifer/deciduous forests, meadows, several types of chaparral, and the state's largest virgin Douglas-fir forest community. Olympic salamanders, flyin3g squirrels, black bears, and federally threatened northern spotted owls are among the old-growth inhabitants. The reserve also protects four undisturbed watersheds, among them the six-square-mile Elder Creek watershed. These pristine aquatic ecosystems support salmon, steelhead trout, river otters, and Pacific giant salamanders.
Blue Oak Ranch	3,259 ac 1,489 to 2,855 ft	Most of the reserve lies within the Upper Sonoran Life Zone. Approximately two-thirds of the site is drained by tributaries of Arroyo Aguague. The bowl-shaped Arroyo Aguague catchment area is characterized by steep wooded slopes and meadows, as well as open flats dotted with oaks and coyote brush. The precipitous Arroyo Hondo is heavily wooded on north- and east-facing slopes, while western and southern exposures consist of open grassland or dense chaparral patches. Streams on the ranch support healthy stands of riparian vegetation in addition to aquatic species. They are important habitat for migratory birds and may be migratory corridors for numerous aquatic and terrestrial animal species. At least 73 vascular plant families are found at the reserve, almost 80 percent of which are native. Plant communities include blue oak woodland, valley oak woodland, black oak woodland, coast live oak woodland, riparian forest, chamise chaparral, Diablan sage scrub, nonnative annual grassland, wildflower field, and native perennial grassland. The reserve's habitats support around 130 species of birds, approximately 41 species of mammals, at least 7 species of amphibians, more than 14 species of reptiles, around 7 species of fish, and hundreds of species of invertebrates. The reserve streams and 17 ponds support most of that site's rare species, such as the river otter, California tiger salamander, foothill yellow-legged frog, and red-legged frog. Riparian areas are utilized by more than ten species of neotropical migratory birds, including flycatchers, warblers, and vireos.
Coal Oil Point	170 ac 0 to 40 ft	This reserve protects a wide variety of coastal and estuarine habitats. Largely undisturbed coastal dunes support a rich assemblage of dune vegetation; older and more stable backdunes are covered with southern coastal scrub habitat. In the heart of the reserve, Devereux Slough is a seasonally flooded tidal lagoon that dries out in the summer to form salt flats and hypersaline ponds and channels. A variety of intertidal habitats occur along the sandy beach and the large rocky reef at the point. Thousands of migratory birds visit throughout the year.
Central Sierra Field Research Station: Sagehen Creek Field Station	8,000 ac 5,900 to 8,700 ft	Located within the Sagehen Experimental Forest on the eastern slope of the northern Sierra Nevada approximately 20 miles north of Lake Tahoe, the field station has been dedicated to research and teaching since 1951. The University of California operates the station under a long-term, special-use permit from the U.S. Forest Service. The surrounding watershed is also available to researchers and classes through an agreement with the Forest Service and includes extensive stands of yellow pine, mixed conifer, and red fir forests, as well as brush fields, scattered mountain meadows, and fens. Sagehen serves as the hub of a much broader network of research areas known as the Central Sierra Field Research Stations, which is comprised of: Sagehen Creek Field Station, Central Sierra Snow Laboratory, Onion Creek Experimental Watershed, Chickering American River Reserve, and North Fork Association Lands.

Reserve	Area (acres) /Elevation(feet)	Summary Description
Central Sierra Field Research Station: Chickering American River	16,875 ac 6,000 to 8,100 ft	Located in the headwaters basin of the North Fork of the American River, the Chickering American River Reserve is the only UCNRS site set on the windward western slopes of the Sierra Nevada. This rugged site has thin soils and a variety of mountain habitats, including black oak woodlands, montane and subalpine coniferous forests, aspen groves, willow thickets, mixed riparian woodland, wet and dry subalpine meadows, montane chaparral, alpine lake margins, and fell fields. The basin also has scattered soda water springs, which contain a variety of minerals, primarily calcium bicarbonate. Rich in flora and fauna, the site harbors one thousand plant species. It also lies within the habitat ranges of a variety of mammals, including pika, yellow-bellied marmot, marten, fisher, mule deer, black bear, and mountain lion. One hundred bird species, including northern goshawks and California spotted owls, are among the other inhabitants, along with more than fifteen reptile and amphibian species, including the yellow-legged frog, a declining species. Significant petroglyphic sites thought to be of the people of the Martis complex may date back 3,000 years or more.
Dawson-Los Monos Canyon	234 ac 220 to 587 ft	Agua Hedionda Creek, one of the few perennial streams in Southern California, flows through the reserve. The stream banks of the canyon floor are characterized by a lush riparian woodland that gives way to dense chaparral up the steep north- and south-facing slopes. The wide upper canyon opens out onto old pastures of introduced annual grasses, the result of a century of grazing. Other habitats include coast live oak woodland, inland sage scrub, and a mixed grassland of native bunchgrasses and introduced annuals. The varied landscape of Los Monos Canyon supports a rich fauna, with more than 75 species of birds, including several pairs of nesting black-shouldered kites.
Elliot Chaparral	107 ac 200 to 1,000 ft	Formerly part of the Camp Elliott Military Reservation, the reserve comprises a diverse mixture of natural coastal and desert habitats that is becoming more and more rare with rapid suburban growth in the San Diego region. The reserve encompasses a narrow, steep-sided ridge of the Kearny Mesa, bounded north and south by broad, flat-bottomed valleys and associated arroyos. The rolling topography is covered with an unusually wide variety of south coastal chaparral, much of it a nearly pure stand of greenwood, intermixed with elements of coastal sage scrub. Forty-five vascular plant species have been identified on the reserve, several of which have a relatively restricted distribution, such as ashy spikemoss, bushrue, and Xylococcus. The soils, formed on an Eocene conglomerate, are thin, pebbly, and leached, making the chaparral plants, particularly chamise, more stunted and open than in most other Southern California locations.
Hastings Natural History	2,373 ac 1,530 to 3,125 ft	The Hastings Natural History Reservation is set in the open foothills of the Santa Lucia Mountains in upper Carmel Valley and protects excellent examples of habitats characteristic of the interior central Coast Range: annual and perennial grasslands, oak woodlands, chaparral, and running streams. This hilly reserve lies primarily on south-facing slopes and encompasses three narrow tributary valleys, with a few small level areas. Detailed ornithological records include sightings of over 165 bird species, nearly half of which have nested on site. Records are also maintained on nine species of amphibians, ten snakes, and seven lizards that live on or near the reserve. The abundance of acorns and oak seedlings provides forage for many mammals, particularly mule deer and pocket gophers. The reserve is also home to numerous other species, smaller - California ground squirrels, dusky-footed woodrats, kangaroo rats, voles, and mice – as well as larger – bobcats and mountain lions.

Reserve	Area (acres) /Elevation(feet)	Summary Description
James San Jacinto Mountains	30 ac 5,325 to 5,550 ft	This reserve is located on an alluvial bench situated at the lower end of Hall Canyon, a steep, western flank of Black Mountain. It hosts a wide variety of plant communities: Sierra mixed-conifer riparian forest, oak woodlands, montane chaparral, alder-willow-cedar riparian forest, and dry meadows. Habitats include mixed conifer and hardwood forest, montane chaparral, montane riparian forest, rapidly flowing mountain stream with manmade reservoir (Lake Fulmor) immediately downstream. The entire watershed is protected for research and study by the U.S. Forest Service. There are records of 259 species of vascular plants, 35 bryophytes, 6 amphibians, 18 reptiles, 125 birds (60 percent nesting), 35 mammals, and about 1,000 invertebrates.
Landels-Hill Big Creek	3,911 ac 0 to 4,000 ft	Located in the Santa Lucia Mountains along the Big Sur coast, this reserve encompasses several miles of rugged ridges that flank the Pacific Ocean and descend to a rocky shoreline. From there, the reserve extends approximately one mile offshore into the Big Creek State Marine Reserve. Extremes in topographic and vegetative diversity range from kelp forests and flat and rocky ocean-bottom habitats reaching 100 meters in depth to multiple upland habitats: coastal scrub, redwood forest, coastal grasslands, oak woodlands, and pine-oak forest and woodlands. The reserve also protects perennial streams and the lower portions of a remote, pristine watershed, which supports a significant run of southern steelhead trout. Big Creek flows strongly year round, even during drought years, and its different forks have unique mineralogical regimes. The region's active tectonic history has produced a wealth of rock formations, complex geological faults, and dozens of springs, some of which are warm.
Motte Rimrock	715 ac 1,580 - 1,985 ft	The Motte Rimrock Reserve lies on a broad, rocky plateau at the western edge of Perris Valley. It contains rich archaeological resources, including some of the best-preserved pictographs in Southern California. Coastal and desert influences intermingle at the site, creating an unusual mix of habitats. An inland type of coastal sage scrub covers most of the reserve, with other areas supporting chaparral, coastal-desert transitional grassland, and riparian thickets. Six seasonal springs add to the diversity of the landscape. The reserve protects critical habitat for a variety of animals, including two federally listed species: the endangered Stephens' kangaroo rat and the threatened California gnatcatcher.
Santa Cruz Island	46,020 ac 0 to 2,434 ft	The Santa Cruz Island Reserve is the largest UCNRS site and the biggest of the Channel Islands located off the Southern California coast. The island has two major mountain systems flanking a central valley that formed along an active fault zone. The mountains are rugged and cut by steep-sided canyons, some with perennial streams and freshwater springs. The coastline is mostly steep and rocky, with some protected coves and sandy beaches. Diverse habitats include rocky intertidal zones, coastal sage scrub, chaparral, grasslands, oak woodlands, and bishop pine forests. The reserve contains breeding grounds for harbor seals, seabird nesting colonies, many endemic plant and animal species, and well-preserved archaeological sites. Santa Cruz Island Reserve is protected, owned, and managed by The Nature Conservancy (TNC); the remainder of the island is managed by the National Park Service as part of the Channel Islands National Park.

Reserve	Area (acres) /Elevation(feet)	Summary Description
Sedgwick	5,900 ac 950 to 2,600 ft	This reserve encompasses 9.2 square miles on the southern slopes of the San Rafael Mountains and spans an elevational range of 1,650 feet. It is noted for both its large size and environmental heterogeneity. The reserve contains a major geologic fault system and two distinctive geologic formations: relatively young Paso Robles alluvium and much older Franciscan metamorphosed seafloor, including large areas of serpentine. Diverse vegetation types include coast live oak forest, blue oak woodland, valley oak savannah, buckbrush chaparral, coastal sage scrub, grassland, willow riparian forest, serpentine outcroppings, and agricultural lands. The site contains major portions of two watersheds and a variety of localized wetland habitats, notably vernal pools. The region has a rich Native American heritage, and at least one Middle Chumash habitation site (1,500 to 2,000 years old) rests on site.
Sweeney Granite Mountains Desert Research Center	8,639 ac 3,700 to 6,796 ft	The Center is located in the Granite Mountains of the East Mojave Desert. High plateaus and ridges dominated by piñon-juniper woodland and sagebrush descend precipitously to the east in highly fractured granitic canyons. Massive pinnacles and broken, rocky terrain eventually give way to densely vegetated bajadas and washes, supporting creosote bush scrub, a unique community of enriched mixed woody and succulent scrub, and other habitat types. Springs and seeps are common. Variation in habitat, hydrology, and elevation supports a diverse plant and animal life, including more than 460 species of vascular plants, two amphibians, 34 reptiles, 138 birds, and 42 mammals. The reserve also protects a dense concentration of archeological sites left by Chemehuevi and other Native American tribes.
Valentine Eastern Sierra Reserves: Valentine Camp	154 ac 7,994 to 8,545 ft	Valentine Camp is a center for research in the high Sierra Nevada and the upper Owens Valley. The reserve lies in a glacier-carved basin in a transition zone between the sagebrush desert of the Great Basin and the coniferous forests of the high Sierra Nevada. With its varied topography and soils, the site encompasses several distinct habitats: Sierran upper-montane forest and chaparral, Great Basin sagebrush, and wet montane meadow, all occurring within a relatively small area. Mammoth Creek flows through the site, bordered by high montane riparian vegetation. Several large springs and small seeps add to diverse habitats.
Valentine Eastern Sierra Reserves: Sierra Nevada Aquatic Research Laboratory	54 ac 4,100 to 13,163 ft	With a fully equipped modern laboratory and computing facilities, the Sierra Nevada Aquatic Research Laboratory (SNARL) serves as a major center for research for the eastern Sierra Nevada and Owens Valley. The site features a human-made experimental stream system, consisting of nine meandering channels used for research on stream hydrology and ecology. Convict Creek flows year-round through SNARL, feeding the experimental system and providing a natural stream environment protected from grazing and other human impacts. Non-aquatic research is also supported and encouraged on the reserve's pristine habitats, which include Great Basin shrubland and grassland, high desert riparian woodland, and riparian meadow.
Boyd Deep Canyon Research Center	16,647 ac 30 to 8,716 ft	One of the largest UCNRS reserves, the Boyd Deep Canyon Desert Research Center encompasses a major drainage system descending from the high peaks of the Santa Rosa Mountains down to Colorado Desert. Deep Canyon's tributaries begin in montane forests, flow across a rolling plateau covered with piñon-juniper woodland and chaparral, join at the head of a precipitous gorge, and plunge 1,180 feet into the canyon. From there, the mouth of the canyon opens out into a broad alluvial fan with sandy washes on the southern edge of the Coachella Valley. Except for a few permanent pools, the streambed in Deep Canyon's lower reaches is dry. However, winter storms can trigger dramatic flooding. The vertebrate fauna is exceptionally rich, with 46 reptile species, 228 birds, and 47 mammals.
Source: http://nrs.ucop.edu/ (accessed June 2010)		

Because backhaul radios only work in straight lines, devices that receive radio signals and then resend it out along another straight line must be installed to get around corners. These devices, called repeater stations, require power. When placed in areas where it is not available, they must include batteries and solar panels, like the mesh radios. Repeaters typically require panels or directional antennas up to three feet in length. A small tower, approximately ten feet tall, may be included to facilitate equipment placement. The engineers at UCLA CENS and the James Reserve have developed a repeater station with up to four solar panels for use in remote areas (model NRS MIT20-B4P4), which is illustrated in Diagram 2-2.

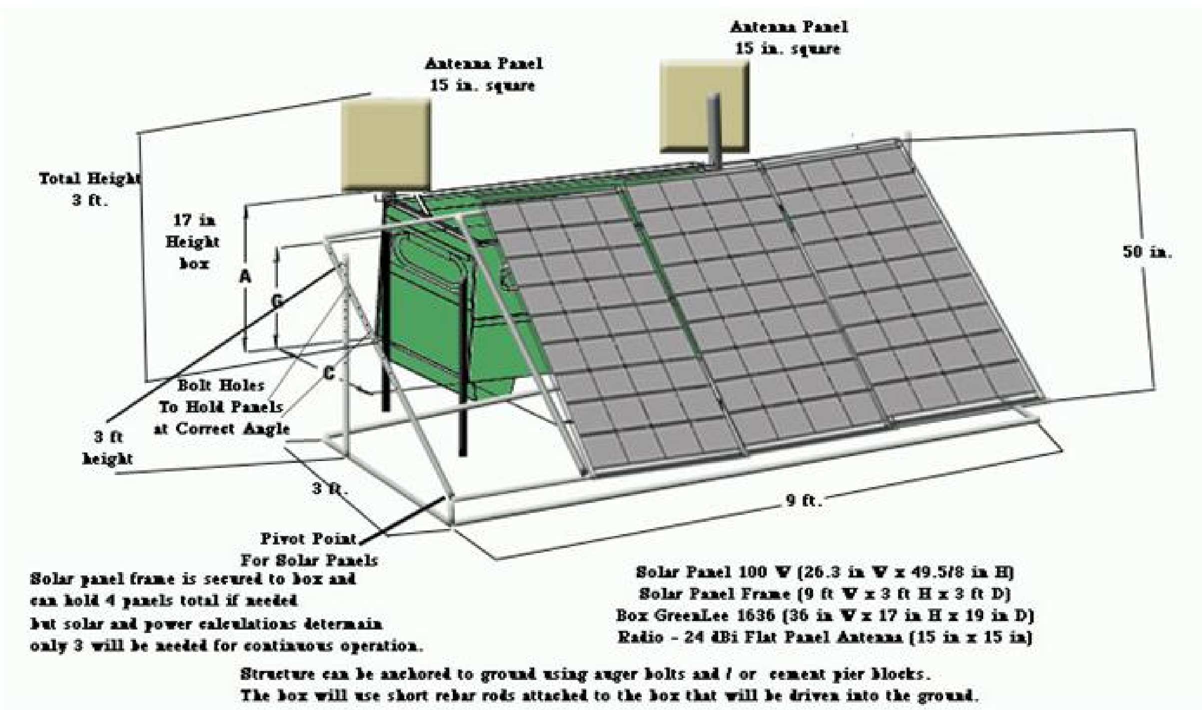

Diagram 2-2 Typical low-profile repeater station with solar panels

The following paragraphs summarize the proposed upgrades at each of the 17 reserves.

2.1.7.1 Heath and Marjorie Angelo Coast Range Reserve

The upgrades proposed for this reserve consist primarily of replacing existing, obsolete, or inadequate network components with more powerful equipment. The reserve's ISP is 101 Netlink, through a connection at the top of Cahto Peak (4,000 feet), within the reserve. Establishing connectivity at this reserve is difficult because of the steep topography and old growth redwood/Douglas fir forest, both of which combine to limit lines of sight and require multiple ridge-top repeater stations. There are five such relay sites, all mounted on tree trunks, with solar panels and batteries either on the trees (two relay sites) or on the ground, mounted on six-foot poles (three sites). The existing, obsolete VIP110-24 radios would be replaced with 2.4 GHz or 900 MHz radios (the latter in areas with trees blocking the line of sight). Because of higher power requirements, new,

Photo 2-4 Ground-mounted solar panels on six-foot pole

higher-yield solar panels would replace the existing ones. Experienced tree climbers assisted by an arborist would install the new radios.

2.1.7.2 Blue Oak Ranch Reserve

The existing cyber-infrastructure at this reserve consists of a high-speed wireless network link to the UC Observatory (UCO)/Lick Observatory on Mount Hamilton, seven miles away and uphill from the reserve, which connects to four leased T1 lines. The proposed improvements would consist of establishing a new network between the reserve, UCO/Lick Observatory, and the NASA Ames Research Center (ARC) in Mountain View. The UC Information Technology Services (UCITS) maintains a connection between ARC and the UC Santa Cruz campus via a fiber-optic link.

The T1 lines would be replaced with a pair of radios that can deliver 100Mbs. The routers, fiber-optic connections, and antennas at ARC and UCO/Lick Observatory would be upgraded and a new router and firewall would be installed in the data center of UCO/Lick Observatory for the reserve’s segment of the network. UCITS would become the ISP for the reserve and the UCO/Lick Observatory.

To establish the needed high-speed connection between UCO/Lick Observatory and ARC, a 6-foot diameter parabolic microwave antenna would be installed at the observatory on the Shane Telescope Dome, a building eligible for listing in the National Register of Historic Places.

2.1.7.3 Coal Oil Point Reserve

This reserve’s existing cyber-infrastructure includes a high-speed radio link with the UC Santa Barbara (UCSB) campus. As part of the proposed project, the existing radios would be upgraded with 5-GHz radios at their existing locations (all are mounted on buildings).

In addition, upgrades would be made to the reserve's internal network with 2.4 GHz or 900 MHz radios. This would include replacing existing radios on buildings and deploying up to four low-profile solar-powered mesh network radios, one acting as a repeater, to be mounted on an existing bridge over the Devereux Slough (this bridge is closed to pedestrians and is used for monitoring water quality.) This would provide connectivity to new areas of the reserve. Minimal ground-disturbing activities would be needed to set up the new equipment. The poles supporting the mesh radios would be anchored to 10-inch pier blocks that would be laid ten inches deep using hand tools. The poles would be further stabilized with guy wires secured by stakes similar to those used to secure a camping tent.

2.1.7.4 Central Sierra Field Research Stations (CSFRS): Sagehen Creek and Chickering American River

The CSFRS is a cluster of field research stations comprised of Sagehen Creek Field Station, Central Sierra Snow Laboratory, Onion Creek Experimental Watershed, Chickering American River Reserve, and North Fork Association Lands. At Sagehen, the hub of the system, the existing network consists of 12 towers, ranging from about 10 to 90 feet in height, typically carrying environmental monitoring equipment in addition to transmitting devices. Tower interconnectivity is provided by WiFi bridges and access points. Internet access is through a T1 phone line and mesh networking is used to connect the different reserve facilities. The other components of CSFRS are not connected to the network: data collection from the weather towers at these sites is manual and through telephone modems.

The proposed improvements would bring needed connectivity to the CSFRS. All existing WiFi radios at Sagehen would be replaced with solar-powered mesh radios to enhance their range and provide redundancy. The phone modems used to transmit data from the other sites would be replaced by a mesh network with radios at sites on Chickering, Onion Creek, and Snow Laboratory.

Two new towers would have to be installed as part of the enhancements: one to the north of Sagehen, near the Highway 89 Experimental Highway; the other in the North Fork of the American River area. These towers would be similar to those of the Sagehen Reserves, about 20 feet tall, and consisting of unpainted lightweight aluminum tubing arranged in a triangular grid for rigidity. Aluminum base units would be buried in the ground, requiring digging a hole about five square feet by three feet deep; three guy wires would further stabilize the towers.

2.1.7.5 Dawson-Los Monos Canyon Reserve

Existing cyber-infrastructure at the Dawson-Los Monos Canyon Reserve consists of a low-speed DSL line on an existing telephone line connected to the field station trailer, with a router and an exterior mesh radio in the existing Lab Tower consisting of an access point on a ten-foot steel pole hardwired to the trailer via a buried conduit. The mesh radio provides connectivity to the reserve steward's residence and the DawsR Weather Station on Mount Marron. There is a second weather station in the meadow behind the trailer, which is hard-wired to the router for internet access.

Photo 2-5 Existing weather station in the meadow behind the station trailer; in the background: Mount Marron

The proposed enhancements would allow for better monitoring of the Agua Hedionda Creek environment, of the effect on the chaparral environment of fuel modification measures against the threat of wildfire, and the real-time observation of stream levels and wildlife activities by cameras. To support these objectives, the existing low-speed DSL would be upgraded to high-speed. The radio would be replaced with a modern 900-MHz unit with Omni antenna for better coverage and foliage penetration. This new radio would be mounted on the existing trailer building. The DawsR Weather Station would be equipped with a solar-powered low-profile repeater station and mesh radio installed at the existing tower. The repeater station would be set up on rocks or within the footprint of previous equipment, with the antenna on the existing weather station tower.

Another solar-powered, low-profile repeater station with a 900-MHz mesh radio and Omni antenna would be installed at a new location west of the DawsR Weather Station (Eagle Nest Point). This equipment would be mounted on concrete pier blocks at the end of an existing dirt road; an eight-foot pole may also be set up for the antenna, also on the dirt road. This would require digging a three-foot deep hole.

2.1.7.6 Elliot Chaparral Reserve

Currently, internet access at the Elliot Chaparral Reserve is through the High Wireless Performance Educational Network (HPWREN) via towers on Mount Soledad in La Jolla. As part of the proposed cyber-infrastructure enhancements, a direct connection would be established between the reserve and HPWREN. Because of the area's topography, this would require multiple repeater stations to provide adequate coverage of the reserve's dispersed sensors and other instrumentation.

Photo 2-6 Existing tower at the Main Repeater Station site

First, a point-to-point EION radio would be installed at the existing 100-foot communication tower at the UC Scripps Institute of Oceanography (Main Repeater Station). A 2.4-gHz parabolic microwave antenna and an Omni antenna would be attached to the tower. Following this step, which is required for the proprietary connection to HPWREN, three low-profile, solar-powered repeater stations with mesh radios would be installed on above-ground concrete piers at three locations on the reserve: Scat Ridge, Sniper Point, and the Field Station Trailer.

At the Scat Ridge Repeater Station, the antennas would be mounted on an eight-foot pole, requiring digging a three-foot deep hole, which would be done by hand or using an auger. At the Sniper Point Repeater Station, they would be installed on a 33-foot National Atmospheric and Oceanographic Administration (NOAA) weather station tower, with the radios next to the tower. At the Field Station Repeater Station, the radios would be installed indoors and antennas on a two-foot pole attached to the roof of the trailer. A solar-power array would be set up outside the trailer.

2.1.7.7 Hastings Natural History Reserve

This reserve currently uses a Hughes satellite connection: a satellite dish receives the internet signal at the Reserve Office and a router provides connectivity to headquarters. A mesh network provides wireless connectivity to the headquarters area.

As part of the proposed improvements, the reserve would use a commercial ISP to provide fast internet access (5Mb/sec) from a bunker located on Palo Escrito Peak. The reserve would provide the radios to the ISP and they would aim one at Haystack Hill. From there, a repeater would bring the signal to the small existing tower above the reserve's offices. In addition, the reserve would set up another repeater on Poison Oak Ridge. Either concrete surface footings or several small stakes or pipes will be used to secure the repeater station framework to the hillside. No excavation would be involved. Two solar panels (two feet by four feet) would be placed on a frame set low on the ground. Two small panel antennas would be placed on the frame, each about two square feet. The entire unit would be less than three feet tall and would be painted a dark color to conceal the metal.

Finally, a mesh network would be installed to replace the existing separate satellite system on the south side of the Reserve. Up to five 900-Mhz radios would provide wireless coverage between the repeater and the south side of the Reserve. They would be mounted on steel poles, about two inches in diameter and eight feet tall.

2.1.7.8 James San Jacinto Mountains Reserve

The James San Jacinto Mountains Reserve would renovate its cyber-infrastructure by installing up to 18 new mesh network radios throughout the reserve. Three of the new radios would be set on buildings in the reserve's headquarters area. Five would be affixed to existing towers and the remaining ten would be attached to eight-foot poles and solar powered. Each pole would have a radio and two solar panels. A hole, about three feet deep, would be dug using a hand auger to set the pole. If needed, the poles would be further stabilized using guy wires secured by nails or stakes similar to those used for pitching a camping tent. Another proposed improvement would enhance the existing connection to a Flux Tower located outside the reserve and owned and operated by UC Irvine. This project element would consist of setting up a repeater station, four feet tall, at the foot of the 80-foot Flux Tower.

2.1.7.9 Landels-Hill Big Creek Reserve

The reserve currently uses a Wild Blue satellite connection for internet access: a satellite dish receives the internet signal at the reserve's Gatehouse and a router provides connectivity to the Research Cabin on a ridge above via a wire on the ground.

To enhance the connection, the reserve is proposing to install a repeater station on Dolan Ridge and a mesh network radio on the Gatehouse and the Research Cabin. The new repeater station would be a typical low-profile, solar-powered device similar to those proposed for Hastings Reserve. No excavation would be needed. The unit would be located about 0.75 miles from Highway 1, a state scenic highway. It would be no more than three feet tall and placed behind a rock to avoid being visible from the highway. Only a 15-inch panel antenna would extend beyond the rock to achieve the needed line of sight. It would have a non-reflective surface to further blend into the landscape. Because of the very remote location of the proposed repeater, materials would be transported to the site by mule and in backpacks. The proposed work also includes installing two 900-MHz radios to connect the Gatehouse and the Research Cabin and approximately five small solar powered mesh network nodes on poles. The radios would be placed on the roofs of the buildings and at key research sites within the reserve.

2.1.7.10 Motte Rimrock Reserve

The proposed cyber-infrastructure enhancements at the Motte Rimrock Reserve consist of installing a repeater station and seven mesh network radios to improve network coverage. The repeater station would be 20 feet tall on above-ground cement piers. It would be placed at the reserve's highest point. The mesh network would provide wireless broadband over the entire reserve and the headquarters area. Two of the radios would be affixed to existing buildings in the headquarters area (Office Building and Bunkhouse); up to five would be set on eight-foot poles at different locations in the reserve. Each pole would have a mesh radio and two small solar panels. Installing them would require digging a small hole with a hand auger. If needed, guy wires secured by stakes similar to camping tent stakes would be used to further stabilize the poles.

2.1.7.11 Santa Cruz Island Reserve

The existing cyber-infrastructure at the Santa Cruz Island Reserve consists of a two-leg microwave connection from the island directly into the UCSB campus system. The reserve is proposing to renovate the network by replacing the existing radios with licensed frequency radios to reduce interference issues and installing three low-profile solar-powered repeater stations.

The replacement radios would use antennas that are the same size as the current ones, and the radios would be installed in the existing boxes. The three low-profile repeater stations would be similar to those proposed for Hastings Reserve. They would be mounted in areas of exposed, natural rock, with small stakes or pipes used to secure the framework. The units would overall be less than three feet tall and positioned among rocks on hillsides so as not to be visible from more than 100 feet; they would be painted with neutral colors and covered with a camouflage net.

2.1.7.12 Sedgwick Reserve

Currently, the Sedgwick Reserve shares a T1 line with the new Las Cumbres Telescope, near the reserve's headquarters. The reserve proposes to replace the shared use of the T1 line with licensed radios to San Ynez Peak and from there to the UCSB campus. A backhaul radio, a repeater station, and approximately nine mesh network radios would be installed to provide connectivity on the reserve. The backhaul radio, which would support the connection with San Ynez Peak, would be set at the new reserve administration center (Tipton Meeting House), with a 20-foot aluminum tower for the antenna. The repeater station, similar to those previously mentioned, would be installed on an existing structure at the research station. Of the approximately nine mesh network radios, five would be stand-alone, solar-powered devices set on eight-foot poles, anchored with concrete surface footings and guy wires. Setting up the poles would require minimum ground disturbance: as previously noted, a three-foot deep hole would be dug using a hand auger. The other three mesh radios would be eave-mounted on existing buildings, requiring no new support.

2.1.7.13 Sweeney Granite Mountain Desert Research Center

The Sweeney Granite Mountains Desert Research Center currently has a satellite internet connection. The center proposes to replace this service with T1 service available from Granite Pass, where the National Park Service, which administers the Mojave National Preserve adjacent to the center, uses the same service and has a tower that could accommodate the equipment needed to establish connectivity to the center without changes to the tower's footprint. The center has secured the approval of the Park Service for this upgrade. The center's radio would be installed below the Park Service's radio and face in the opposite direction.

To relay the signal to the center, a low-profile repeater station would be installed on land owned by the center. This would comprise a metal box (36 x 17 x 19 inches) containing the charge controller and four batteries and anchored to the ground using rebar. Three or four solar panels (26.3 x 50 inches) would be attached to a metal frame (9 x 3 x 3 feet) affixed to the side of the box, angled properly, and anchored to the ground with rebar. Two flat panel antennas (15 x 15 inches), one vertically aligned and one horizontally aligned, would be attached to a ten-foot metal pole. The pole (three inches in diameter) would be sunk five feet into the ground using a hand auger and would be affixed to the metal container. A guy wire would be used for further stabilization. The last element of the network would be a mesh radio network deployed on the roofs of four existing buildings, with its hub on the roof of the Allanson Administrative Building and up to 5 solar-powered nodes located at key research areas inside the reserve.

Photo 2-7 Allanson Administrative Building

2.1.7.14 Valentine Camp and Sierra Nevada Aquatic Research Laboratory (Valentine Eastern Sierra Reserve)

Valentine Camp and Sierra Nevada Aquatic Research Laboratory (SNARL), approximately 15 miles apart, together comprise the Valentine Eastern Sierra Reserve. No local ISP is able to provide the reserve with a broadband internet connection. In 2008, a 5.8 GHz wireless point-to-point system, with relay sites, was constructed to serve both locations. The Mono County Office of Education in Mammoth Lakes serves as the reserve’s ISP with a connection to their T3 backbone. While the bandwidth of the new system is adequate to meet the reserve’s needs, the system is prone to downtimes.

The reserve is proposing to make its cyber-infrastructure system more robust by installing power supplies in key locations that cannot be interrupted and by replacing problem hardware with more robust equipment. In addition, the network at SNARL would be upgraded to reach streamside areas for the installation of instrumentation for stream monitoring and experiments.

At Valentine Camp, the project would involve replacing the existing equipment with new devices at the same locations. These locations include the roof of the Mammoth Middle School, a radio mounted on a pole at a private residence (under agreement with the owner), and four radios within Valentine Camp, two indoors, and two mounted on the outside of existing buildings. There would be no change to the footprint of this system and no ground-disturbing activities.

At SNARL, similar upgrades of existing equipment would be conducted, with no change in footprint and no ground disturbance. This would include a repeater on Doe Ridge on a pole supporting one of three warning lights of the Mammoth Yosemite Airport that have been in place for decades; and a radio on SNARL mounted outside an existing building. Additionally, eight-foot steel pipes would be set up in hand-dug holes at up to six locations to support 900-MHz radios and a small access point to communicate with nearby instrumentation. In sites with no existing power connections, solar panels and batteries would be used.

2.1.7.15 Boyd Deep Canyon Desert Research Center

Boyd Deep Canyon Desert Research Center connects to the UC Riverside Palm Desert campus eleven miles away, its source of broadband, via a solar-powered repeater on Agave Hill that is difficult to maintain. A HPWREN repeater tower near this repeater currently provides a radio link from the center to a HPWREN repeater on Toro Peak and then to UC San Diego (approximately 80 miles away). The proposed cyber-infrastructure enhancements at the center include creating a new radio link with the UC Riverside Palm Desert campus using the center's existing HPWREN tower on Agave Hill.

This would involve extending the tower to allow a line-of-sight radio link with center buildings to the northeast. The radios on the modified repeater tower would increase the repeater's reliability, improve access to the repeater electronics, and reduce maintenance and complexity (no solar panels needed). The tower would also enable a radio link to research instruments on Agave Hill. The HPWREN repeater tower is located in an arid, undeveloped desert area, about a quarter mile from State Route (SR) 74, a designated state scenic highway. The tower is eight feet tall and stands next to a 45-foot electrical pole which would provide power for the new equipment. The proposed extension is needed to achieve the required line of sight and would bring the tower to a total height of either 27 or 37 feet, depending on how many modules are needed. The tower would be a latticed aluminum structure to be painted in a non-reflective, neutral color. It would carry two bridge radios with built-in 15-inch flat panel antennas and a mesh radio, less than 12 square inches. Weather data instruments would be installed near the base of the tower. Only the two bridge radios would be potentially visible from SR 74.

Photo 2-8 Existing HPWREN repeater tower and electric pole at Agave Hill site

Photo 2-9 Repeater station similar to the one proposed for the Boyd Center

Another mesh radio would be attached to the existing research facility on Agave Hill and link to the mesh radio on the repeater tower. A third, solar-powered mesh radio would be installed in the same area on an eight-foot pole to provide network connectivity to data collection devices in the field. Setting up the pole would require a small excavation using a hand auger.

North of Agave Hill, at the Boyd Center, an existing bridge radio at the center's headquarters (a mobile home) would be replaced with a new bridge radio affixed to a pole anchored to one of the vertical supports of the carport using adjustable straps. A solar-powered repeater station would be installed on the flood plain near the center's campground structures about two miles north of the headquarters. The station would be 10 to 20 feet tall, set on raised concrete blocks. Approximately four mesh radios would also be installed, one on one of the reserve's buildings, another near an existing weather station; and the others further inside the reserve on poles with solar panels.

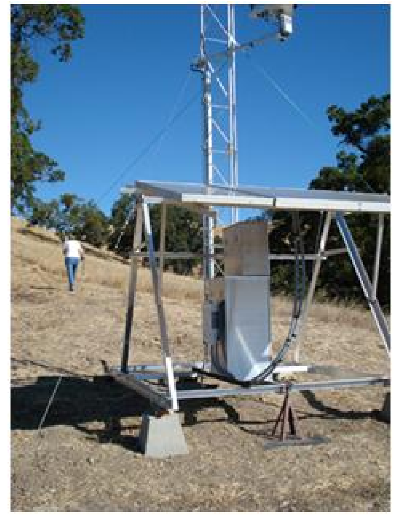

Photo 2-10 Repeater station on concrete blocks

2.1.8 Project 8: Microwave Relay Antennas

This project consists of improvements to Lowell Observatory's data communication infrastructure to create a four-leg, 100-Mbps microwave network linking the Observatory's three sites via existing relay towers located on Elden Mountain, one mile north of Flagstaff, and Squaw Peak, 33 miles southwest of Happy Jack.

At Mars Hill, this would involve attaching a two- to four-foot microwave relay antenna to an existing water tank built in 1994 (see Figure 1-9b). The tank has a ladder and power source available at the location where the antenna would be placed. No ground disturbance would be required.

Photo 2-11 Example of above-ground cell block foundation, similar to what is proposed at Anderson Mesa

At Anderson Mesa, the project involves the removal of an existing 30-foot antenna (see Figure 1-9c), a four-square-foot concrete pad, and existing guy wires, followed by the installation at the same location of a 40-foot monopole on cell block foundation and a four-foot antenna at the top of the pole. Ground disturbance would occur only where the current concrete pad, antenna, and guy wires would be removed. An electric connection would be established with the nearby western telescope dome using an existing conduit, requiring no trenching. Guy wires would not be required to stabilize the monopole.

At the Happy Jack site, the project involves placing a four-foot microwave relay antenna on the southwest corner of the Auxiliary Building (see Figure 1-9d). The antenna would be mounted on a support pole to be attached to the building, which would require hand-excavation of a less than one-foot diameter hole near the building foundation.

Finally, the existing datacenter in the Hendricks Center for Planetary Studies would be reconfigured to create more usable and flexible space; the electrical and HVAC systems would be renovated to ensure proper functioning of the electronic equipment and adequate climate control. These actions would take place in late 2010 or 2011.

2.1.9 Project 9: Greenhouse Replacement

This project involves the construction of approximately 3,400 square feet of new greenhouse space on the main campus of UCSB. Two new structures would be constructed: a 2,700-square-foot commercial-grade greenhouse with three 900-square-foot bays and a 700-square-foot greenhouse specially designed to simulate alpine environmental conditions (Alpine Greenhouse). Each structure would consist of a galvanized steel or aluminum framework with concrete floors. Drains in the floor would flow to the sanitary sewer. There would be one sink per bay with cold water only.

The proposed greenhouses would be equipped with motor-driven shade curtains along the roof and partition walls between bays, circulating and exhaust fans, cooling pads and heaters to maintain adequate temperatures throughout the year (between 72 and 80°F in the larger greenhouse; from 60 to 70°F during the day and 40°F at night in the Alpine Greenhouse), water supply, supplemental lighting, and connection to emergency power. Double-glazing of the walls and roof would provide maximal insulation and energy efficiency.

The larger greenhouse would be built on a site currently occupied by Building 539, which would be demolished. Building 539 covers 1,370 square feet in two connected units, approximately 430 square feet and 940 square feet respectively. It is currently used for administrative functions that would be relocated. The Alpine Greenhouse would be constructed on a currently outdoor storage site to the east of Building 539 and the recently built Technical Greenhouse (see Figure 1-10b). Thanks to this layout, climate control and other utility systems serving the Technical Greenhouse could be extended to the two proposed greenhouses with minimal adjustments.

Photo 2-12 Building 539

2.1.10 Project 10: St. Anthony Falls Laboratory renovations

Under this project, the SAFL building would undergo interior renovations to address the deficiencies described in Section 1.2.2.10. The Outdoor StreamLab (OSL) would be enhanced by the construction of a movable instrument-carrying gantry.

The proposed renovations to the SAFL Building include the following:

- Building Infrastructure and Systems: Renovate the mechanical, electrical, and plumbing systems to accommodate current and projected use; replace or repair corroded structural elements; repair doors and windows; construct a code-compliant sprinkler system; provide dedicated space for wireless sensor and network laboratory.

- Level 4 and Wind Tunnel: Add dehumidification; improve insulation; upgrade and replace the turning vanes with a new modular system that can readily be re-configured; upgrade electrical system.

- Main Channel: Add a crane to allow for the placement of large devices (e.g., turbines); replace the existing wave-generator with one capable of simulating multi-component waves; upgrade the water intake to allow for precise flow control and programmable hydrographs; upgrade the volumetric tanks to restore full functionality and add connectivity for remote operation.

- Biofuels Research: Convert 580 square feet of existing research space to biofuel research, particularly fluid-algae interactions; create a new eco-flume with sunlight exposure and controllable temperature and nutrient conditions.

- Indoor StreamLab: Upgrade existing experimental levels to allow for artificial sunlight, temperature, and nutrient control; upgrade sediment-handling capabilities on the lower levels; add facility for the study of channel and floodplain evolution, with light and nutrient control; improve HVAC in Granular-Flow Lab.

- XES system: Add a second wall and associated control system to allow for parallel experiments; add wave- and tidal-current generating capabilities to the XES and Delta Basins.

Exterior work at the OSL would involve the construction within Wasteway 2 of an instrument gantry capable of moving over the research riverine system to support the study of stream flow dynamics. This would require installing two parallel, elevated rails on both sides of the basin over a total length of 128 feet. Steel posts on concrete footings would support the rails; the foundations would extend about five feet into the fill or to the underlying bedrock. The instrument-carrying bridge would be a steel structure 6 feet wide and 60 feet long that would travel on the elevated rails. Figure 2-4 shows an early concept for this structure; however, final design may vary to avoid or minimize any adverse effects to the historic setting.

SAFL is also planning to install a new elevator in an exterior shaft to be constructed at the southeastern end of the laboratory building. This project is not being considered for funding by NSF and is not part of the proposed action. However, it would be implemented as part of the same renovation campaign.

2.2 Alternatives Selection and Evaluation Process

2.2.1 Project Alternatives

The projects included in the proposed action were selected by NSF from the grant applications received in response to a solicitation issued in 2009 (NSF 09-562). Applications were evaluated

Project 10: Concept for Proposed OSL Gantry

Figure 2-4

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during the second half of 2009 and early 2010 for compliance with the goals of the program and other applicable considerations as stated in the solicitation. The primary review criteria were the following:

- What is the intellectual merit of the proposed activity (e.g., how important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer to conduct the project? To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?)

- What are the broader impacts of the proposed activity (e.g., how well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups [e.g., gender, ethnicity, disability, geographic, etc.]? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?)

The outcome of this process was a list of projects potentially qualifying for a grant under the program. Of these, ten were further identified as requiring the preparation of an EA per 45 CFR 640.3. These ten projects, therefore, make up the proposed action. As explained in the following paragraphs, each of the proposed projects is the only course of action that:

1. Adequately meets the project proponent's need while remaining consistent with the requirements of the ARI-R2 program.

2. Is consistent with the project proponent's overall mission, its ongoing activities and plans, and known operational, technical, and environmental constraints.

Therefore, there are no reasonable alternatives to the projects.

2.2.1.1 Project 1: COBCC Building

As explained in Section 1.2.2.1, laboratory space at the existing Bigelow Laboratory campus in Boothbay, Maine, is physically and functionally inadequate. The existing facilities are in too poor a condition to be repaired or upgraded. Furthermore, these facilities are held under lease from the State of Maine and renewal of the lease, due in 2020, is not a certainty. Finally, Bigelow Laboratory is in the process of building a new campus in East Boothbay, where it plans to relocate its activities. In these circumstances, the proposed project, involving the construction of new laboratory space as one of several modular wings of the new campus's main building, is the only alternative that meets both reasonableness criteria. Remaining in the existing facilities with or without repairs and upgrades would fail to meet criteria 1 and 2; constructing a stand-alone new laboratory or leasing existing space at a different location might meet criterion 1 but would fail to meet criterion 2. Conversely, the proposed project meets both criterion 1 (it meets the proponent's need and was found to qualify for an ARI-R2 grant) and criterion 2 (it is consistent with Bigelow Laboratory's current plans for its new campus).

(When planning the development of the new campus, Bigelow Laboratory went through an extensive alternative evaluation process. Four sites meeting the Laboratory's initial requirements [at least 30 acres with 12 buildable acres capable of supporting 60,000 square feet with access to the marine environment] were identified and evaluated: a property on Southport Island Bigelow already owned [Cameron Point]; a site in Boothbay Harbor [Oak Point]; one in Boothbay [Bottle Cove]; and Farnham Point in East Boothbay. The alternative study, completed in 1999, considered the full suite of factors affecting the feasibility of the proposed development, including available space, access to water, access to public roads, availability of utilities, and potential impacts to wetlands and other sensitive environments. Eventually, the Farnham property was found to be the most appropriate site, with available drinking water and power supply, relatively few wetlands, excellent water access, and moderate slopes. Limited access, steep slopes, and no utility connections led to the elimination of the other sites from consideration.)

2.2.1.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

Watershed Component

There are no alternatives to the proposed repairs or replacement of the stream weirs and tidal flux stations other than letting them deteriorate further. SERC needs to continue using these structures for monitoring water flows on the property. No alternative methods are possible. With respect to the proposed burying of the electrical line supplying the two adjacent tidal flux stations, SERC considered burying the cable by trenching along 1,950 feet of the gravel road leading to the stations. However, this would have caused some soil disturbance and cut many tree roots in addition to resulting in a longer line with a greater drop in power voltage, making this option inconsistent with both criteria. Another alternative considered was burying the cable by trenching through approximately 1,200 feet of forest. While the shorter distance would have reduced the voltage drop, this option would have had unnecessary adverse environmental impacts on undisturbed forest, *contra* criterion 2.

Wetland Component

There are no alternatives to the proposed renovations of the CO_2 building: this is the most financially and environmentally economical way to address the deficiencies of the building. With respect to the storage sheds, SERC considered providing new storage space without a composting toilet or upgraded electric service. But such an alternative, while more economical, would not address the need for more reliable electrical supply and better bathroom facilities on the site. Another option, constructing the new storage space as a building with full 36-inch-deep footers, a composting toilet, and upgraded electrical system, was also considered, but while it would be consistent with Criterion 1, it would result in greater environmental impacts than strictly necessary in a sensitive area near water.

There are no reasonable alternatives to the proposed replacement of the marsh boardwalks, though SERC considered different designs, including boardwalks similar to the existing ones and boardwalks using “recycled plastic lumber” for decking. While these would address SERC’s need for safe access to the marsh facilities, they would also result in more shade than the proposed design with no additional benefits.

Data Collection

The only potential alternative to building the proposed communication towers would be to run data transmission cables through the forest from some of the monitoring nodes to connect to telephone or fiber optics lines. However, this would have greater environmental impacts than building the towers as proposed because of the extensive trenching that would be required. It would also fail to provide the flexibility needed for the addition of other data sensors and video communications for education programs. Thus, SERC’s data transmission needs would not be fully addressed, *contra* criterion 1.

2.2.1.3 Project 3: Murray Laboratory

In order to remedy the deficiencies of the existing laboratory space, RMBL proposes to demolish the existing Murray Building, build a new laboratory at the same location, and move the research functions currently housed in the Murray as well as the Willey buildings to the new facility. As part of its planning for this project, RMBL conducted an evaluation to determine the most effective strategy for meeting its research needs, using an assessment instrument adopted by the Board of Education of the State of Washington in 1992, the Building Condition Evaluation Form (BCEF). This methodology examines the condition of the interior and exterior of the building, the mechanical systems (including electrical and lighting), safety and building code compliance, and programming needs. The results of the analysis indicated that renovating Murray was not a realistic option. This is a small log building constructed at a time when field biology was beginning to move from a focus on description of nature to a more experimental emphasis. It cannot accommodate contemporary research needs. Simply creating a dust-free, temperature-controlled environment with adequate ventilation would require replacing the log walls, practically amounting to replacing the building. Therefore, no alternative involving renovating the existing facility would meet criterion 1 or 2.

Similarly, replacing Murray with a building of the same size, albeit better adapted to modern research conditions, would mean that the new facility could not accommodate the research activities currently housed in Willey, thus perpetuating a situation that is not conducive to optimal scientific collaboration between research teams, something that is key to the continuing performance of innovative research at RMBL. Such an alternative would not meet criterion 2.

Given the parlous condition of the existing Murray Building and the lack of any function it could be retrofitted for, RMBL’s proposal to demolish it and build the new facility at the same location is the only reasonable option. Keeping the existing building would be an ineffective use of RMBL’s financial and physical resources, inconsistent with the optimal fulfillment of its scientific mission.

2.2.1.4 Project 4: Moe Pond Laboratory

Because of the primitive character of the existing laboratory structure at Moe Pond, it could not be usefully renovated to meet the project proponent's needs (Criterion 1). Another potential alternative could be to expand an existing laboratory facility located adjacent to Lake Otsego. However, this would require the systematic transfer of water and biological samples taken from the Moe Pond area to the Lake Otsego facility, thus worsening and perpetuating a situation detrimental to the optimal use of the Moe Pond site when the need for the project is precisely to make better use of this environmentally rich location for research and research training. Therefore, building a new facility is the only reasonable alternative. The site, immediately adjacent to the existing structure, was selected because it would result in the least amount of disruption to the property and allow the reuse of the former laboratory as storage space for the proposed new research facility.

2.2.1.5 Project 5: Wawona Field Station Renovations

Potential alternatives for this project are severely constrained by the character of the field station, installed in National Park Service buildings within a National Register-eligible historic district. It is not possible to construct new buildings or add to the footprint of the existing buildings. The proposed renovations are the only alternative that meets the need of UC-Merced (Criterion 1) and is consistent with operational and environmental constraints (Criterion 2).

2.2.1.6 Project 6: Northwest Indian College Laboratory

Because of the poor condition of NWIC's laboratory building – a DoD surplus structure well passed its useful life expectancy – renovation cannot be considered a reasonable alternative to the proposed construction of a new laboratory building under both criteria. Constructing the new facility within the Phase II area of the new campus, as proposed, is the only reasonable course of action under Criterion 2: there is room and environmental conditions on the site have recently been evaluated, allowing NWIC to site the building in a manner that takes into account environmental constraints, resulting in minimal impacts.

2.2.1.7 Project 7: Multi-site Cyber-infrastructure Improvements

The reserves UCNRS selected for cyber-infrastructure improvements under this project are those that need better connectivity based on current and planned research programs. There is no alternative set of reserves that could be selected. Within each reserve, the proposed enhancements are those found necessary to establish the needed connectivity. The location and type of the proposed data transmission equipment are largely constrained by the type of broadband connection available, the portions of the reserve to be covered, and, most importantly, the character of the terrain, as there must be clear lines of sight between the different radios. Line of sight requirements, in particular, dictate the siting of equipment at high points as well as the need for, and height of, towers and supporting poles for antennas. Within these constraints, however, and because of the small footprint of the proposed equipment and equipment-supporting structures, a degree of flexibility is possible and the reserves have selected specific locations with minimal potential for affecting sensitive resources based on known environmental conditions, for instance the presence of rare habitats or archaeological resources. While further micro-siting is possible and would take place as the project is implemented, there are no alternatives to the project as proposed that would be sufficiently different to offer a substantive choice while still being consistent with Criterion 2.

2.2.1.8 Project 8: Microwave Relay Antennas

Given the large amount of data that Lowell Observatory must transmit between its three sites, there are no reasonable alternatives to the proposed microwave network that would still meet the observatory's needs. Using T1 lines would require 60 or 70 lines to carry the same amount of data and cannot be considered a feasible option. The proposed locations for the transmitting antennas are those that would create the least disturbance, being set either on existing structures (Mars Hill, Happy Jack) or at the same location as existing equipment to be replaced (Anderson Mesa). As is the case for project 7 and for similar reasons, there are no alternatives that would both meet Criterion 2 and be substantively different from the project as proposed.

2.2.1.9 Project 9: Greenhouse Replacement

The poor condition of the existing greenhouse requires that it be replaced. Lacking a concrete foundation and adequate drainage, the building could not be renovated to modern standards without razing it and constructing an entirely new facility. Because the greenhouse is located within an area of the UCSB campus designated as future open space in the university's new Long Range Development Plan, however, replacement at the same location would not be a reasonable alternative under Criterion 2. Additionally, the two proposed greenhouses must be within proximity of the recently-built Technical Greenhouse, with which they would form part of a unified research facility, and near the existing Head House, which stands just north of the existing greenhouse. Available space near the site of the Technical Greenhouse and Head House is limited and only sufficient to construct the smaller, proposed Alpine Greenhouse to the west of the former. The site where Building 539 currently stands is the only area near the Technical Greenhouse that can accommodate the proposed 2,700-square-foot greenhouse.

2.2.1.10 Project 10: St. Anthony Falls Laboratory renovations

While alternatives involving different sets of renovations and upgrades would be potentially feasible for this project, none of them would fully address SAFL's research-related needs and thus be consistent with criterion 1. Because of the direct connection between the unique location of the laboratory and the research that is conducted there, there can be no reasonable alternatives that would involve relocating ongoing or future research activities to another, new or existing facility at a different location.

2.2.2 Alternatives Carried Forward

2.2.2.1 Proposed Action Alternative

Based on the considerations above (Section 2.2.2), only one action alternative was retained for consideration in this EA: this alternative consists of the proposed action as described in Section 2.2.1.

2.2.2.2 No Action Alternative

The No Action Alternative would not meet NSF's purpose and need and, as such, is not a reasonable alternative. However, NEPA regulations require that an EA evaluate the impacts of the No Action Alternative to provide a baseline against which the impacts of the other alternative or alternatives can be evaluated.

Under the No Action Alternative, NSF would fund none of the ten projects included in the proposed action. While it is possible that the project proponents could find alternative funding and proceed with the projects, for the purposes of the EA, it is assumed that in the absence of ARI-R2 funding, none of the projects would move forward. Existing conditions at the affected research facilities would remain as at present and none of the deficiencies and shortcomings described in Chapter 1 would be remedied. Project 1 is a partial exception: the proposed COBCC building is part of a larger complex for which planning began several years ago, before the option of ARI-R2 funding became available. While the building would be an important part of the campus, the other planned facilities – including the in-water construction – would be able to proceed as planned even if it were not built. Therefore, for Project 1, the No Action Alternative assumes that the new Bigelow Laboratory campus would be constructed, although without its COBCC component.

3. Affected Environment and Environmental Impacts of the Proposed Action and Alternatives

3.1 Introduction

This chapter describes the existing environment at each of the project sites and evaluates the potential consequences, or impacts, of the proposed action on this environment. "Environment" refers to both natural features, such as soils, topography, surface water, vegetation, and wildlife, and human-made features, such as land use and historic sites. Because the ten projects that make up the proposed action are widely scattered across the United States and would take place within different types of environment, from downtown Minneapolis for Project 10 to pristine natural reserves in California for Project 7, existing conditions and environmental impacts are generally described separately for each project. The findings of the impact evaluation are summarized and compiled into findings for the proposed action as a whole in Chapter 4. Unless otherwise specified, because of the modest scale of the projects, the Region of Influence (ROI) consists of the project's footprint and the larger compound or property of which it is a part. Existing conditions are described at a level of detail proportional to the expected impacts.

3.1.1.1 Impacts Areas Not Considered

Consistent with 40 CFR 1501.7(a)(3), issues that are not significant are not considered in detail. This includes for all projects:

- **Transportation**: The proposed action has no potential to generate any noticeable impacts pertaining to transportation. The projects mostly consist of upgrades, renovations, or replacement of existing facilities and do not include any significant increase in the number of persons traveling to and from the project sites every day. In the long term, some of the projects may lead to a greater use of the improved facilities by researchers and students than would be the case under no action conditions. However, these increases would remain small in absolute terms and would also vary with the time of the year as well as other factors not related to the proposed action (e.g., availability of financial help or scholarships, popularity of certain programs, etc.).

  A partial exception is Project 1, which is part of a long-planned larger campus to be built on a new site currently undeveloped. Once complete, the campus will be the work place of approximately 76 employees and will receive about 30 visitors every day. Under the Maine Site Location of Development Law, Chapter 374, projects that generate less than 100 passenger-car equivalents during peak travel hours are not subject to traffic review, indicating an expectation of *de minimis* impacts.

  While the projects would generate construction-related traffic, their small scale combined with the temporary character of construction-related traffic ensures that these impacts would be negligible.

- **Demographics, Community Facilities, and Utilities**: None of the projects would result in any significant change in the permanent population of the areas where they are located.

As previously noted, the proposed projects consist of the upgrade, renovation, or replacement of existing facilities and do not include or would not lead to a measurable increase in the working or residential population present on the sites. With regard to Project 1, the staff and visitors that would come to the new campus are already present on the existing campus in Boothbay Harbor, a short distance away. For the same reason, the proposed action has no potential to affect community facilities such as schools, hospitals, or emergency services. Finally, again for the same reason, none of the projects would result in a significant increase in the demand for utility services (e.g., water, electricity) relative to no action conditions.

- **Coastal Zone Management Act and Federal Consistency Requirements**: The following projects are not located in a designated state or tribal coastal zone: Project 3; Project 4; Project 5; Project 6; Project 8; and Project 10. Project 1 is in Maine's designated Coastal Zone; however, under the state's Coastal Zone Program, federal assistance to an independent 501(c)(3) non-profit research institution such as Bigelow Laboratory does not require the preparation and filing of a federal consistency determination (Leyden, May 18, 2010). Projects 7 (for some of the reserves) and 9 are within the California Coastal Zone. However, under California's Coastal Zone program, federal assistance to state or local governments or agencies (in this case, the University of California system) does not require a federal consistency determination (CCC, 2001). Project 2 is located within the designated coastal zone of Maryland. However, as explained in Section 3.9.2.2, the project at SERC would have negligible impacts on water resources and warrants a Negative Determination pursuant to 15 CFR 930.35. The Draft EA was submitted to the Maryland Department of the Environment for review.

- **Environmental Justice:** Signed on February 11, 1994, Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs all federal departments and agencies to incorporate environmental justice considerations in achieving their mission. Each federal department or agency is to accomplish this by conducting programs, policies, and activities that substantially affect human health or the environment in a manner that does not exclude communities from participation in, deny communities the benefits of, nor subject communities to discrimination under such actions because of their race, color, or national origin. According to CEQ guidance on EO 12898, "minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis […] Low-income populations in an affected area should be identified using the annual statistical poverty thresholds from the Bureau of the Census." None of the projects included in the proposed action raise environmental justice issues for the reasons stated in Table 3-1.

Table 3-1 - Environmental Justice Considerations

Project	Reasons for Not Considering Environmental Justice Issues Further
Project 1	The project site is in 2000 Census Tract 9758, where in 2000 all minorities (defined as all persons not reported as "One race-White") accounted for 0.9 percent of the total population of 2,960, less than in Lincoln County (1.5 percent) and Maine as a whole (3.1 percent). Persons living below the poverty level accounted for 6.9 percent of the tract's population, against 10.1 percent in Lincoln County and 12.6 percent in Maine as a whole.
Project 2	The project site is in 2000 Census Tract 7014, where in 2000 all minorities (defined as all persons not reported as "One race-White") accounted for 19.2 percent of the total population of 2,690, comparable to Anne Arundel County as a whole (18.8 percent) and substantially less than Maryland (36 percent). There were more persons living below the poverty level in Tract 7014 (11.5 percent) than in the county (5.1 percent) or the state (8.5 percent) as a whole. However, because of the small scale of the project, which would be entirely contained within the SERC facility, substantial effects to human health or the environment that could disproportionately affect economically disadvantaged populations would not occur.
Project 3	There is no resident population at or near the project site other than the staff and users of RMBL, who are present during the summer season. The nearest populated place is the town of Mount Crested Butte, approximately four miles away. The project would not generate impacts noticeable by the residents of Mount Crested Butte.
Project 4	The project site is near the village of Cooperstown, which in 2000 had 2,032 residents, 3.8 percent of whom were minorities (defined as all persons not reported as "One race-White"), comparable to 4.2 percent for Otsego County and much less than for the state of New York as a whole (32.1 percent). Persons living below the poverty level accounted for 10.2 percent of the town's population, against 14.9 percent in Otsego County and 14.6 percent in New York as a whole.
Project 5	This project consists of renovation to a building at Wawona Village in Yosemite National Park, on NPS property. There is no permanent resident population at or near the site.
Project 6	The project site is located on the Lummi Indian Reservation near Bellingham, WA. In 2000, 50.4 percent of the Reservation's population was reported as "American Indian or Alaska Native." However, the project proponent is NWIC, a Tribal college serving the Lummi Nation as well as other Native tribes in Washington, Oregon, and Idaho and the project is intended to improve the educational and research opportunities offered by the college.
Project 7	This project involves the installation of radio devices at 17 natural reserves of the UC Natural Reserve System. The different locations selected are well away from any significant population center and the project has no potential to generate substantial effects on human health or the environment that could disproportionately affect minority populations or economically disadvantaged ones.
Project 8	This project consists of the installation of data transmission equipment at Lowell Observatory's three campuses. Because of the small scale of the proposed work and the remote location of the three sites, the project has no potential to affect any minority populations or economically disadvantaged ones.
Project 9	This project would take place on the main campus of the University of California at Santa Barbara and consists of replacing existing facilities with similar, though slightly larger, ones. It would not have any perceptible impacts outside the immediate vicinity of the project site.
Project 10	The project site is in 2000 Census Tract 1037, where in 2000 minorities (defined as all persons not reported as "One race-White") accounted for 21.7 percent of the total population of 3,204, much less than in the city of Minneapolis (34.9 percent) though more than in Minnesota as a whole (9.2 percent). Persons living below the poverty level accounted for 16.9 percent of the tract's population, against only 7.9 in Minnesota as a whole but 26.5 percent in the city of Minneapolis.
Source: American Factfinder <http://factfinder.census.gov/>	

- **Protection of Children**: EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, was signed on April 21, 1997. Because the scientific community has recognized that children may suffer disproportionately from environmental health and safety risks, the EO directs federal agencies to identify and assess such risks, and consequently to ensure that their policies, programs, activities, and standards address effects on children. "Environmental health and safety risks" are defined as "risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest." Regulatory actions that are affected by this EO are those substantive actions that involve an environmental health risk or safety risk that an agency has reason to believe may disproportionately affect children. None of the projects included in the proposed action has the potential to disproportionately affect children.

  All project locations are either remote from population centers (Project 3, Project 4, and Project 7) or are located on campuses or facilities that are not accessible to unsupervised children. While several of the proponent institutions may temporarily host groups of children (for instance as part of a school's field trip), none of the proposed projects would create conditions that are likely to result in harm to these children. While construction activities may involve some risks, visitors would not be allowed near or in construction areas.

- **Recreational Facilities**: None of the proposed projects have the potential to adversely affect recreational facilities such as public parks or trails. The site of the new Bigelow Campus in East Boothbay contains public walking/all-terrain vehicle trails. These trails will be preserved or adequately relocated as required by the Contract Zoning Agreement with the Town of Boothbay (see Section 3.2.1.1), though they will be designated for pedestrian use only; a public parking area will be provided. These actions are part of the overall plan for the campus and the proposed construction of the COBCC building under Project 1 would not affect them. All the other projects would take place on land that is not publicly accessible and/or would not materially affect any nearby recreational facilities.

- **Hazardous Substances**: The projects included in the proposed action consist of the repair, renovation, upgrading, or replacement of existing research facilities. In the long term, while these projects would enhance the different proposing institutions' ability to fulfill their scientific and educational mission, they would not result in a substantial change in the type and scale of the activities conducted at the project locations. At those sites where hazardous substances are stored and used, the acquisition, storage, and disposal of those substances are, and would continue to be, conducted in compliance with applicable federal, state, and local laws and regulations. In the short term, any demolition and construction activities potentially involving the use or generation of hazardous substances also would be conducted in compliance with applicable laws and regulations.

Resources that have no potential to be affected by some of the projects only, and, therefore, are not addressed in detail for these projects, are identified individually under the appropriate project.

3.1.1.2 Impact Evaluation Methodology

Consistent with 40 CFR Parts 1500 to 1508, Section 1508.8, the analyses in this EA consider the following effects (synonymous with impacts):

- Direct effects, which are caused by the action and occur at the same time and place.
- Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably known.
- Cumulative effects, which are "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." Cumulative effects are evaluated by adding the impacts of the proposed action to the impacts of the past, present, and reasonably foreseeable projects in the ROI.

Impacts can be positive or negative (synonymous with adverse). CEQ regulations (40 CFR 1508.27) state that the significance of the impacts of a proposed action should be evaluated based on both context and intensity. Context refers to the geographic, social, and environmental circumstances within which the project may have effects; an action in a disturbed urban area may have little effect compared to one in an old growth forest. Intensity refers to the severity and/or duration of the impacts. Impacts similar in their intensity may be significant or not depending on the sensitivity of the context. For each project, impacts, if any, are evaluated on the following intensity scale: negligible, minor, moderate, and major. Resource-specific definitions for each intensity level are provided at the beginning of each section.

3.2 Land Use

Land use refers to the type of activities, functions, and improvements a parcel of land supports or is intended to support. Examples of land uses include residential (the land is used to support housing and associated functions), commercial (the land is used to support business activities, such as shopping malls or office buildings), industrial (the land is used to support manufacturing or warehousing functions), recreational (the land is used to support parks or trails), or agricultural (the land is used to support farming).

The impacts of the alternatives on land use are evaluated using the scale shown in Table 3-2.

Table 3-2 - Land Use Impact Intensity Scale

Intensity	Description
Negligible	The alternative would result in changes to a land use or the level and types of existing activities so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would result in a change to a land use or the level and types of existing activities, but the change would be small and localized and of little consequence.
Moderate	The alternative could result in a change to a land use or the level and types of existing activities; the change would be measurable and of consequence.
Major	The alternative would result in a noticeable change to a land use or the level and types of existing activities; the change would be measurable and result in a severely adverse or beneficial impact.
Duration:	Short-term – occurs only during the construction period. Long-term – occurs or continues after the construction period.

A direct impact on land use would occur when a proposed action would result in a change to the land use existing at, or planned for, the project site or a change to the type or level of existing activities conducted at the site as an immediate consequence of the action. An indirect impact would occur when a proposed action would create conditions likely to lead to future, foreseeable changes in land use or the type or level of activity supported by the project site. An impact on land use would be negative when the change would be inconsistent with the existing or planned land use for the affected site, or would hinder the activities supported by the site. Conversely, a positive impact on land use would occur when the change would be consistent or enhance existing or planned land use.

The construction activities associated with the proposed projects would require the temporary use of currently open areas on or near the project sites for staging and storing of construction equipment. Because of the modest scale of the projects, none would require the construction of temporary facilities or structures. After construction is complete, the staging/storage area would be restored to its previous condition. Therefore, in all cases, these short-term negative impacts on land use would be negligible and are not addressed further in this section.

3.2.1 Project 1: COBCC Building

3.2.1.1 Affected Environment

The site where the proposed COBCC building would be constructed is part of a 62.8-acre property owned by Bigelow Laboratory in East Boothbay, Maine, between Ocean Point Road (Route 96) and Farnham Point on the Damariscotta River, south of Green Landing Road and School Street. Bigelow Laboratory is planning to construct a new, purpose-built campus on this property to replace its existing facilities, which are scattered, ageing, and leased from the State of Maine without guarantee of renewal when the current lease is up in 2020.

The fully-built-out campus will be comprised of several research buildings encompassing a four-wing building complex (of which the proposed COBCC building would be one), a dormitory, visitor housing, and an educational building, as well as parking areas, internal roads, and waterfront facilities. The waterfront facilities will consist of a fixed L-shaped pier for docking research vessels, with a floating dock to support diving operations and a marine operations building. The pier will extend out approximately 140 feet and will consist of a concrete deck on concrete piles. Bigelow Laboratory has obtained or is in the process of obtaining the necessary permits and approvals for the construction of the proposed campus, including the in-water components.

The site of the new campus, including the site of the proposed COBCC building, is currently undeveloped and forested. The surrounding area also is primarily forested with residential uses concentrated along Ocean Point Road, to the west of the property, and Green Landing Road and School Street, to the north. A house, located off Green Landing Road, is adjacent to, and visible from, the northeast corner of the Bigelow property. Some marine industrial uses are located further to the north: they include the Ocean Point Marina and two boatyards, Washburn & Doughty (steel and aluminum boat construction and dockside repair and design services) and Hodgdon Yachts (boat building). To the south, there are only undeveloped woodlands (Bigelow, 2009).

In May 2006, Bigelow Laboratory and the Town of Boothbay entered into a Contract Zoning Agreement (Town of Boothbay, 2006). The property was originally located in the General Residential (GR) zoning district and the Shoreland Overlay Zone (SOZ) under the Zoning Ordinance of the Town of Boothbay, which did not recognize a marine research and educational facility, such as the new campus being planned, as a defined use. The Agreement determined that the proposed facility is pursuant to, and consistent with, the town's local growth management program and comprehensive plan and established the Bigelow Laboratory Contract Overlay Zone for the Bigelow property. As part of this agreement, Bigelow Laboratory was allowed to develop up to 14 acres (including roadways) of the property and required to preserve the remaining 49 acres of land as open space. The Agreement also specified that Bigelow Laboratory would grant a public recreational easement for walking trails across the property (Bigelow, 2009). An existing recreational trail begins at Green Landing Road and loops around the interior of the site. The trail is the width of a logging trail in some areas (furthest upland) and is a smaller walking path closer to the shoreline.

3.2.1.2 Impacts of the Proposed Action Alternative

The Proposed Action Alternative would have a **minor direct and indirect long-term positive impact** on land use. There would be a minor direct positive impact because under this alternative, Bigelow Laboratory would construct the proposed COBCC building, which is fully consistent with the use planned for the property and would support, though it would not change, the activities of the Laboratory at the site. Like the rest of the campus buildings, it would be designed in compliance with the 2006 Zoning Agreement’s conditions, including maximum building heights and footprints. It would be located in the center of the property, invisible from Ocean Point Road or Green Landing Road. The activities to be conducted in the proposed building are fully consistent with, and indeed require, a waterside location and would not generate any loud noise, odors, or other nuisance incompatible with the surrounding residential uses (Bigelow, 2009).

The proposed action would have an indirect positive impact because it would enhance the scientific productivity of Bigelow Laboratory by allowing it to make a better use of its new research facilities. Constructing the proposed COBCC building would eliminate the existing fragmentation of Bigelow Laboratory’s research facilities and would provide both the quantity and quality of space the Laboratory needs to do its work; house, operate, and maintain its instrumentation; and train the next generation of researchers. The new center would make significant contributions to advancing the scientific knowledge of oceanic processes, understanding how earth’s climate system is evolving at global and regional scales, and addressing the emerging challenges of climate change as they pertain to ocean ecosystems. It would also allow Bigelow Laboratory to sustain and broaden its collaboration with researchers from multiple disciplines and improve its ability to attract, mentor, and train graduate and undergraduate students.

No indirect impacts on land use are expected. The construction of the proposed COBCC building would not create conditions that could result in future change in land use in or outside the ROI.

3.2.1.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed COBCC building would not be funded through the ARI-R2 program and, therefore, would not be built. However, the rest of the new Bigelow Laboratory campus would be constructed on the Farnham property as planned. The site on which the COBCC building would be constructed under the Proposed Action Alternative would be cleared but would likely remain open, with landscape lawns and plantings. The No Action Alternative would have **minor direct and indirect long-term adverse impacts** on land use because constructing the planned new campus without the proposed COBCC building would not be fully consistent with the current plans for the property or fully support Bigelow Laboratory’s needs. Not constructing the COBCC building would in the long term reduce the ability of the Laboratory to effectively conduct research, since researchers and students would have to continue using the existing, obsolete facility. Additionally, Bigelow Laboratory may lose the use of even this facility if the lease is not renewed in 2020. The impact would remain minor, however, since the rest of the campus could still be built and operated. Additionally, the No Action Alternative would not preclude Bigelow Laboratory from obtaining alternative funding for the COBCC part of the campus.

3.2.1.4 Cumulative Impacts of the Proposed Action

There are no past, ongoing, or reasonably foreseeable future projects at the Farnham Point property other than the construction of the new Bigelow Laboratory campus. Thus, cumulative impacts would be the impacts resulting from constructing the campus with the COBCC facility. These impacts would be **moderate, long-term, direct and indirect, and positive**: constructing the entire campus would make optimal use of the Farnham Point property; it would be fully consistent with the 2006 Zoning Agreement; and it would improve Bigelow Laboratory's research capabilities.

3.2.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

3.2.2.1 Affected Environment

SERC occupies a 2,650-acre site on the Rhode River, a sub-watershed of the Chesapeake Bay in Anne Arundel County, Maryland. It is the largest, contiguous undeveloped land holding on the western shore of the Chesapeake Bay in the state. It includes forests in varying stages of succession, fresh and estuarine wetlands, croplands, and pastures. The property's primary use is for environmental research and education. Research, administrative, and educational buildings are clustered and take up a small portion of the site in the middle of the property, off Contees Wharf Road, which provides access to the site from Muddy Creek Road (Route 468). Small structures and facilities supporting SERC's research, such as the stream weirs, tidal flux stations, storage sheds, and boardwalks proposed for renovation, are scattered across the property, generally accessible only by gravel or dirt roads or lanes.

Muddy Creek Road runs along much of the western boundary of the site and Central Avenue (Route 214) runs along its northern edge. The areas to the west and south of SERC can be characterized as rural. The nearest center of population is Edgewater, two to three miles north from the entrance on Contees Wharf Road. A privately-owned airfield, Lee Airport, is located in Edgewater.

In 2008, SERC completed a Comprehensive Site and Facilities Master Plan Report (SERC, March 2008) that lays out the principles, goals, and objectives that support proposals for landscape management, infrastructure, and facilities. The Master Plan identified and addressed "Four Master Challenges:"

- Advance the Scientific Excellence of SERC.
- Demonstrate Responsible Land Stewardship.
- Expand Public Education and Outreach through Experiential and Inspirational Learning.
- Operate and Maintain Facilities with a Holistic Approach to Sustainability.

3.2.2.2 Impacts of the Proposed Action Alternative

The proposed action would have a **minor direct and indirect long-term positive impact** on land use at SERC. It consists mostly of repairs and upgrades to existing structures and facilities that would enhance, without changing, their functionality. The location proposed for the new CO_2 storage shed is already occupied by two smaller portable sheds used for the same purpose and only the size of the footprint would change slightly. Only the data collection component of the proposed action, which involves erecting seven 120-foot tall communication towers on the property, would result in the addition of new structures on previously vacant sites. However, the purpose of these antennas is to automate the collection and transmission of the monitoring data generated by the stream weirs and tidal flux stations and, more generally, to increase the bandwidth available to SERC for communication and data-sharing purposes. This is fully compatible with the primary use of the SERC property as a research facility. Because of their location and limited height, only slightly higher than the surrounding forest, the towers would be visually unobtrusive and do not raise airspace concerns. No aviation warning lights or permits would be required. They are too far from Lee Airport to infringe on any Federal Aviation Regulations (FAR) Part 77 areas (SERC, 2010).

The proposed action would have a positive indirect impact because it would allow SERC to make a more productive use of its facility for scientific research. SERC's major research objective is to conduct long-term monitoring and experimental tests of the factors regulating ecosystem processes in a coastal landscape. Several of the datasets generated at SERC are among the longest in the world and the ability to mine these long-term datasets for information about emerging issues such as global climate change, sea level rise, and cultural eutrophication has proven a powerful tool for the scientists, students, fellows, and visitors to the site. The proposed repairs and upgrades to the ECRF structures and facilities that support this work would ensure its successful continuation and development, which the current poor condition of the infrastructure is threatening. The proposed upgrade of the data acquisition system would increase SERC's capacity for many new projects and allow more data to be posted at or near real-time over the internet, as SERC does currently for its meteorological data. Finally, the proposed action would ensure SERC continues to be a resource for professional training of undergraduate interns, graduate students, and postdoctoral researchers.

No indirect impacts on land use are expected. The implementation of the proposed upgrades and repairs would not create conditions that could result in future change in land use in or outside the ROI.

3.2.2.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed improvements would not be implemented and existing conditions would continue. The stream weirs, tidal flux stations, and marsh boardwalks would continue to deteriorate; storage space would remain inadequate; and the CO_2 Laboratory building would be left in its current, poorly configured state. Therefore, the No Action Alternative would have **minor direct and indirect, long-term adverse impacts** as SERC's ability to continue performing ecological research safely and effectively in the short and long term would be diminished, though it would not be completely impaired.

3.2.2.4 Cumulative Impacts of the Proposed Action

An ongoing project at SERC is the Mathias Laboratory Expansion and Trailer Replacement, in the administrative core of the facility. Additionally, the 2008 Master Plan includes an improvement program designed to meet the "Master Challenges" listed in Section 3.2.2., which includes several central and peripheral nodes, each a tightly configured complex of buildings and landscapes. Depending on the availability of funding, these projects would be implemented over the coming years. Together, these improvements are expected to result in moderate direct and indirect long-term adverse impacts as they enhance SERC's research infrastructure and its ability to fulfill its scientific mission without resulting in major change in activities or levels of activities. As explained in Section 3.2.2.2, the proposed action would have moderate direct and indirect long-term positive impacts on land use at SERC. When considered in combination with past, ongoing, and reasonably foreseeable future projects, the proposed action would result in **minor direct and indirect long-term positive cumulative impacts** on land use**.** It would add its positive impacts to those of other action. Since it mostly consists of renovations and repairs, however, its contribution would not cause a change in the activities or levels of activity at SERC; hence, the cumulative impacts would remain minor.

3.2.3 Project 3: Murray Laboratory

3.2.3.1 Affected Environment

RMBL has been occupying multiple, scattered facilities within the boundaries of the ghost town of Gothic, Gunnison County, Colorado since 1928. Increasing demand for facilities over the decades has led to the development of a complex physical plant, including 54 cabins and an additional 17 structures (including laboratory buildings, administrative buildings, and a classroom), for a total of 45,000 square feet of space and a public water system. RMBL is the only occupant of the site. Gothic is surrounded by, but not part of, the Gunnison National Forest.

Gunnison County does not have zoning. Any change to a parcel must obtain a Land Use Change Permit. In 1989, RMBL, whose presence at Gothic predated the establishment of the county's land use regulations, submitted a land use application, which was approved as a "minor impact project" for the operation of research laboratories.

In 2006, RMBL prepared a Facilities Master Plan to guide future decisions about the development of its infrastructure. In addition to an analysis of needs, including the need for new laboratory space, the plan identified buildable zones and restricted development areas that took into consideration avalanche zones, geologic hazard zones, wetland and riparian areas, utility corridors, and access.

3.2.3.2 Impacts of the Proposed Action Alternative

The replacement of the existing Murray Building on the same location with a larger and more modern facility, as would occur under the Proposed Action Alternative, would have **minor direct and indirect long-term positive impacts** on land use. It would not introduce a new use to the site; instead, it would replace an inadequate facility with a similar one better able to support its intended use. It would be consistent with the 2006 Master Plan. It would be constructed within a designated buildable zone. It would enhance RMBL's scientific capabilities by making possible activities and providing amenities not available in the existing laboratory facilities, including the use of chemicals, running water, a dedicated space for telecommunications, and a dedicated space for microbalances. Better insulation would allow for increased use of the laboratory outside the summer season, resulting in greater productivity. With a new laboratory, RMBL would be better able to respond to current trends in ecology and evolutionary biology, including the recognition of the importance of place-based research; the growing interest in the biology of climate change; the recognized importance of integrating modern laboratory techniques with field research; and the increasing use of automated sensors for measuring environmental parameters. No indirect impacts on land use are expected. The construction of the proposed new laboratory would not create conditions that could result in future change in land use in or outside the ROI.

3.2.3.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new Murray Laboratory would not be constructed and RMBL would continue to use the existing Murray and Willey buildings for laboratory functions. This alternative would have **no direct impact** on land use, as nothing would change. However, it would have a **moderate indirect, long-term adverse impact** because the continuing inadequacies of the laboratory space would eventually diminish RMBL's ability to support productive, modern research.

3.2.3.4 Cumulative Impacts of the Proposed Action

Because of the remote location of RMBL, which is largely surrounded by undeveloped public lands, and small scale of the proposed construction, the only projects that could generate cumulative impacts when considered along with the proposed action are projects planned and implemented by RMBL itself. These projects include:

- Finishing the renovation of Barclay Cabin and an associated septic system (2010).
- Adding a storage facility near the facilities workshop (2010).
- Renovating Richards Cabin (2011 if funding is available) and associated septic work.
- Renovating McLeod Cabin (2012 if funding is available), and associated septic work.
- Upgrading the water distribution system, including installation of additional storage and a water reinjection system (no date).
- Constructing a new housing facility (if and when funding is available).

These projects are included in the Facilities Master Plan and would be constructed consistent with the constraints identified in the plan. Therefore, they can be expected to result in positive direct and indirect long-term positive impact on land use. These impacts would remain minor, as they would not result or support a major change in the activities or levels of activity at RMBL. As explained in Section 3.2.3.2, the proposed action would also have minor direct and indirect long-term positive impacts on land use. These impacts would contribute positively – although modestly because of the relatively small scale of the project and because no major change in activities or levels activity on the site would result – to the combined impacts of other past, present, and reasonably foreseeable future projects. Therefore, the proposed action would result in **minor, direct and indirect, long-term positive cumulative impacts** on land use.

3.2.4 Project 4: Moe Pond Laboratory

3.2.4.1 Affected Environment

The Upper Research Station is mostly undeveloped. The laboratory facility proposed for replacement is the only structure on the site. The surrounding forest is currently used for biological and aquatic research by SUNY Oneonta faculty, staff, and students. Moe Pond is an artificial water body that serves as a water source for the irrigation of the Leatherstocking (Otesaga Resort) Golf Course; it also is a source of fire fighting water for the Cooperstown Farmers Museum. Adjacent to the station, there are two abandoned runways, now mere dirt roads, remaining from the former Cooperstown Airport. A private Sporstmen's Club is located nearby. Most of the surrounding lands are Clark Foundation Holdings designated for conservation use. A small waste transfer station is located to the south of the research station.

3.2.4.2 Impacts of the Proposed Action Alternative

The Proposed Action Alternative would have **minor direct and indirect long-term positive impacts** on land use at the Upper Research Station. The existing, inadequate laboratory building would be replaced on the same site by a new facility with a similar function but better adapted to the needs of the station's users, enhancing the station's usefulness as a research and education site. The proposed action would contribute to making the resources of the Upper Research Station more available to the scientific community. The station has generated datasets dating back from the 1960's and a better laboratory facility would ensure these datasets are usefully continued and built upon. By promoting more and better use of the Upper Research Station, the proposed action would support the university's educational mission. For instance, a new Master of Science in Lake Management program will soon be offered by the SUNY Oneonta Biology Department. It will be the first such program with name recognition in the country. Within five years, the university expects to have twelve full-time and four part-time students in the program, who will be conducting much of their field research activity at the Cooperstown Biological Field Station and the Upper Research Station. No indirect impacts on land use are expected. The construction of the proposed new laboratory would not create conditions that could result in future change in land use in or outside the ROI.

3.2.4.3 Impacts of the No Action Alternative

Under the No Action Alternative, the existing, inadequate laboratory building would remain in use. This would have no direct impact on land use, as nothing would change. However, it would have a **minor indirect, long-term adverse impact** as the Upper Research Station's ability to support current research needs would remain less than adequate.

3.2.4.4 Cumulative Impacts of the Proposed Action

The Upper Research Station and surrounding areas are mostly undeveloped. There are no ongoing or reasonably foreseeable projects that would result in cumulative impacts when considered in conjunction with the proposed action. Therefore, **cumulative impacts on land use** would be the same as those of the proposed action: minor, direct and indirect, long-term and positive.

3.2.5 Project 5: Wawona Field Station Renovations

3.2.5.1 Affected environment

The Wawona Field Station (WFS) is located in the southern part of Yosemite National Park. The buildings are owned by the park, but are operated by UC-Merced under Special Use Permits and a 25-year renewable cooperative agreement. WFS has use of a total of nine buildings along Chilnualna Falls Road, within the village of Wawona, a historic resort community centered on the Wawona Hotel (built in 1879). WFS uses two of the buildings, a former ranger house (Building 4000) and its former detached garage (Building 4050, the facility proposed for renovation), for administrative, research, and training functions. The other seven buildings, located farther up Chilnualna Falls Roads, are used as housing for researchers and students working at the station.

3.2.5.2 Impacts of the Proposed Action Alternative

The proposed action would have **no direct impacts on land use.** It consists of renovations and upgrades to Building 4050 that are designed to make it better able to support WSF's research and educational activities. NPS would review the proposed improvements for consistency with the special use permits. The proposed action would have a **minor indirect, long-term, positive impact** as it would enhance the ability of the property to support research activities. It would provide the station with the ability to integrate field data with remote sensing, virtual data libraries, and geospatial data stored on remote servers, an ability it particularly needs because of its remote location. Addressing interdisciplinary environmental questions at landscape scales requires that field data be tightly coupled in real time with data synthesis and visualization to help refine and target subsequent field sampling. The proposed renovations would enable this interdisciplinary cross-scale integration of multiple data sources.

3.2.5.3 Impacts of the No Action Alternative

Under the No Action Alternative, Building 4050 would not be renovated as proposed. There would be **no direct impacts** on land use, as current conditions would remain unchanged. However, by not providing WFS with the more modern research space it needs, the No Action Alternative would have a **minor indirect, long-term adverse impact**, as it would diminish the field station's ability to function as a modern, productive research center.

3.2.5.4 Cumulative Impacts of the Proposed Action

Past, ongoing, and reasonably future projects at Wawona are severely constrained by the historic character of the site and consist primarily of routine maintenance activities and upgrades to existing facilities. All projects are reviewed by the National Park Service consistent with its current General Management Plan, ensuring that direct and indirect impacts on land use, if any, are positive.

As explained in Section 3.2.5.2, the proposed action would have no direct impact on land use and a moderate long-term indirect impact. Therefore, when considered with past, ongoing, and reasonably future projects, the proposed action would result in **no direct and minor long-term positive indirect cumulative impacts,** though its contribution to indirect cumulative impacts would be small because of the modest scale of the project.

3.2.6 Project 6: NWIC Laboratory

3.2.6.1 Affected Environment

NWIC campus is located on the Lummi Reservation, on a peninsula west of Bellingham, Washington, near the intersection of Kwina Road and Lummi Shore Drive. The campus comprises two areas, north and south of Kwina Road, respectively. The 3.5-acre North Campus is NWIC's original campus, consisting primarily of prefabricated buildings, including the existing laboratory; the 30-acre South Campus is in the process of being developed to replace the generally inadequate facilities of the North Campus. The property is owned by the Lummi Indian Business Council (LIBC) and was assigned to NWIC for developing its new campus in 2003. To this end, it was rezoned for "Mixed Use," which allows for the development of an educational facility on the site.

In 2003, NWIC developed a master plan for its new campus, which included the construction of 23 facilities for a total of 170,000 square feet. The college planned for a phased development over 15 years, with Phase I to be initiated in 2005. Phase I is now nearing completion. It consists of several buildings – including a natural resources laboratory, Center for Student Success, Child Care Center, and Student Dormitory – clustered near the northwest corner of the property. Recently, NWIC has been proceeding with the planning for Phase II. Phase II will consist of three buildings – a 16,000-square-foot library, an 11,000-square-foot Coast Salish Institute, and a 2,000-square-foot traditional long house, along with supporting infrastructure – to be constructed in an area just west of the Phase I development. The proposed laboratory building would be built within the Phase II area.

Development in this area has not yet begun and the site is currently open, consisting of an open grass field and mixed coniferous/deciduous second- to-third-growth forest. The adjacent Phase I area has been cleared and consists of open, mowed areas between the new facilities recently completed.

Outside NWIC, the Kwina Road corridor includes most of the Lummi government offices, the tribal medical clinic, and a fitness center. The area is the primary urban center of the reservation. A church – St. Joachim's – stands southwest of the intersection of Kwina Road and Lummi Shore Drive, adjacent to the South Campus.

3.2.6.2 Impacts of the Proposed Action Alternative

The proposed action would have **minor direct and indirect long-term positive impacts** on land use because it would involve the construction of a new facility that would be fully consistent, and usefully complement, existing and planned land uses on NWIC's South Campus. The new building would enhance the college's ability to perform its educational and scientific mission and promote a more optimal use of the land than originally planned. In particular, it would enhance NWIC's ability to support and expand its Native Environmental Science (NES) program. The proposed research laboratory would provide a space where NES faculty, research staff, and upper level student researchers are able to work alongside researchers from the Lummi Natural Resources Department; other tribes; Western Washington University's Shannon Point Marine Laboratories; NOAA; University of Washington Marine Labs; State Department of Fisheries; U.S. Fish and Wildlife; Center for Coastal Margin Observation and Prediction; and more. This would make the NES program more visible and desirable to a broader range of students that would intellectually, socially, and spiritually benefit from the synthesis of western science and traditional tribal knowledge that characterizes the program.

3.2.6.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new laboratory building would not be constructed. The laboratory was not one of the planned Phase II facilities and these facilities would eventually be built. The site being considered for the proposed laboratory would remain open, though the part of it that is currently forested may be cleared as the Phase II facilities are constructed. Overall, therefore, the No Action Alternative would have **no direct impact** on land use at NWIC. However, not constructing the proposed laboratory would in the long term reduce the ability of NWIC to effectively perform its educational and research missions as scientists and students would have to continue using the existing, obsolete facility. Therefore, in this respect, the No Action Alternative would have a **minor indirect long-term adverse impact.**

3.2.6.4 Cumulative Impacts of the Proposed Action

Among the past, present, and future projects that, in conjunction with the proposed action, may potentially result in cumulative impacts to land use are the completion of Phase I and Phase II of the South Campus as well as projects planned for the Kwina Road corridor, including a Tribal Center and a residential development (Kwina Apartments), just west of the South Campus. The completion of these projects would result in the development of previously forested areas. However, such a change is fully consistent with the character of the area as the main urban center of the Lummi Reservation. Direct and indirect impacts in the long term would be positive, as they would contribute to improving the urban center of the Reservation and making it more vibrant. Since they would not generate any major changes in the character of the area or the activities conducted there, these impacts would remain minor.

As explained in Section 3.2.6.2, the proposed action would result in moderate direct and indirect long-term positive impacts. When added to the effects of past, ongoing, and reasonably foreseeable future projects, these impacts would make a positive contribution to the overall positive impacts without substantially changing the character of the area or the level of activities. Therefore, when considered together with past, ongoing, and reasonably foreseeable future projects, **the proposed action would result in minor direct and indirect long-term positive cumulative impacts.**

3.2.7 Multi-site Cyber-infrastructure Improvements

3.2.7.1 Affected Environment

While the 17 UCNRS reserves that are proposed for cyber-infrastructure improvements vary widely in the types of environments and habitats they contain, all have in common to be and function as natural reserves, and therefore, all are mostly undeveloped and intended to remain this way. A summary description of each reserve is provided in Table 2-1. Existing buildings at the reserves include administrative, research, and housing or camping facilities that support the management of the reserves as well as the scientific and educational work done there. Most of the reserves included in the proposed action are already equipped with a range of communication structures and devices as well as sensors and monitoring equipment that support the collection and transmission of field monitoring data.

3.2.7.2 Impacts of the Proposed Action Alternative

The proposed action would have a **minor direct, long-term positive impact** on land use at the reserves. It would involve upgrading existing data transmission equipment or placing new equipment at various, widely scattered locations across the reserves, to enhance the connectivity of the reserve and their functionality as centers of ecological study. The largest structures proposed, which include 20-foot towers at the Sagehen Reserve and the Motte Rimrock Reserve and a 27- to 37-foot tower to replace an existing eight-foot tower at Boyd Deep Canyon Desert Research Center, would have footprints not exceeding a few square feet. The amount of currently open land that would become occupied by new structures would be negligible. Where the proposed action would affect land that is not owned by UCNRS or the UC system, the reserves have sought and obtained permission to set up the proposed equipment: this includes the US Forest Service and private land owners at the Central Sierra Research Stations (Sagehen and Chickering) and the Nature Conservancy at Santa Cruz Island (Central Sierra Field Research Stations, 2010; Santa Cruz Island, 2010).

The proposed action would also have a **minor, indirect, long-term positive impact** on land use at the reserves, as it would enhance their ability to support ongoing and future ecological research by increasing the quantity, quality, and reliability of the data they generate and enabling real-time sharing and analysis of these data both on and off site. This is fully consistent with the mission of the Natural Reserve System, which is "*to contribute to the understanding and wise management of the Earth and its natural systems by supporting university-level teaching, research, and public service at protected natural areas throughout California*."

3.2.7.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed cyber-infrastructure improvements would not be implemented. This would not physically affect existing land uses and thus, there would be **no direct impact** to land use. However, there would be a **minor, indirect, long-term adverse impact** because no installing the proposed new equipment would diminish the ability of the reserves to function as centers of field research. Sub-par data transmission equipment and networks would prevent or impede the successful transition of the system to the new methods of data collection and sharing that are essential to the reserves' continued scientific productivity.

3.2.7.4 Cumulative Impacts of the Proposed Action

The primary use of the UCNRS reserves is to serve as centers of ecological studies and research. Past, present, and foreseeable future projects at the reserves are intended to support this function and their combined impact has been positive. Most of the reserves affected by the proposed action already have multiple sensors, instruments, weather data stations, and communication devices. It is possible that more equipment will be added in the future to increase the density of the networks and likely that obsolete equipment will continue to be replaced. SNARL, for instance, has been proposed as a site for the aquatic component of the National Ecological Observatory Network (NEON), the Stream Experimental and Observational Network (STREON), which would require placing a suite of instruments at different locations in a stream. The reserves also have been improving their supporting physical plant, modernizing and adding buildings and facilities supporting staff and researcher needs. An example is the recently completed Allanson administrative building at Sweeney Granite Mountain Desert Research Center. As explained in Section 3.2.7.2, the proposed action would have minor direct and indirect long-term positive impacts on land use at the reserves. When added to the impacts of past, present, and reasonably foreseeable future projects, it would result in **minor direct and indirect long-term positive cumulative impacts**, as the densification of communication networks at the reserves would enhance the reserve's value as a source of detailed and diverse ecological field data without resulting in major changes in the types of activities supported.

3.2.8 Project 8: Microwave Relay Antennas

3.2.8.1 Existing Environment

Lowell Observatory's three sites are developed with facilities and equipment that all support astronomical research. The Mars Hill campus, covering approximately one square mile of land, is the observatory's historic location. The campus includes both the original structures (e.g., the 1916 Administration [Slipher] Building, the 1896 dome housing the Clark Telescope, and the original customized iron gate leading to the site) and newer ones (several telescopes, the Hendricks Center for Planetary Studies, the Steele Visitor Center, the Discovery Channel Telescope headquarters, an instrument shop, garage, water tanks, an instrument testing dome, and several staff residences). The facilities form a loose cluster at the end of Mars Hills Road.

The Anderson Mesa site was established in 1959. Located within the jurisdiction of the Mormon Lake ranger District of the Coconino National Forest, it is operated by the Observatory under a Special Use Permit from the US Forest Service. Originally 320 acres in size, the permitted area was reduced to 180 acres in the 1990s. The developed portion of the site is occupied by several structures including 1.8-meter and 1.1-meter reflectors, a 0.6-meter telescope used for asteroid surveys, and a 0.9-meter telescope and planet search facility. The site is also home to the Navy Prototype Optical Interferometer (NPOI), a specialized instrument with a Y-shaped array of mirrors that is capable of extremely high-resolution observations.

The main structure at the Happy Jack site is the new Discovery Channel Telescope, currently being built by Lowell Observatory in partnership with Discovery Communications, Inc. on a 40-acre site held under a Special Use Permit from the US Forest Service. The main structures on the site are the observatory itself, a 1,500-square foot Auxiliary Building, and an underground water tank.

3.2.8.2 Impacts of the Proposed Action Alternative

The proposed action consists of installing a two- to four-foot microwave relay antenna on an existing water tank at the Mars Hill site; replacing an existing 30-foot antenna with a 40-foot monopole topped by a four-foot antenna at the Anderson Mesa site; and setting up a four-foot microwave relay antenna on the southwest corner of the Auxiliary Building at the Happy Jack site. The datacenter room at the Mars Hill site would also undergo interior renovations. None of these activities would change existing land uses; therefore, the proposed action would have **no direct impact on land use**. The US Forest Service has reviewed the improvements proposed at the Anderson Mesa and Happy Jack site for compatibility with the Special Use Permits governing the operation of these sites by Lowell Observatory. The proposed action would have a **minor indirect, long-term positive impact** as it would support and enhance the existing facilities' functionality by allowing Lowell Observatory to use them to generate, analyze, and share ever growing amounts of data, resulting in a substantial positive effect on the scientific research and training work conducted at the Observatory.

3.2.8.3 Impacts of the No Action Alternative

Under this alternative, the proposed microwave antennas would not be installed. This would not physically affect land uses at the sites. Therefore, the No Action Alternative would have **no direct impact** on land use. However**,** it would have a **minor indirect, long-term negative impact** because it would diminish the functionality of Lowell Observatory and its ability to continue effectively supporting astronomical research since the Observatory's need for more bandwidth would not be met. In particular, this would reduce the utility and effectiveness of the new Discovery Channel Telescope and reduce the value of Lowell Observatory's investment in this facility.

3.2.8.4 Cumulative Impacts of the Proposed Action

Past, ongoing, and reasonably foreseeable future projects at Lowell Observatory that could potentially generate cumulative impacts on land use include the construction of the Discovery Channel Telescope now being completed; improvements to the NPOI facility, that may happen within one to five years; and the construction of four new telescopes at the Anderson Mesa site for which the Observatory is seeking a modification to its Special Use Permit from the US Forest Service. These projects are designed to support Lowell's scientific mission. This would result in a minor direct and indirect positive impact as they enhance the scientific productivity of the sites.

Since the proposed action would have no direct impact on land use, it would generate **no direct cumulative impacts** when considered in conjunction with past, present, and reasonably foreseeable future projects. It would result in **minor indirect long-term positive cumulative**

impacts, as it would contribute to enhancing Lowell Observatory's research capabilities and help it continue to produce competitive astronomical research.

3.2.9 Project 9: Greenhouse Replacement

3.2.9.1 Affected Environment

The existing greenhouse and the site of the proposed new ones are located in the eastern part of UCSB's Main Campus, in an area designated for academic uses. The Main Campus covers approximately 421 acres and provides about 3.9 million square feet of academic, administrative, athletic, student support, and housing facilities (UCSB, 2008).

The site of the proposed 2,700-square-foot greenhouse is occupied by Building 539, a former research facility built in 1961, now used for administrative functions. The site of the proposed Alpine Greenhouse is occupied by an outdoor vehicle storage area. A new Technical Greenhouse has just been constructed between the two sites, north of the existing greenhouse. The area is densely built, framed by two large academic buildings: Webb Hall to the north and Noble Hall to the south (see Figure 1-10b).

3.2.9.2 Impacts of the Proposed Action Alternative

The Proposed Action Alternative would have a minor direct, long-term, positive impact on land use. The construction of new research greenhouses on the proposed site would result in a change in land use, but on both sites, the new use would be more directly associated with UCSB's educational and scientific mission than the existing uses, and thus represent an enhancement in the university's utilization of its land. **The proposed action would have a minor indirect, long-term positive impact** in that it would improve UCSB's ability to support innovative botanical research by providing more and better greenhouse space that, for instance, would allow researchers and students to grow larger populations simultaneously for better comparison purposes and would make possible experiments that currently cannot even be considered.

3.2.9.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new greenhouses would not be built. This would have **no direct impact on land use**. However, the No Action Alternative would have a **minor indirect long-term negative impact** because UCSB's need for larger and better greenhouse space would not be met. While the new Technical Greenhouse, constructed under a different project, would satisfy some of this need, it still would provide an insufficient amount of research space and UCSB would have to continue using the existing greenhouse for the foreseeable future. This would prevent researchers and students at USBC from working under optimal condition and limit the type of research they can conduct.

3.2.9.4 Cumulative Impacts of the Proposed Action

Recent, ongoing, and reasonably foreseeable future projects at UCSB's main Campus that, in combination with the proposed action, may result in cumulative impacts include the recent construction of a new Technical Greenhouse on a site just north of the existing greenhouse. For the same reasons as stated in Section 3.2.9.2 for the proposed action, this project is expected to result in direct and indirect long-term positive impacts on land use at UCSB. More generally, campus-wide projects at UCSB are planned and implemented consistent with the policies outlined in the university's current Long Range Development Plan. Compliance with the plan ensures that the long-term cumulative impacts of past, present, and reasonably foreseeable future projects are positive and fully support UCSB's continued development as an institution of higher learning. The proposed action, whose impacts are described in Section 3.2.9.2, would add to those positive impacts, although its contribution would be relatively small because of the modest scale of the project. Therefore, the proposed action is expected to result in **minor direct and indirect long-term positive cumulative impacts on land use**.

3.2.10 Project 10: St. Anthony Falls Laboratory renovations

3.2.10.1 Affected Environment

SAFL is located in central Minneapolis, on an island in the Mississippi River, across from the city's downtown area, to the west. The setting is urban and industrial. Local land uses immediately around the laboratory are also related to the nearby St. Anthony Falls. Xcel Energy operates a hydroelectric plant just east of the site. The falls have been essentially replaced by the concrete channels controlling the flow of water through the hydroelectric plant. Two of these channels, Wasteways 1 and 2, between the SAFL building and the river, are used by SAFL under lease from Xcel. SAFL's Outdoor StreamLab occupies Wasteway 2.

SAFL is located within the St. Anthony Falls Historic District, a National-Register listed district and local landmark whose significance centers on the falls and their role in the industrial and urban development of Minneapolis. The laboratory building is a contributing element to the historic district. The site is located within the Mississippi National River and Recreation Area (MNRRA). MNRRA includes 72 miles of the Mississippi River from between the cities of Dayton and Ramsey to just south of Hastings, Minnesota.

3.2.10.2 Impacts of the Proposed Action Alternative

The proposed action would have **no direct impact on land use** at the site because it consists of renovations and upgrades to existing uses. No changes in land use are involved. The proposed action would have a **minor indirect, long-term positive impact** because it is designed to restore the full functionality and scientific value of the existing, deteriorating, or makeshift facilities so SAFL can continue to support high-level research and effective research training consistent with its history as a major national laboratory in environmental science and engineering. It would also contribute to SAFL's transition from a hydraulics laboratory to an interdisciplinary laboratory in engineering, environmental, biological, and geophysical fluid dynamics.

3.2.10.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed improvements and upgrades to SAFL Laboratory would not take place. Therefore, this alternative would have **no direct impact on land use**. The No Action Alternative would have a **minor indirect, long-term adverse impact** because it would prevent SAFL to make optimal use of its facilities and limits its ability to effectively fulfill its scientific mission.

3.2.10.4 Cumulative Impacts of the Proposed Action

Past, present, and reasonably foreseeable future projects at SAFL include the creation of the OSL in 2005 and additional renovation work that would be conducted at the same time as the proposed improvements, including the installation of a new elevator in an exterior shaft to be constructed at the southeastern end of the building. These projects resulted in minor direct and indirect long-term positive impacts on land use because of the resulting enhancement of SAFL's scientific capabilities. Because the proposed action would have no direct impact on land use, it would generate **no direct cumulative impacts.** The proposed action would result in **minor indirect long-term positive cumulative impacts** because it would contribute to enhancing SAFL's ability to support scientific research and to fulfill its mission.

3.3 Historic, Archaeological, and Cultural Resources

Historic resources include districts, sites, structures, or landscapes that are significant in American history, architecture, engineering, archeology or culture. Archeological resources are any material remains or physical evidence of past human life or activities found below or on ground surface. Cultural resources contain significant information about a culture and are tangible entities or cultural practices, including sites, structures, objects, landscapes, or natural resource features assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it.

The impacts of the alternatives on historic, archaeological, and cultural, resources, if any, are evaluated using the scale shown in Table 3-3.

Table 3-3 - Historic, Archaeological, and Cultural Impact Intensity Scale

Intensity	Description
Negligible	Effect is at the lowest levels of detection with neither adverse nor beneficial consequences and would neither alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. This is typically analogous to a determination of *no effect* under Section 106 of the NHPA.
Minor	Adverse impact — impact(s) result(s) in little, if any, loss of integrity and would be slight but noticeable, but would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. This is typically analogous to a determination of *no adverse effect* under Section 106 of the NHPA.
Moderate	Adverse impact — disturbance of a site(s) results in loss of integrity and impact(s) would be apparent and would alter resource conditions. There would be an interference with traditional access, site preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the group's practices and beliefs would survive. Also included are major impacts that have been mitigated to reduce their intensity under NEPA CEQ 1508. 20 from major to moderate. The determination of effects for Section 106 would be *adverse effects.*
Major	Adverse impact — disturbance of a site(s) results in loss of integrity and impact(s) would alter resource conditions. There would be a block to, or great affect on, traditional access, site preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of a group's practices and/or beliefs would be jeopardized. This is analogous to a determination of *adverse effect* under Section 106 of the NHPA, and measures to minimize or mitigate adverse effects cannot be agreed upon that would reduce the intensity of impacts under NEPA CEQ 1508.20 from major to moderate.
Duration:	Short-term – occurs only during the construction period. Long-term – occurs or continues after the construction period.

For each project, the ROI for archaeological resources encompasses the area of ground-disturbance for the project. The ROI for historic and cultural resources encompasses the same area plus the portions of the surrounding property within visual distance of the project site (viewshed). When the project site is within a designated historic district (Project 5, Project 8 for the Mars Hill site, Project 10), the ROI consists of the district.

3.3.1 Project 1: COBCC Building

3.3.1.1 Affected Environment

The entire ROI for this project is undeveloped with no buildings or structures. There are no known archaeological resources within the ROI. The shallow depth to bedrock throughout the Farnham Point property makes it unlikely that undiscovered resources are present. In November 2009, seven test pits were excavated across the project footprint as part of a subsurface exploration to determine building foundation design and construction recommendations. No archaeological artifacts were encountered during this survey (Bigelow, 2009). As part of the planning for the new campus, Bigelow Laboratory consulted with the Maine State Historic Preservation Office (SHPO) with respect to potential effects to historic properties. The SHPO issued a finding of "no historic properties affected" on October 26, 2009. Bigelow Laboratory also consulted with the Penobscot Nation, the Passamaquoddy Tribe of Indians, the Aroostook Band of Micmacs, and the Houlton Band of Maliseet Indians (Bigelow, 2010). In a response dated February 24, 2010, the Penobscot Nation Tribal Historic Preservation Officer (THPO) indicated that the proposed project would have no impact on any structure or site of historic, architectural, or archaeological significance to the Penobscot Nation. In a response dated March 13, 2010, the Passamaquoddy THPO indicated that the proposed project would not have any impact on any cultural and historical concerns of the tribe (Bigelow, 2009)

3.3.1.2 Impacts of the Proposed Action Alternative

Under this alternative, the proposed COBCC building would be constructed. This would have **no impact** on cultural, historic, or archaeological resources because there are no such resources within the ROI.

3.3.1.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed COBCC building would not be constructed. This would have **no impact** on cultural, historic, or archaeological resources because there are no such resources within the ROI.

3.3.1.4 Cumulative Impacts of the Proposed Action

Because the proposed action would have no impacts on cultural, historic, or archaeological resources, it would generate **no cumulative impacts** on such resources when considered in combination with past, present, and reasonably foreseeable future projects within the ROI.

3.3.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

3.3.2.1 Affected Environment

None of the structures that would be affected by the proposed action have any particular architectural or historic character. Because of the small size of each project component, the ROI is very unlikely to contain any archaeological or cultural resources. However, previous archaeological surveys have documented the presence of historic and prehistoric resources at SERC. Henry T. Wright identified a number of sites from walkovers (Wright, 1968: *Archeological Survey of the Chesapeake Bay Center for Field Biology*, MHT # AN 21A); and he investigated some of the sites (Wright, 1969: *Archeological Investigations of Several Sites on the Chesapeake Bay Center for Field Biology*, MHT#AN 21B). Hettie L. Ballweber et al. (1990) also conducted surveys (*Preliminary Archaeological Reconnaissance of the Java History Trail, Smithsonian Environmental Research Center*, MHT# AN 126).

Anne Arundel County's Lost Towns Project, in cooperation with the Anne Arundel County Trust for Preservation, Inc., has been investigating the cultural resources of the Rhode River drainage since 2006. The goal is to survey, assess, and investigate archaeological resources within a limited watershed, notable for the wealth and variety of recorded sites, varied land ownership, and location near the rapidly developing city of Annapolis. The Lost Towns Project has produced three reports. Volume I developed a comprehensive cultural and historic framework for the Rhode River and placed it in a regional context. Volume I also included the relocation, identification, and updated/new site forms for 46 sites in the watershed. Volume II focused on assessing the National Register eligibility of five sites. Volume III reported on Phase III investigations of two promising and representative sites, one of which is on SERC – 18AN339, the Java Plantation (Al Luckenbach and C. Jane Cox, 2008, *Limited Phase III Investigations at 18AN339: the Java Plantation and 18AN1285: Camp Letts, Rhode River Region, Anne Arundel County, Maryland*). Based on these existing surveys, therefore, all undisturbed portions of SERC must be considered to have high archaeological potential (Cox, 2010).

3.3.2.2 Impacts of the Proposed Action Alternative

Only one of the project components – the construction of seven new data transmission towers – has any potential to affect previously undiscovered buried archaeological resources. Each of the towers and its three supporting guy wires would require a below-ground 3x3x3.5-foot concrete footer. Other project components are unlikely to affect archaeological resources. The site of the proposed storage shed has been graded in the past and the foundation of the shed would be a floating concrete slab that would cover rather than disturb any potential resources not already affected by grading. The 2.5-inch diameter, directionally-bored tunnel for 950 feet of electrical cable would have no-to-minimal impact on any subsurface archaeological resources.

The exact location of each of the proposed data transmission towers has not yet been determined because SERC plans to micro-site each one to avoid any impacts to sensitive resources as part of the project implementation phase. SERC would conduct this effort under the supervision of an archaeologist from the Smithsonian's National Museum of Archaeology who is currently conducting archaeological research at the facility. The supervising archaeologist would excavate a shovel test pit at each of the potential micro-sites for the tower footings and guy wire locations and screen the excavated soil for any artifacts. If any are discovered, the siting team would re-adjust the location of the tower so as not to disturb them and the discovery would be documented and reported as part of the ongoing archaeological work at SERC. This monitoring process would ensure that no unknown archaeological resources are adversely affected. Therefore, the proposed action could have **minor direct, long-term adverse effects on archaeological resources**. It would have **no impacts on historic or cultural resources**, as no such resources are present within the ROI. No short-term or indirect impacts are expected.

3.3.2.3 Impacts of the No Action Alternative

Under the No Action Alternative, none of the proposed repairs or upgrades would be implemented. No ground-disturbing activities would take place. Therefore, there would be **no impacts**.

3.3.2.4 Cumulative Impacts of the Proposed Action

Past, present, and reasonably foreseeable future projects at SERC (see Section 3.2.2.4) may result in minor direct long-term impacts to archaeological resources insofar as they involve ground-disturbing activities. As explained in Section 3.3.2.2, any impacts of the proposed action on archaeological resources would be minor. Because of the small footprint of the proposed projects, the proposed action would make only a small contribution to past, present, and future impacts. Additionally, continuation of the ongoing archaeological work at SERC can be expected to facilitate the identification and avoidance of sites of archaeological interest. Therefore, the proposed action can be expected to result only in **minor direct long-term cumulative impacts to archaeological resources**. As it would have no impacts on historic or cultural resources, it would result in no cumulative impacts to these resources.

3.3.3 Project 3: Murray Laboratory

3.3.3.1 Affected Environment

The town of Gothic, where RMBL is located, has been in existence for about 130 years. Its creation was prompted by the discovery in 1879 of silver in the mountains above Copper Creek. Evidence of prehistoric use of the town site has not been documented, but there is anecdotal indication of Native American use of the area prior to the mining boom. Native Americans likely used the area for hunting during the summer season, as the elevation is too high for year-round habitation with a long winter season that has an average of 38 feet of snow annually and a snow pack of 6.5 feet.

The mining town had its heyday in the 1880s. Following the collapse of the silver mining industry in the 1890s, Gothic was essentially abandoned by 1914 and had become a ghost town by the 1920s. In 1928, Dr. John Johnson, a biology professor at Western Colorado College, having recognized the rare and rich ecology of the area, set up a field station amid the remnants of the town. Five of the buildings originally occupied by the Laboratory are still extant. Over the decades, new structures were constructed for various uses from materials primarily salvaged from former town buildings. There are currently 54 cabins used for living quarters, 17 buildings used for other functions, and numerous outhouses. Of the 71 cabins and other use buildings, 37 were constructed prior to 1960, 14 were constructed between 1961 and 1980, and the remainder was constructed after 1980.

Gothic is not listed on either the National Register or the Colorado Register of historic sites. A draft nomination form was prepared in 1978 but was never completed and likely does not represent the site's condition any longer. Indeed, since then, many of the buildings have been substantially renovated or altered. Several of the older remaining buildings have been designated historic by Gunnison County, including the Town Hall (b. 1880, renovated 2003); Swallows Nest

(b. 1880, renovated 2004); Mammal Lab (b. 1914, renovated 2004); Ore House (b. 1914, renovated 2005); McLeod (b. 1936); Barclay (b. 1935); and Richards (b. 1930).

Murray Laboratory, proposed for replacement, was constructed in 1962. It is a pre-fabricated log building with no special architectural or historic character; it is not eligible for listing in the National Register of Historic Places (see Section 3.5.3). It is part of a small cluster of facilities that include Willey (b. 1982), Johnson Lab (b. 1989), and Barclay Classroom (b. c. 1992). No previous structures are known to have stood at the location of the cluster. Other, farther-away facilities within the ROI (which consists of the project footprint and the viewshed to the project site) include Old Johnson (b. 1935) and Weese (b. 1962). The historic status of these two buildings has not been evaluated; however, according to RMLB's facilities master plan, the Laboratory is considering adding Old Johnson to the list of County-designated historic buildings. None of the currently County-designated buildings are near Murray or in the ROI.

A number of archaeological monitoring reports have been prepared at RMBL in association with renovation activities at some of the older structures. These include:

- *Archaeological Monitoring at the Gothic Town Hall Building in Gothic City (5GN1525) Gunnison County, Colorado* (2003). Restoration work required ground disturbance around the foundation of the structure (b. 1880), removal of its interior floor, and of an attached shed. Archaeological monitoring and data recovery took place on June 4 and June 16, 2003. The preliminary site visit revealed a large concentration of archaeological deposits present in all monitored areas: beneath the interior ground floor and around the foundation of the structure, and especially within the floor area of the attached shed. The purpose of the second site visit was to conduct additional data recovery in the shed area by further test excavation. In all, 2,801 artifacts were recovered from four 1 by 1-m test units and overall surface collection, reflecting at least two distinct historic occupations and functions. The collected artifacts have been described and inventoried.

- *Archaeological Monitoring of Rocky Mountain Biological Laboratory's Swallows Nest and Mammal Lab Gothic City, Gunnison County, Colorado* (2004). This project involved the structural stabilization and renovation of the Swallows Nest (b. 1880) and Mammal Lab (b. 1914) buildings and involved ground disturbance around the foundation of the structures. Monitoring and testing was conducted on July 1, 6, and 7, 2004. Minimal historic artifacts were observed during the monitoring and excavation, none of which warranted collection. Monitors analyzed the artifacts in the field and left them to RMBL for curating. No cultural features or archaeological deposits were identified as a result of the monitoring.

- *Archaeological Monitoring of Rocky Mountain Biological Laboratory's Ore House, Gothic City, Gunnison, Colorado* (2005). This was conducted as part of the structural stabilization and renovation of the Ore House (b. 1914), which involved ground disturbance around the building site and foundation of the structure. Monitoring was conducted on June 16 and 22. Minimal artifacts, none of which clearly dated to the historic occupation of the Ore House, were observed during the monitoring. Monitors analyzed the artifacts in the field and none warranted collection. No additional cultural features or archaeological deposits were identified as a result of the monitoring.

- *Archaeological Monitoring of Rocky Mountain Biological Laboratory's Barclay Cabin in Gothic City (5GN1525), Gunnison County, Colorado* (2009). The complete structural stabilization and renovation of the Barclay Cabin (b. 1935) in Gothic City, Colorado required monitoring all ground-disturbing activities associated with the stabilization of the structure's foundation. The monitoring was conducted on May 29, 2009. Trenching occurred along the exterior and interior walls of the structure where foundation replacement was deemed necessary. Minimal cultural material was found; there were no cultural features. No artifacts were collected and what few artifacts were found were analyzed in the field.

Much of the footprint of the proposed new Murray Laboratory building is currently occupied by the existing building. Therefore, it has been disturbed and is unlikely to contain any intact archaeological resources. The part of the new building's footprint that extends beyond the existing structure also has low archaeological potential. As can be seen on Figure 1-4b, the site is used for biological experiments that have required digging throughout; it also has been disturbed by the installation of a weather station on a concrete pad and of utility lines (Billick, June 22, 2010).

3.3.3.2 Impacts of the Proposed Action Alternative

As noted in Section 3.3.3.1, Murray laboratory was built in 1962 and has no special architectural or historic character. It is not eligible for listing in the National Register or one of the buildings designated as historic by Gunnison County nor is it adjacent to any of those buildings. It is part of a cluster of fairly recently constructed buildings without connection to the town's past. Also as noted, the project footprint has been disturbed and, as such, has minimal potential to contain archaeological resources. Furthermore, Murray is in a relatively recently developed part of Gothic, which is unlikely to contain historical artifacts. However, RMBL would incorporate an archaeological monitoring clause to the construction contract as it has previously done for work affecting older structures on the site. In the event that archaeological resources are encountered during demolition and construction activities, the construction contractor would be required to suspend work in the immediate area, protect the site in place, and report the discovery to RMBL and the Colorado SHPO to determine if additional investigation is required. This would ensure that there are no impacts to unknown archaeological resources. Any visual impacts on potentially historic resources such as the Old Johnson Building would be minimal, as the new laboratory would be designed and built in a manner consistent with the style of the existing, older buildings. Therefore, the Proposed Action Alternative would have **negligible direct long-term adverse impacts** on archaeological, historic, or cultural resources. No short-term or indirect impacts are expected.

3.3.3.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new Murray Laboratory building would not be built. This would result in **no impacts** to archaeological, historic, or cultural resources.

3.3.3.4 Cumulative Impacts of the Proposed Action

As previously noted, many of the older structures of RMBL have already undergone renovation as a result of past projects and will likely continue to do so for the foreseeable future, as RMBL upgrades its physical plant to better meets its evolving needs. Ongoing and reasonably foreseeable projects include:

- Finishing the renovation of Barclay Cabin and an associated septic system.
- Adding a storage facility nearby the facilities workshop.
- Renovating Richards Cabin (b. 1930) and associated septic work.
- Renovating McLeod Cabin (b. 1936) and associated septic work.
- Upgrading the water distribution system, including installation of additional storage, installation of a water reinjection system.
- Building a new housing facility in a different part of the town site.

These and other future projects would be planned and implemented consistent with the Laboratory's Facilities Master Plan (2006). The master plan recognizes the historic legacy of Gothic and includes, among its general guiding principles that "the historical nature and the character of the town site will be respected and preserved, recognizing that not all historical buildings will be retained. New buildings will fit in with the historical nature of the town site." Archaeological monitoring provisions are incorporated into construction contracts, as needed, to ensure any impacts to unknown archaeological resources are minimized. Simultaneously, RMBL continues to work with Gunnison County to designate some of its facilities as historic: presently under consideration are Beanpod (b. 1929); Red Rock (b. 1961); and Old Johnson Lab (b. 1935). Overall, therefore, past, ongoing, and reasonably foreseeable future projects at RMBL other than the proposed action can be expected to result in minor direct long-term adverse impacts on archaeological, historic, and cultural resources.

As explained in Section 3.3.3.3, the proposed action would have a negligible direct long-term adverse impact on archaeological, historic, and cultural resources. As this impact would be negligible, it would not make a perceivable difference when added to the impacts of other past, present, and future action. Thus, there would be **minor direct long-term adverse cumulative impacts**.

3.3.4 Project 4: Moe Pond Laboratory

3.3.4.1 Affected Environment

The Upper Research Station is a mostly undeveloped site. The only existing structure is the existing laboratory proposed for replacement: it is a simple wood shed set up in 1967 (see Photo 1-6) with no special architectural or historic character. The undeveloped character of the surrounding area, however, and visible foundation remnants, raise the possibility that archaeological remains may be present within the project's footprint. Therefore, in spring 2010, a Phase 1a and b survey was conducted by SUNY-Oneonta to determine whether archaeological resources may be present. No significant artifacts or deposits were uncovered (see Section 3.5.4).

3.3.4.2 Impacts of the Proposed Action Alternative

Construction of the proposed new laboratory building under the Proposed Action Alternative would result in **no impacts** to historic, archeological, or cultural resources. There are no such resources in the ROI.

3.3.4.3 Impacts of the No Action Alternative

Under this alternative, the proposed new laboratory would not be built and existing conditions would continue. This would result in no impacts to historic, archeological, or cultural resources.

3.3.4.4 Cumulative Impacts of the Proposed Action

As the proposed action would have no impact on historic, archeological, or cultural resources, it would result in **no cumulative impacts** to such resources.

3.3.5 Project 5: Wawona Field Station Renovations

3.3.5.1 Affected Environment

The building proposed for renovation by WFS (Building 4050) is located within, and is a contributing element to, the Wawona Historic District. The District has National Register significance under Criterion A for its association with the development of tourism and outdoor recreation through three periods of development in the late 19th century, the New Deal Era, and Mission 66 and under Criterion B for its association with the lives of landscape painter Thomas Hill and Yosemite area pioneer and guardian Galen Clark. The district has National Historic Landmark significance under Criterion C in the area of architecture for its collection of Victorian style buildings. The period of significance for the district is 1856 to 1964. Much of the original infrastructure and buildings – from the hotel grounds to the surrounding developed areas – still remain and retain a high degree of integrity to the historic period. Some of the District's major features include the covered bridge, the Washburn Ditch, the Pioneer Yosemite History Center and the Wawona Hotel complex. The landscape characteristics that contribute to the significance of the district include natural systems and features, spatial organization, land use, circulation, vegetation, views and vistas, buildings and structures, and historic archeological sites.

Building 4050 was constructed in 1935 as a garage for the nearby ranger residence and for a fire truck as well as a tool and wood storage building. It is rectangular in plan with a gabled roof that retains its original wood shingle roofing. It originally had two bays with hinged carriage doors along its southern façade; the western bay's automotive carriage doors were replaced with a set of pedestrian double doors in1969. The building retains its original concrete foundation and its horizontal 1x12 plank siding as well as its original eight-light hopper windows throughout. It is painted white with green trim. In 1991, the east wing was modified from a garage with dirt floors into a search-and-rescue cache with concrete floors.

3.3.5.2 Impacts of the Proposed Action Alternative

The proposed action would have a **minor direct long-term adverse impact** on historic, archaeological, and cultural resources because it would alter some of the remaining original features of Building 4050, particularly the roof shingle, and to this extent, would have a negative impact on the historic integrity of this resource; the proposed solar panels would introduce a new, modern element in the landscape, with potential impacts on the setting of the building; and the trenching that would be required to upgrade the utility connections may affect archaeological resources, if any are present. However, these impacts would remain minor because:

- All renovations would be designed and implemented in accordance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*.
- The proposed solar panel arrays would be set up behind the building at a location not visible from the road or the front of the building.
- The small amount of trenching required (approximately 6 inches wide, 36 inches deep, and 30 feet long in two portions) would be planned and conducted in coordination and under the supervision of Park Service archaeologists, who would establish monitoring, reporting, and other conditions, as needed to avoid any impacts to potential archaeological resources, which UC-Merced would incorporate in the work contract documents.
- The project would be reviewed by the National Park Service (NPS) pursuant to the *Programmatic Agreement Among the National Park Service at Yosemite, the California State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding Planning, Design, Construction, Operations and maintenance, Yosemite National Park, California* (1999) and the *Service-wide Programmatic Agreement Among the National Park Service (U.S. Dept. of the Interior), the Advisory council on Historic Preservation, and the National Conference of State Historic Preservation Officers* (1995). Only those renovations approved by the Park would proceed.

The proposed action would also have negligible direct short-term negative impacts because during the construction of the proposed improvements and renovations, construction equipment and activities would detract from the appearance and setting of Building 4050. However, this impact would be of short duration and cease entirely after construction is complete. No indirect impacts are expected.

3.3.5.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed renovations to Building 4050 would not take place. UC-Merced would continue to use and maintain the building as at present, consistent with the Special Use Permit under which the property is operated. This would result in **no impact** to historic, archaeological, or cultural resources.

3.3.5.4 Cumulative Impacts of the Proposed Action Alternative

The collective impacts of past, present, and reasonably foreseeable projects on historic, archaeological, and cultural resources at Wawona have been minor. As noted in Section 3.3.5.1, the historic district has retained much of the original infrastructure and buildings and have a high degree of integrity. Moreover, projects within Yosemite National Park are reviewed by the Park and any adverse impacts to historic, archaeological, or cultural resources are avoided, minimized, or mitigated, as needed.

When added to these impacts, the impacts expected to result from the proposed renovation of Building 4050, which would be minor, are not such as to result in noticeable additional adverse impacts that would noticeably diminish the integrity of the building or the historic district Therefore, there would be only **minor, direct, long-term adverse cumulative negative impacts.**

3.3.6 Project 6: Northwest Indian College Laboratory

3.3.6.1 Affected Environment

The area set aside for the development of NWIC's South Campus was evaluated for the presence of cultural resources in 2004 (HUD, 2004). A survey was conducted over approximately 30 acres, which included the Phase I and II areas. The survey identified five archaeological resources and one cultural resource within the surveyed area: a prehistoric projectile point, a historic shell, and debris scatter (Hist#1), an isolated historic artifact (Hist#2), a modern and historic debris scatter (Hist#3), a culturally modified tree, and St. Joachim's Church. All these resources were located in the Phase I area. Hist#1 was found to be potentially eligible for listing in the National Register and the site plan was modified to avoid and protect it. The Lummi Nation THPO concurred with these measures by letter dated April 19, 2004. The other resources were either not affected (modified tree and St. Joachim Church) or not eligible for listing in the National Register (Hist#2 and Hist#3).

Visually, the developed area of the South Campus is typical an educational campus including structures, with classrooms, dining areas, recreational facilities, open areas, and pathways. Buildings are designed in a culturally appropriate style with ample open space around them.

3.3.6.2 Impacts of the Proposed Action Alternative

The proposed new laboratory would be located within the Phase II area of the South Campus, which was surveyed in 2004 for cultural resources along with the Phase I area. The only resources identified during the survey were within the Phase I area. Therefore, construction of the new laboratory would not affect any historical properties. Consistent with the 2004 concurrence of the THPO, construction contract documents would include an inadvertent discovery clause: if archaeological artifacts were discovered during ground-disturbing operations, work would stop and the contractor would inform NWIC and the THPO. Work in the affected area would not resume until the discovery has been evaluated and protective measures, if needed, have been implemented. Therefore, the proposed action would have **no impact** on historic, archaeological, or cultural resources**.**

3.3.6.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed laboratory building would not be built. Implementation of Phase II of the new campus development would proceed as planned. This would result in **no impact** to historic, archaeological, or cultural resources.

3.3.6.4 Cumulative Impacts of the Proposed Action

The proposed action would not result in any impacts to historic, archaeological, or cultural resources. Therefore, it would generate **no cumulative impacts** when considered along past, current, and future projects at the site.

3.3.7 Project 7: Multi-site Cyber-infrastructure Improvements

3.3.7.1 Affected Environment

Several of the natural reserves included in the proposed action have known areas of archaeological and cultural interest, for instance Motte-Rimrock Reserve, which includes some of the best-preserved pictographs in Southern California, and Santa Cruz Island. However, because of the large size of most of the reserves and their primary function as natural conservation areas, which leave them largely undisturbed, most have not been systematically surveyed for archaeological resources and all may potentially contain unknown resources in addition to the known sites.

Because of the reserve's function as natural conservation areas, the built environment is limited. In a few cases, existing buildings would continue, or be fitted, to support antennas and data transmission devices. At three reserves, buildings of known or potential historic interest would be affected:

- The improvements proposed for the Blue Oak Ranch Reserve involve installing a six-foot diameter parabolic microwave antenna on the Shane Telescope Dome at the UC Observatory/Lick Observatory site on Mount Hamilton. The Shane Dome is a historic building that was determined to be eligible for listing in the National Register of Historic Places in 2006 (UCSC, May 2010).

- At VESR-Valentine Camp, two existing radios mounted outside buildings would be replaced at the same location by more modern equipment. The existing buildings are log cabins constructed in the 1920s that have been extensively modernized since.

- At the Sweeney Granite Mountains Desert Research Center, 900 MHz radios would be set up on the rooftops of several buildings, all of them less than 20 years old, with one exception: the Staples Cabin, which was originally built in 1927 by the site's original homesteaders. However, the house has since been significantly altered by the addition of a second story in 1993 (Sweeney Granite Mountains Desert Research Center, 2010). The roof also is modern.

3.3.7.2 Impacts of the Proposed Action Alternative

Depending on the reserve**,** the proposed action would have **no or negligible direct long-term negative impacts**. No short-term or indirect impacts are expected.

At each reserve, prior to installing the proposed equipment, reserve staff would review the location of known archaeologically- or culturally-sensitive areas and all the project components requiring ground-disturbing work would be sited outside these areas. The potential for impacts to unknown archaeological or cultural resources is minimal because of the very small disturbance footprint of each project component. Installing the poles that would support mesh radio networks would require, in each case, digging a hole about three to five feet deep using a hand auger. If needed, guy wires would be used to further stabilize the unit. The stakes used to secure the guy wires would be similar to camping tent stakes. Where towers would be installed to support antennas (e.g., Sagehen Reserve), excavations would be approximately five square feet by three feet deep. Additionally, the reserve directors and staff would be instructed on the federal and state requirements relating to the discovery of any artifacts or bones before they dig these small holes. If any artifacts or remains are discovered during digging, all soil disturbing work within 35 feet of the find would cease. The managing campus would contact a qualified archaeologist to provide and implement a plan for subsurface investigation, as needed, define the deposit, and assess the remainder of the site to determine whether the resource is significant and would be affected by the project (Nakayama, 2010).

With respect to the built environment, the Blue Oak Ranch Reserve/Lick Observatory: UC Santa Cruz has prepared a formal evaluation of effect for the proposed installation of a new antenna on the Shane Dome building at UCO/Lick Observatory, a National-Register-eligible facility (UCSC, 2010). The study found that “the proposed project would not materially detract from any of the character defining features of the Shane Telescope Dome, and because it would not alter the characteristics that qualify it for listing in the National Register of Historic Places and California Register of Historical Resources, including its setting, the installation of project components would cause no substantial adverse change to the resource.”

At VESR-Valentine Camp, the proposed action would consist of replacing existing equipment at the same locations. The proposed radios are small, removable devices (about 10 by 10 by 3 inches; see Photo 2-3 for a typical example) and no significant new elements would be introduced. The proposed action would not result in any change to any historically-significant characteristics the buildings may retain.

At the Sweeney Granite Mountains Desert Research Center, a new mesh network radio would be installed on the modern part of the Staples Cabin, a 1927 structure extensively altered in the mid 1990’s by the addition of a second story. The radio would be a small, removable device (10 by 10 by 3 inches; see Photo 2-3 for a typical example) and the proposed action would not result in any change to any historically-significant characteristics or features the building may retain.

3.3.7.3 Impacts of the No Action Alternative

The No Action Alternative, under which the proposed cyber-infrastructure improvements would not be funded or implemented, has no potential to affect cultural resources. Thus, the No Action Alternative would have **no impacts.**

3.3.7.4 Cumulative impacts of the Proposed Action

The impacts of past, present, and reasonably foreseeable future projects at the different reserves affected by the proposed action vary from reserve to reserve. In general, because of the role of the reserves as conservation and research areas, ground-disturbing activities in the non-disturbed parts of the reserves have been and can be expected to remain minimal. Impacts to the built environment have been more noticeable and, as noted above, the historic integrity of the Staples Cabin at Sweeney Granite Mountains Desert Research Center and of the log cabins at Camp Valentine has been cumulatively compromised by past renovations and additions. Overall, impacts on historic, archaeological, or cultural resources have been minor at the most. The proposed action, whose impacts would range from none to minor, would make a minimal contribution to the cumulative impacts of past, present, and future projects at the reserves. **Adverse cumulative impacts would range from none to minor**, depending on the reserve.

3.3.8 Project 8: Microwave Relay Antennas

3.3.8.1 Affected Environment

The Lowell Observatory site at Mars Hill was designated a National Historic Landmark (NHL) in 1965 under Theme XX, Arts and Science in the "Science and Invention" subcategory (now Theme XIII – Science, Subcategory A-1: Physical Sciences-Astronomy). It was listed in the National Register of Historic Places in 1978 (NRHP Number 66000172; Larew, 1977). Components of the site listed in the Nomination Documentation include the 24-inch Refractor and Housing (Clark Telescope, 1896), Mausoleum (c. 1916), Lowell Library (c. 1894), the Administration (Slipher) Building (1914), Stone Water Tower, 1912 Residence, and Iron Gate. Other structures within the boundary include the 1929 Pluto Discovery Telescope and other telescopes, the Hendricks Center for Planetary Studies (built in the 1960s), the Steele Visitor Center (opened in 1994), the Discovery Channel Telescope headquarters, an instrument shop, garage, water tanks, an instrument testing dome and several staff residences. The water tank on which one of the proposed antennas would be mounted was installed in 1994.

The Anderson Mesa site was established in 1960 and the first structure there was the Perkins Telescope dome, completed in 1961. In 1994, Lowell Observatory prepared an EA for a long-term management plan for the operations of its astronomical facilities on Anderson Mesa. With regard to cultural resources on the site, the EA provided the following information: three archaeological sites (AR-03-04-05-31, 05-288, and 05-433) considered National Register-eligible and five ineligible prehistoric lithic scatters were documented within the boundaries of the permit area prior to the EA (Lowell Observatory, 1992). A Class I survey of the Lowell Observatory permit area completed in 1992 identified an NRHP-eligible historic site (AR 03 04-05-446) outside the boundaries of the permit area (Dosh, 1993). Another NRHP-eligible site (AR-03-04-05-580) was identified within the special permit area during a Class III survey of a 25-acre parcel in 1993 (Dosh, 1993). None of the sites are located close to the site of the antenna proposed for replacement.

The Happy Jack site was surveyed for cultural resources, as documented in a 2004 report titled *Cultural Resources Survey of 40 Acres for Lowell Observatory's Proposed Discovery Channel Telescope West of Happy Jack, Coconino National Forest, Coconino County, Arizona* (Lane and Neal, 2004). Lane and Neal surveyed 39.8 acres of the future Discovery Channel telescope site and power line. No prehistoric materials were observed within the project area. A 2003 search of the Coconino National Forest records at the Flagstaff Supervisor's Office revealed that the site had been partially surveyed by Coconino National Forest personnel (Gratz, 1980; Pilles, 1985, and Boston 1997, as cited in USDA Forest Service 2004). A survey of the site conducted on

Nov. 29, 2003 and Feb. 16, 2004 (Lane and Neal, 2004) found one ineligible isolated historic feature and no historic properties. No prehistoric materials or National Register-eligible historic properties were identified within the project area.

3.3.8.2 Impacts of the Proposed Action Alternative

The proposed action would result in **no direct impact** to historic, archaeological, or cultural resources. None of the proposed antennas would be attached to historic buildings or structures; no previously undisturbed area would be disturbed to install them. **Nor would the proposed action result in indirect impacts to the historic buildings and structures at Mars Hill** (there are no such buildings or structures at the other two sites). Surrounding trees and terrain largely obscure the view of the tank where the proposed antenna would be set up from the nearby historic buildings. The antenna would not be visible the Administrative (Slipher) Building or the Pluto Telescope; nor would it be visible from the 1896 Clark Telescope, located much farther away (see Figure 1-9b). The antenna's visibility would be further reduced by painting it a dark color or covering it in a manner that helps it blend against the background.

Photo 3-1 Water tank (site of the proposed antenna) seen from the historic Slipher Building – In addition to being small relative to the water tank, the antenna would be masked by trees.

Photo 3-2 Water tank (site of the proposed antenna) seen from the Pluto Telescope

3.3.8.3 Impacts of the No Action Alternative

Under this alternative, the proposed microwave antennas would not be installed and existing conditions would continue unchanged. Therefore, there would be **no impacts** to historic, archaeological, or cultural resources.

3.3.8.4 Cumulative Impacts of the Proposed Action

The proposed action would have no impacts on historic, archaeological, or cultural resources. Therefore, it would result in **no cumulative impacts** to these resources

3.3.9 Project 9: Greenhouse Replacement

3.3.9.1 Affected environment

The project site is on the Main Campus of UC Santa Barbara. The March 2008 Draft Environmental Impact Report for the University's Long Range Development Plan (LRDP) indicates that no comprehensive archaeological survey has been conducted for the Main Campus. A review of older surveys found eight previously identified sites on the Main Campus, most unevaluated for eligibility to the National Register. None are within the ROI for this project. The site of the proposed 2,700-square-foot greenhouse is currently occupied by Building 539, built in 1961, and the site of the proposed Alpine Greenhouse is paved and used for vehicle storage. Therefore, previous construction and paving are likely to have disturbed any surface or subsurface archaeological resources that may have been present. Building 539, constructed in 1961, would be demolished. As explained in Section 3.5.9, this building is not eligible for listing in the National Register of Historic Places.

3.3.9.2 Impacts of the Proposed Action Alternative

The proposed action would have **no impacts**. Building 539, which would be demolished, is not eligible for listing in the National Register. The potential for archaeological resources to be present under the building or under the parking lot that the proposed Alpine Greenhouse would replace is minimal because of previous disturbance from the construction of the existing buildings and pavements.

3.3.9.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new greenhouses would not be built and the existing greenhouse would remain in use. This has no potential to affect any historic, archaeological, or cultural resources. Under this alternative, therefore, there would be **no impacts**.

3.3.9.4 Cumulative Impacts of the Proposed Action

The proposed action would have no impacts on historic, archaeological, or cultural resources. Therefore, it would result in **no cumulative impacts** to these resources

3.3.10 Project 10: St. Anthony Falls Laboratory Renovations

3.3.10.1 Affected Environment

The SAFL building was constructed in 1938 by the Work Progress Administration (WPA, Work Project Administration after 1939), the largest of the New Deal agencies created to address the economic and social impacts of the Great Depression. It is a contributing element to the National Register-listed St. Anthony Falls Historic District. The district is generally bounded by Plymouth Avenue, 2nd Street, 10th Avenue South, 6th Avenue Southeast, and University Avenue. It includes several neighborhoods: North Loop, Downtown West, Downtown East, Marcy Holmes, Nicollet Island/East Bank, St. Anthony West. The District is also a designated Minneapolis Landmark. St. Anthony Falls are the geographical and historical center of the District. The falls served as a source of energy that supported the development of lumber and flour industries, later followed by electrical power. As such, they played a significant role in the development of the city of Minneapolis. The Historic District is a witness to the origins and early history of Minneapolis.

It contains more than 200 buildings, structures, and sites associated with the development and use of the falls for hydropower from the 1820s to the mid 20th century. Of the structures in the District, two are separately designated as National Historic Landmarks: the Pillsbury A Mill, on South Main Street (b. 1881), north of SAFL; and the Washburn A Mill Complex (b. 1878) on South First Street. Other major buildings and structures in the District include the Our Lady of Lourdes church (b. 1858) and the Stone Arch Bridge (b. 1882-1883), initially a railroad bridge, now a pedestrian/bicycle facility and a component of the St. Anthony Falls Heritage Trail, which runs through both banks of the Mississippi River, Nicollet Island, and Hennepin Avenue. The bridge is a 2,100-foot structure with 23 limestone arches spanning from 40 to 100 feet. It affords views of SAFL and the adjacent Xcel Energy hydroelectric facilities, which also contribute to the Historic District (including Wasteways 1 and 2 and adjacent walls).

The only area where the proposed project would involve some ground disturbance is the OSL. The OSL was set up in 2006, after Wasteway 2 channel was filled with about five feet of river dredge material. The fill material was placed directly on bedrock and is unlikely to include imported archeological materials. The filling operation, conducted by Xcel Energy, was designed to control seepage from the upstream dam feeding the Xcel hydroelectric plant, which was causing damage to the historic walls adjacent to the wasteway. After the channel was filled, SAFL and Xcel entered into an agreement allowing SAFL to create and operate the OSL.

3.3.10.2 Impacts of the Proposed Action Alternative

The bulk of the project involves interior renovation; nevertheless, some elements of the proposed action have the potential to directly affect some of the characteristics that qualify SAFL as a contributing element to the St. Anthony Falls Historic District if not done in a context-sensitive manner. These elements include: gate house restoration, including installation of the new overhead crane; all door and window replacements; any substantial re-channeling of the internal or external waterways that change the historic functioning of the building hydraulics; structural repairs, especially those involving the cutting and patching of existing walls; concrete restoration, both interior and exterior; floor plan re-configurations for remodeled offices, labs, and restrooms; new elevator and stair well configurations; interior and exterior trims and finishes, for period compatibility-and possible salvage or re-use of existing period items; site repairs and modifications; and outdoor OSL improvements. Indirect visual impacts on other nearby elements of the Historic District are also possible, particularly impacts to views from the Stone Arch Bridge toward SAFL and the adjacent wasteways from the construction of the proposed instrument-carrying gantry. The primary project component that would involve ground-disturbing work is the installation of an instrument-carrying gantry in the OSL. The OSL was created by placing several feet of fill on top of the rock surface within Wasteway 2; the potential for any archaeological resources to be present there is minimal. Other site work is at locations in close proximity to the building's walls. It may potentially affect unknown archaeological resources.

However, at this early stage in the planning process, design documents are not sufficiently detailed to allow for a full evaluation of these potential impacts (note that the concept shown in Figure 2-4 is an early concept likely to be modified as design proceeds). Therefore, a Programmatic Agreement (PA) has been executed among NSF, the University of Minnesota, the Minnesota SHPO, and the National Park Service (NPS) (copy in Appendix I), with the Minneapolis HPC and Minneapolis Riverfront Corporation as consulting parties, to establish a consultation and review process with public participation that will provide input to and feedback during the design phase that would be part of the project, if funded. In general, the principles guiding the design will be to honor the WPA-era construction and style of the SAFL building while maintaining compatibility with the historic industrial setting of the St. Anthony Falls Historic District. Additionally, if applicable, a Certificate of Appropriateness would be sought for the proposed improvements and upgrades; this process would involve review of the project by the Minneapolis Heritage Preservation Commission (HPC).

While the process described in the PA does not guarantee a specific outcome, it is designed to avoid, minimize or, if appropriate, mitigate any adverse effects on historic resources and so it provides a reasonable basis for a conclusion of no significant impact. The bulk of the project involves interior renovation. Two aspects that will be apparent from the outside of the laboratory are the addition of an elevator shaft and the addition of a low instrument gantry to an existing outdoor stream laboratory located in Wasteway 2. Some of the parties to the PA have provided examples of projects in which additions similar to the elevator shaft were achieved in a way that resulted in only minor impact on Historic Resources and Visual Quality. Therefore, it can be expected that compliance with the procedures established in the PA and, if appropriate for this project, application for a Certificate of Appropriateness will ensure that the proposed action has non-significant, **minor direct long-term negative impacts** on SAFL and the St. Anthony Falls Historic District. No significant indirect impacts are expected.

The proposed action would also have negligible direct short-term negative impacts because during the construction of the proposed improvements and upgrades, construction equipment and activities would detract from the appearance and setting of SAFL. However, this impact would be of short duration and cease entirely after construction is complete.

3.3.10.3 Impacts of the No Action Alternative

Under the No Action Alternative, none of the proposed improvements and upgrades would be implemented by SAFL. This would not affect the historic character of the building or the historic district. There would be **no impacts**.

3.3.10.4 Cumulative Impacts of the Proposed Action

Past projects at SAFL have over time resulted in minor adverse impacts to the historic integrity of the building. Historically, SAFL and the University and Minnesota have maintained and upgraded the laboratory's facilities as needed. The larger work projects have been mainly for energy efficiency and keeping the building weather-tight. In 1993, all of the original single-paned windows were replaced with historically-accurate, insulated windows and frames. The SHPO reviewed and approved the new windows. In 2002, all flat roof surfaces were insulated and replaced. Also in 2002, electrical systems were upgraded. In 2009, the plaza parking deck was replaced to bring it into compliance with the Americans with Disabilities Act (ADA) and provide a higher load limit. In 2006, through a license agreement with Xcel, SAFL installed three concrete structures within Wasteway 2 to create the OSL: a concrete headbox, tailbox, and downstream stilling basin, needed to provide hydraulic control. Two 18-inch supply pipes were installed bringing water from SAFL's supply channel to the OSL facility. As previously noted, the filling of Wasteway 2 was intended to control water seepage that was damaging the adjacent historic walls. The work that led to the creation of the OSL was conducted in the context of larger improvements to the upstream end of Hennepin Island required as part of Xcel's relicensing process, including structural repairs to the dam and development of a new Waterpower Park for recreational purposes. The potential effects of this work on cultural resources were addressed through consultation with, and review by, the SHPO and other consulting parties. The proposed action includes all currently foreseeable projects at SAFL. As noted above, it is expected to result in minor adverse impacts, as review by the SHPO and other parties will ensure that impacts are avoided, minimized, or mitigated as needed. Therefore, when considered in combination with past, present, and reasonably foreseeable projects, the proposed action is expected to result in **minor direct long-term negative cumulative impacts to the historic SAFL building**.

Recent significant projects within the historic district include the construction of the new Guthrie Theater, a signature work by architect Jean Nouvel in collaboration with the Minneapolis architectural firm Architectural Alliance, on South 2nd Street, across from SAFL; and the DeLaSalle Athletic Field, opened in 2009, a project that has been an object of controversy with regard to the impact of its construction on the Historic District. The St. Anthony Falls Historic District is located on the Minneapolis waterfront, an area that has been targeted for revitalization by the City. In the long term, the combined impacts of past, present, and future projects supporting the revitalization of the waterfront area can be expected to result in adverse cumulative effects to the St. Anthony Falls Historic District, though project reviews by the SHPO, the Minneapolis Heritage Preservation Commission, the National Park Service (for projects within the MNRRA) and other parties, as provided for under federal, state, and city laws and regulations, can be expected to minimize these effects to a minor level. Because it would be limited to the SAFL facility, one element in the larger Historic District, and, as explained above, is expected to have only minor negative impacts, the proposed action, when considered along with past, present, and future projects within the Historic District, is not expected to substantially increase the overall level of impacts to the district. Thus, there would be **minor direct long-term negative cumulative impacts to the St. Anthony Falls Historic District.**

3.4 Visual Quality

This section considers the potential visual impacts of the proposed action. A proposed action may have an adverse effect on the human environment if it would lead to a noticeable deterioration of the visual quality of a site that is likely to detract from its enjoyment by residents or visitors. The impacts of the alternatives on visual quality are evaluated using the scale shown in Table 3-4.

Table 3-4 - Visual Impact Intensity Scale

Intensity	Description
Negligible	The alternative would affect the visual quality of the landscape so slightly that there would be no measurable or perceptible consequence to the observer.
Minor	The alternative would result in a detectable change to the visual quality of the landscape; this change would be localized, small, and of little consequence to the observer.
Moderate	The alternative would impact the visual quality of the landscape; this impact would be readily detectable, localized, with consequences at the regional level. Mitigation measures may be necessary to offset adverse impacts and would likely be successful.
Major	The alternative would result in a substantial change to the visual quality of the landscape with substantial consequences to the visitor use and experience in the region. Extensive mitigation measures would be needed to offset any adverse impacts and their success would not be guaranteed.
Duration:	Short-term – occurs only during the construction period. Long-term – occurs or continues after the construction period.

A mere change in the appearance of a site does not amount in and of itself to an impact unless it can reasonably be determined to improve or detract from the aesthetics of the area. When a proposed action would change the visual character of a site in a manner that may be noticeable but cannot be determined to be negative or positive, the proposed action is considered to cause no impact to visual resources.

For each project, the ROI is the project site and area within its viewshed (i.e., area from which the project site is visible). All projects involving more than a trivial amount of construction would result in **negligible direct short-term negative visual impacts** as construction equipment and activities would temporarily detract from the visual quality of the project site. These impacts would cease after construction is complete and are not addressed further in this section.

3.4.1 Project 1: COBCC Building

3.4.1.1 Affected environment

The future Bigelow Laboratory campus, including the site where the proposed COBCC Building would be located, is a waterfront property bordered to the north and west by residential neighborhoods, to the south by undeveloped forest, and to the east by Farnham Point on the Damariscotta River. The entire property is primarily undeveloped forest with no special aesthetic characteristics or features. From the river in the vicinity of the property, residential docks and waterfront facilities at the nearby boatyards are visible. None of the property's waterfront is visible from public vantage points.

3.4.1.2 Impacts of the Proposed Action Alternative

Under the proposed action, the COBCC building would be constructed on the Farnham Point property. It would not be an isolated building, but part of a larger complex being planned independently. It would be located near the center of the site and would be screened from surrounding off-campus areas by forested buffers required under the provisions of the 2006 Contract Zoning Agreement. The building would also comply with the footprint and height restrictions contained in the Agreement. Therefore, it would not be visible outside the immediate vicinity and result in **no impact** to visual quality.

3.4.1.3 Impacts of the No Action Alternative

Under the No Action Alternative, ARI-R2 funding would not be available to finance the construction of the proposed COBCC building. However, as previously noted, it is expected that other, long-planned components of the campus would nevertheless be built. Most of the development, including the proposed COBCC building, would be built near the center of the property and extensive forested buffers would screen it from the surrounding areas, consistent with the provisions of the 2006 Contract Zoning Agreement. The height and footprint restrictions contained in the Agreement would also be in compliance. The main entrance, on Ocean Point Road, would be planted with native vegetation along the roadside, including vegetation to screen the gate from adjacent homes. The Emergency Access Drive, to the north, would be gated and for use by pedestrians and emergency vehicles only, also per the Zoning Agreement. None of the building elements would be visible from either entrance. The waterfront structures would be designed to blend as much as possible in the landscape; no equipment would be stored or structures built on the dock. The pier would not introduce a discordant, incompatible element in the landscape when seen from the river. From mid-channel in the Damariscotta River, boaters would be able to see, in addition to the pier, three residential docks to the north and the Washburn and Doughty shipyard building and waterfront facilities at the head of East Boothbay Harbor. To avoid sky glow at night, lighting on the project facility would be kept to the minimum required for safety and security. All lights would be equipped with cut-off fixtures to avoid light trespass onto abutting properties. Lights on the dock would include only those required by the Coast Guard for navigational purposes. Not constructing the proposed COBCC building, as would happen under this alternative, would not change any of these considerations. Therefore, it would have **no impacts** on visual quality.

3.4.1.4 Cumulative Impacts of the Proposed Action

Past projects and developments within the ROI have created the existing visual environment. The only significant ongoing and foreseeable future project is the construction of the new Bigelow Laboratory campus. As explained in Section 3.4.1.3, a number of measures and conditions have been incorporated in the 2006 Zoning Agreement to minimize the visual impacts of the new campus. Based on these conditions, and without the proposed COBCC building, construction of the new campus would result in no visual adverse impacts. Adding the proposed COBCC building would not change this, since it would not preclude or undermine any of the measures design to avoid visual impacts. Therefore, there would be **no cumulative impacts** on the visual quality of the ROI.

3.4.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

3.4.2.1 Affected Environment

SERC is the largest, contiguous undeveloped land holding on the western shore of the Chesapeake Bay in Maryland. SERC's 2,650 acres include forests in varying stages of succession, fresh and estuarine wetlands, croplands, and pastures, rendering the site a microcosm of coastal ecological systems. Research, administrative, and educational buildings are clustered and take up a small portion of the interior of the site. Because of its size and diversity, the property does not have a strong, specific visual identity. Rather, it blends into the general rural landscape. The facilities and structures proposed for repair or upgrade are primarily utilitarian in character, with no special aesthetic quality or interest. They are small and only visible from the immediate vicinity.

3.4.2.2 Impacts of the No Action Alternative

Under the No Action Alternative, none of the proposed improvements, repairs, and upgrades would be implemented. Existing conditions would continue. This alternative would have **no impact** on visual resources.

3.4.2.3 Impacts of the Proposed Action Alternative

One element of the proposed action – the construction of seven 120-foot antenna towers – would potentially result in negligible long-term direct negative visual impacts. The towers would be located in forested areas and their antennas would barely reach above the surrounding tree tops, making them very visually unobtrusive. While potentially visible, they would most likely go unnoticed by any observer not already aware of their presence and looking for them. The **other elements would result in no visual impacts**, as they mostly consist of repairing or replacing small, existing structures in a manner that would not change their overall appearance. The proposed new storage shed would be constructed at a location already occupied by existing sheds and the slightly greater footprint would make very little difference to the overall appearance of the area; additionally the site is remote and not visible from anywhere outside the immediate vicinity. Similarly, the proposed new boardwalks would follow the exact same alignment as the existing ones.

3.4.2.4 Cumulative Impacts of the Proposed Action

Past, present, and reasonably foreseeable future projects at SERC (See Section 3.2.2.4) have and would continue to introduce new elements to the property. However, because of the size of SERC, visual impacts have remained and are expected to remain negligible. The property seamlessly blends in the larger rural landscape. The added negligible impacts of the proposed action (from the installation of the proposed antenna towers) would not change this, and overall, any **adverse long-term cumulative impacts would be negligible**.

3.4.3 Project 3: Murray Laboratory

3.4.3.1 Affected Environment

Gothic is located within a small valley 9,500 feet high at the confluence of Copper Creek and the East River within a native alpine ecosystem with clusters of spruce, fir, and aspen trees; willows grow along drainages and Copper Creek and East River. There are no evident introduced plantings. Visually, the dominant factor is the town's natural setting. The 12,625-foot high Gothic Mountain serves as a backdrop. The town is reached by a dirt road that roughly bisects it. Small footpaths meander between buildings, the edges often delineated with stones. RMBL is the only occupant of the town, which it uses for ecological and environmental studies. Study plots are marked out by small flags and posts. Buildings and structures are clustered at various locations across the site. They consist of log buildings with metal roofs of various construction dates. There is no formal organization or arrangement. RMBL is the only occupant and user of the site.

3.4.3.2 Impacts of the Proposed Action Alternative

Demolition of the existing Murray Building and construction of a new laboratory at the same location would have a **negligible direct long-term positive impact** on the visual quality of the area in that it would replace a ageing, fairly dilapidated building with a modern, more elegant facility (see Figure 2-2). No indirect impacts would result. The new laboratory would be constructed in a style and materials consistent with the existing facilities while at the same time being recognizable as a modern construction. Although larger than the existing Murray Building, it would not be so large as to be overly prominent or out of scale with its surroundings. Being located on the same site as the existing Murray Building, it would not alter the layout of the overall property. The area's topography and vegetation would further ensure that it does not stand out and appropriately blends in with its surroundings.

3.4.3.3 Impacts of the No Action Alternative

Under the No Action Alternative, the new Murray Laboratory building would not be built and the existing laboratory would remain in use. Existing conditions would continue. There would be **no impact** to the visual quality of the area.

3.4.3.4 Cumulative Impacts of the Proposed Action

The appearance of RMBL and Gothic today is the result of several decades spent maintaining, renovating, and adding to the buildings inherited from the old mining town. To the extent that this ongoing effort has preserved the general appearance and style of the town, along with a number of original buildings, which otherwise would likely have deteriorated and crumbled, the impacts on the visual quality of the area have been positive, though minor. Foreseeable future projects, which consist primarily of restoration and some new construction (see Section 3.2.3.4), can be expected to be designed in a manner consistent with the visual character of the site and to have, overall, a moderate positive impact. The proposed action, when added to those of the past, present, and reasonably foreseeable projects at RMBL, can be expected to result in similarly **minor direct long-term positive cumulative visual impacts**.

3.4.4 Project 4: Moe Pond Laboratory

3.4.4.1 Affected Environment

The Upper Research Station is a mostly undeveloped site. The project site is heavily wooded and is screened from surrounding properties by the surrounding forest. It is not visible away from the immediate vicinity. A limited view of Moe Pond is afforded from the existing laboratory building, but it is primarily blocked by moderate to heavy scrub-shrub and existing trees. The existing laboratory is a modest wood structure with no particular aesthetic interest (see Photo 1-6).

3.4.4.2 Impacts of the Proposed Action Alternative

The proposed action would have a **negligible direct long-term positive impact** on visual quality in that it would replace the existing laboratory with a more modern and more attractive building. Wood would be the primary building material, consistent with the natural setting of the facility. Because of the isolated character of the site, however, and surrounding forest, the resulting change would not be noticeable outside the immediate vicinity of the project site.

3.4.4.3 Impacts of the No Action Alternative

Under this alternative, the proposed new laboratory would not be built and the existing building would remain as is. This would have **no impact** on the visual quality of the site, which would not change.

3.4.4.4 Cumulative Impacts of the Proposed Action

The Upper Research Station and surrounding areas are mostly undeveloped. There are no ongoing or reasonably foreseeable projects that would result in cumulative impacts when considered in conjunction with the proposed action. Therefore, cumulative impacts would be the same as those of the proposed action, **negligible direct long-term and positive**.

3.4.5 Project 5: Wawona Field Station Renovations

3.4.5.1 Affected Environment

Building 4050 (see Figure 1-6b) was constructed in 1935 as a garage for the nearby ranger residence and for a fire truck as well as a tool and wood storage building. It is rectangular in plan with a gabled roof that retains its original wood shingle roofing. It originally had two bays with hinged carriage doors along its southern façade; the western bay’s automotive carriage doors were replaced with a set of pedestrian double doors in1969. The building retains its original concrete foundation and its horizontal 1x12 plank siding as well as its original eight-light hopper windows throughout. It is painted white with green trim. The building is a stand-alone facility. The nearest building is Building 4000, also used by UC-Merced. When Building 4000 was a residence, Building 4050 was the garage serving this residence.

3.4.5.2 Impacts of the Proposed Action Alternative

As explained in Section 3.3.5.2, it is expected that the proposed renovations would be conducted in a manner that minimizes effects to the historic integrity of the building. At a minimum, this would include ensuring that the general appearance of the building remains the same, even if some original elements (e.g., the roof shingles) are replaced with modern substitutes. Additionally, the proposed solar panels would be set up behind the building so as to not be visible from the front of it or from the road. Therefore, the proposed action is expected to result in **no impacts** to the visual quality of the building and surrounding area.

3.4.5.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed renovations to Building 4050 would not be implemented. UC-Merced would continue to use and maintain the building as at present, consistent with the Special Use Permit under which the property is operated. This would result in **no impacts** to the visual quality of the building or its surroundings.

3.4.5.4 Cumulative Impacts of the Proposed Action Alternative

As the proposed project would result in no visual impacts, it would generate **no cumulative impacts** when considered along with past, present, and reasonably foreseeable future projects.

3.4.6 Project 6: Northwest Indian College Laboratory

3.4.6.1 Affected Environment

The developed portion of NWIC's South Campus (Phase I) is characterized by one-story, educational and student residential buildings arrayed along an access road that separates it from the Phase II area, still undeveloped and mostly forested. Buildings are designed in a culturally-appropriate style.

3.4.6.2 Impacts of the Proposed Action Alternative

The proposed new laboratory would be located within the Phase II area of the South Campus, on the west side of the access road, just across the recently built Phase I facilities. It would be designed in a style that is consistent with the style of both the existing Phase I and planned Phased II buildings. While constructing the proposed laboratory would result in a slightly denser campus than would be the case under no action conditions, the difference would not be particularly noticeable. Therefore, the proposed action would have **no impact** on visual quality relative to no action conditions.

3.4.6.3 Impacts of the No Action Alternative

Under the No Action alternative, there would be **no impacts** to visual resources. The proposed new laboratory building would not be constructed but the planned Phase II facilities would be built in an area that is currently forested, just across the road from the existing Phase I facilities. While this would change the visual character of the area, this change cannot easily be characterized as either negative or positive.

3.4.6.4 Cumulative Impacts of the Proposed Action

As the proposed project would result in no visual impacts, it would generate **no cumulative impacts** when considered along with past, present, and reasonably foreseeable future projects.

3.4.7 Multi-site Cyber-infrastructure Improvements

3.4.7.1 Affected Environment

The visual character of the reserves varies considerably among them and within each reserve but everywhere it is dominated by natural elements. Because of their size, the reserves do not constitute discrete visual units but rather large segments of the Californian landscape. At two reserves, new structures would be sited within potential viewing distance of roadways designated as Scenic Highway by the State of California: Highway 1 (improvement proposed at Landels-Hills Big Creek Reserve) and State Route 74 (improvement proposed at Boyd Deep Canyon Desert Research Center). The Scenic Highway Program was created by the California Legislature in 1963. Its purpose is to protect and enhance the natural scenic beauty of California highways and adjacent corridors through special conservation treatment.

3.4.7.2 Impacts of the Proposed Action Alternative

Depending on the reserve, the proposed action would have **no to minor direct, long-term negative impacts.** Most of the proposed new equipment would be installed in remote, undeveloped, and not easily accessible parts of the reserves. The limited height and footprints of the proposed towers and antennas, the use of neutral, non-reflective paint and of camouflage netting (at the Santa Cruz Island Reserve), as needed, would make them visually unobtrusive.

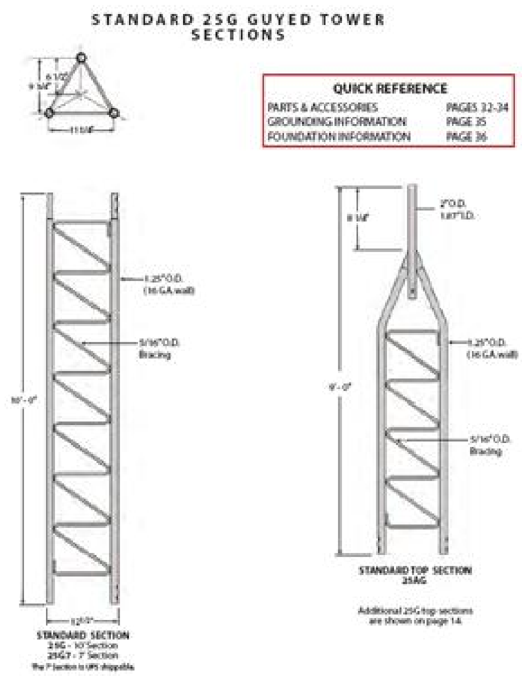

Diagram 3-1 Typical latticed radio tower

The 20-foot towers to be installed at VESR-Camp Valentine, Sagehen Reserve, and Sedgwick Reserve would be light, aluminum latticed structures painted in a neutral color that would help them blend in the landscape (see Diagram 3-1 for an illustration of the type of tower that would be installed). At Camp Valentine, the new tower would be visible from the entrance of the reserve compound, but not off site. At Sagehen, the towers would be in remote, undeveloped areas. At Sedgwick, it would be behind a new building.

Photo 3-3 Repeater site seen from Highway 1

As noted above, in two cases, a proposed new structure is within a relatively short distance of a state designated Scenic Highway. At Landels-Hill Big Creek Reserve, a low-profile repeater station would be set among rocks on a hillside about three quarters of a mile from Highway 1. However, the structure would be hidden by the surrounding rocks and the only part that might potentially be visible from the highway (Whale Point Bridge) would be a 15-inch panel antenna that must reach above the rock to achieve the required line of sight. This panel would be painted in a non-reflective, neutral color and is unlikely to be noticeable from anywhere but a very short distance (see Photo 3-3).

Photo 3-4 Antenna site seen from SR 74 – The red arrow indicates the site

The improvements proposed for Boyd Deep Canyon Desert Research Center include extending an existing eight-foot antenna tower. The tower stands approximately a quarter mile from State Route (SR) 74. The existing tower is eight feet tall and stands next to a 45-foot electrical pole that would provide power for the new equipment (see Photo 2-8). The extension is needed to achieve the required line of sight and would bring the tower to a total height of either 27 or 37 feet, depending on how many modules are needed. The tower would be a latticed aluminum structure to be painted in a non-reflective, neutral color (see Diagram 3-1). It would carry two bridge radios with built-in 15-inch flat panel antennas and a mesh radio, less than 12 square inches. Weather data instruments would be installed near the base of the tower. Only the two bridge radios would be potentially visible from SR 74. Given the distance from the roadway, visual effects would be minimal (see Photo 3-4). At neither site would the proposed action affect trees, rock outcroppings, or historic buildings that contribute to the scenic character of the highway. Any adverse visual impacts, therefore, would be negligible.

3.4.7.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed cyber-infrastructure improvements would not be funded or implemented. This has no potential to affect visual resources. Therefore, there would be **no impacts.**

3.4.7.4 Cumulative impacts of the Proposed Action

Because of their character as conservation and ecological research sites, the reserves are mostly undeveloped. Buildings and infrastructure are limited to what is needed to support staff and visitors. Administrative and other supporting facilities are generally clustered and represent a very small proportion of the reserves' area. While past, ongoing, and future projects have had, and may continue to generate, some impacts on visual quality, these impacts are at most minor, being very localized and not or barely noticeable from outside the immediate vicinity of the project sites. The conservation of the largest part of the reserves in a natural state more than offset these minor impacts.

When added to these minor impacts of past, present, and future projects, the impacts of the proposed action are not expected to make a noticeable difference. Although they vary from reserve to reserve, these impacts range from none to minor at most. They are individually small, very localized, and scattered across large areas, therefore unlikely to combine with the impacts of other projects to result in a noticeable alteration of the visual quality of the reserves or surrounding areas. Thus, when considered in combination with past, present, and future projects, the proposed action would result in **no to minor direct long-term negative cumulative impacts** on visual quality.

3.4.8 Project 8: Microwave Relay Antennas

3.4.8.1 Affected Environment

The three sites where Lowell Observatory would install microwave antennas are low-density research campuses characterized by research (astronomical) and administrative/support facilities. The natural landscape at the Mars Hill site is characterized by gentle slopes and open views over downtown Flagstaff to the east. Ponderosa pine trees dot the property and grow among the different facilities scattered across the site, creating visual buffers between them. The water tank on which the proposed antenna would be mounted is a circular, approximately 36-foot tall structure painted green with a fresco representing an astronomical theme sited among pine trees. The Anderson Mesa site is also gently sloping and dotted with ponderosa pines and pinyon-juniper woodlands. The Happy Jack site is on a partially-mined cinder cone and the facilities there, all of them of recent construction, are more tightly clustered together.

3.4.8.2 Impacts of the No Action Alternative

The proposed microwave antennas would not be set up under this alternative. This would generate **no visual impacts**. Existing conditions would continue.

3.4.8.3 Impacts of the Proposed Action Alternative

The proposed action would result in **negligible direct long-term adverse visual impacts**. As explained in Section 3.3.8.2, the antenna to be place on a water tank at the Mars Hill site would not be noticeable outside the immediate vicinity of the tank. At the Anderson Mesa site, the proposed monopole would be taller than the existing antenna that it would replace by about 14 feet, which would make it about as tall as the nearby Western Dome. Distance, terrain, and intervening trees would make the change in height little noticeable away from the immediate vicinity of the site. The monopole would be painted in a dark, non-reflective neutral color – brown or federal green – that would help it further blend against the background. Lowell Observatory would consult with the US Forest Service to ensure an appropriate choice of color. Similarly, the antenna proposed for the happy Jack site would be painted or covered so it does not overly stand out. Therefore, while the proposed antennas would introduce new visual elements in the landscape, the change from existing or no action conditions would be barely noticeable.

3.4.8.4 Cumulative Impacts of the Proposed Action

Over time, the appearance of Lowell Observatory's three sites has been modified by the addition or renovation of the observatory's physical plant. The current visual characteristics of the sites are the result of these past projects. The most notable recent change has been at the Happy Jack site, with the construction, still under way, of the Discovery Channel telescope and supporting facilities. The project, whose impacts the US Forest Service evaluated in an EA completed in 2004, included features designed to minimize adverse visual effects such as the use of appropriate exterior paints and screening vegetation. One foreseeable future project with potential to have an effect on the site's visual quality is the construction of four new telescopes at the Anderson Mesa site. This project would require a modification to the permit under which the site is operated, and potential visual impacts would be taken into account by the US Forest Service when reviewing the action's potential impacts, as was done with the Discovery Channel Telescope project. Mitigation measures would be identified, as needed. Overall, therefore, ongoing, and foreseeable future projects at the three project sites can be considered to have had moderate direct long-term negative impacts on visual quality. When added to these impacts, the negligible negative visual impacts that would result from the proposed action evaluated in this EA would not make a noticeable difference, as they would add only small, visual unobtrusive, context-appropriate elements to the sites. Consequently, there would be **moderate direct long-term negative cumulative impacts** on visual resources.

3.4.9 Project 9: Greenhouse Replacement

3.4.9.1 Affected environment

Development of UCSB's main campus over time has resulted in a mix of architectural forms and styles. Buildings vary in height, massing, and design. Some of the most significant visual elements and landmarks include the Storke Tower, the Campus Lagoon, the Davidson Library, the University Center, Cheadle Hall, the mature trees along Pardall Mall, Library Mall, UCen Road, and the Campus Green and Squad. Important public views and corridors include points along Ocean Road, the Library Mall, Pardall Mall, the Tower Mall and Storke Plaza, UCen Road, Channel Island Road, and the open space around the Campus Lagoon. The large amount and size of the existing vegetation define much of the campus's aesthetic quality. While the block where the project site is located is fairly typical of the varied architecture of the campus (see Figure 1-10b), it does not contain any of the main features listed above. Building 539 is a typical, ordinary Ranch-style building with a typical low roof, wide overhanging eaves, exterior breezeway, wide window panels that connect interior and exterior, and simple floor plan. It is not considered to have any special aesthetic or historic interest.

3.4.9.2 Impacts of the Proposed Action Alternative

Under the proposed action, Building 539 would be demolished and a 2,700-square-foot greenhouse built in its place; a smaller Alpine Greenhouse would be built on a site currently used for outdoor vehicle storage. While the construction of these new facilities would change the appearance of the affect area, the change would be little visible away from the immediate vicinity due in large part to the relatively small size of the proposed greenhouses compared to the much larger nearby building (Noble and Webb Hall), which, by their bulk, define the general visual character of the block. Construction of the new greenhouses would not affect any of the significant landmarks or view corridors on the campus. Nor would the demolition of Building 539 remove a structure of special aesthetic interest. Therefore, the proposed action would have **no impact** on visual resources.

3.4.9.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new greenhouses would not be built and the existing structures would remain in use. This would result in no **visual impacts**.

3.4.9.4 Cumulative Impacts of the Proposed Action

As the proposed project would result in no visual impacts, it would generate **no cumulative impacts** when considered along with past, present, and reasonably foreseeable future projects.

3.4.10 Project 10: St. Anthony Falls Laboratory Renovations

3.4.10.1 Affected Environment

SAFL is located in central Minneapolis, on an island in the Mississippi River. The setting is urban and largely historic-industrial in character. A general description of the surrounding historic district is provided in Section 3.3.10.1. The dominant visual elements in the vicinity of the project site include the river, SAFL itself, and the Xcel Hydroelectric plant. As previously noted, the SAFL building was constructed in 1938 by the WPA and retains much of its original appearance. SAFL is within the viewshed of the nearby Stone Arch Bridge, a contributing element to the St. Anthony Falls Historic District

3.4.10.2 Impacts of the Proposed Action Alternative

Because of the historic status of SAFL and the surrounding area, impacts to the visual quality of the site are also impacts on historic resources. These impacts are described in Section 3.3.10.2. As noted there, the proposed action has the potential to result in direct impacts to the historically significant appearance of SAFL by altering certain elements of the building such as exterior doors and windows. Indirect impacts on views from the nearby Stone Arch Bridge may also occur, if the proposed instrument-carrying gantry introduces a discordant element in the cityscape. For the reasons explained in Section 3.3.10.2, it is expected that the proposed action would have **minor direct long-term negative impacts** on the visual character of the affected area.

3.4.10.3 Impacts of the No Action Alternative

Under the No Action Alternative, none of the proposed improvements would be implemented. Therefore, there would be **no impacts**.

3.4.10.4 Cumulative Impacts of the Proposed Action

Cumulative visual impacts would be the same as the cumulative impacts to historic resources described in Section 3.3.10.4. There would be **minor direct long-term negative cumulative impacts.**

3.5 Section 106 Review

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, requires federal agencies to integrate consideration of historic preservation issues into the early stages of their planning projects. Under Section 106, the head of any federal agency having direct or indirect jurisdiction over a proposed federal or federally-financed undertaking is required to account for the effects of this action on any district, site, building, structure, or object that is included or eligible for inclusion in the National Register of Historic Places. Eligibility determinations are based on National Register criteria summarized in Table 3-5. Section 106 consultation is conducted in consultation with the State Historic Preservation Officer (SHPO) and/or Tribal Historic Preservation Office (THPO) with jurisdiction over the project area. Regulations governing Section 106 compliance are found at 36 CFR Part 800. As part of their planning, federal agencies must identify eligible properties within the project's area of potential effect (APE) and avoid, minimize, or mitigate any adverse effects.

An adverse effect to a cultural resource occurs when a proposed action would alter any of the characteristics that qualify it for listing in the National Register. Criteria of adverse effects are shown in Table 3-6.

Additionally, NHPA includes provisions that specifically address an agency's responsibility when its activities involve a designated National Historic Landmark (NHL). Section 110(f) outlines specific actions that must be taken when an NHL may be affected by a proposed undertaking. Agencies must "to the maximum extent possible … minimize harm" to NHL.

The section 106 review process includes the following steps:

- Identifying National Register-listed or -eligible properties within the area of potential effects (APE).
- Assessing whether the federal undertaking will have adverse effects on these properties if any; and, if so,
- Through consultation with the SHPO and other consulting parties, as appropriate determine whether the adverse effects can be addressed through avoidance, minimization and/or mitigation.

A description of this evaluation process to date for each project is provided in the following sections. For all projects, the APE is the same as the ROI as defined in Section 3.3: it consists of the project's footprint and the viewshed to the project site.

For the following projects, the Section 106 process is still ongoing: Project 5; Project 8; Project 9; and Project 10. NSF will not move forward with the proposed action until the process is completed.

Table 3-5 - Criteria for Historic Significance

36 CFR 60.4, Part I
The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and: A. That are associated with events that have made a significant contribution to the broad patterns of our history; or B. That are associated with the lives of persons significant in our past; or C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or D. That have yielded, or may be likely to yield, information important in prehistory or history.
36 CFR 60.4, Part II
Ordinarily cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the National Register. However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the following categories: A. A religious property deriving primary significance from architectural or artistic distinction or historical importance; or B. A building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or C. A birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building directly associated with his productive life; or D. A cemetery which derives its primary significance from graves or persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or E. A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or F. A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or G. A property achieving significance within the past 50 years if it is of exceptional importance.

Table 3-6 - Criteria of Adverse Effects

Criteria of Adverse Effect (36 CFR 800.5[a][1])
"An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative."
Examples of Adverse Effects (36 CFR 800.5[a][2])
Adverse effects on historic properties include, but are not limited to: i. Physical destruction of or damage to all or part of the property; ii. Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's *Standards for the Treatment of Historic Properties* (36 CFR Part 68) and applicable guidelines; iii. Removal of the property from its historic location; iv. Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; v. Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features; vi. Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; vii. Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

3.5.1 Project 1: COBCC Building

As explained in Section 3.3.1.1, review of the potential effects of constructing the new Bigelow Laboratory campus on the Farnham Point property by the Maine SHPO under Section 106 found that there would be no historic properties affected and that, pursuant to 36 CFR 800.4(d)(1), no further consultation was required unless further resources are discovered during implementation of the project (see statement of finding dated October 26, 2009 in Appendix A). The proposed COBCC building is a component of the planned campus and as such was included in the evaluation of potential effects for the entire development. Construction of the building would be in compliance with the October 26, 2009 finding. Therefore, there would be **no historic properties affected**.

3.5.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

As explained in Section 3.3.2.1, there are no known historic properties in the project's APE. However, because the entire SERC property has a high potential to contain unknown archaeological resources, such resources may be present within the APE. As explained in Section 3.3.2.2, only one project component – the proposed communication towers – has any potential to affect archaeological resources, if any are present. However, the exact location of the tower has not yet been determined because SERC plans to micro-site each tower to avoid impacts to sensitive resources. SERC would conduct this effort under the supervision of an archaeologist from the Smithsonian's National Museum of Archaeology who is currently conducting archaeological research at the facility. The supervising archaeologist would excavate a shovel test pit at each of the potential micro-sites for the tower footings and guy wire locations and screen the excavated soil for any artifacts. If any are discovered, the siting team would re-adjust the location of the tower so as not to disturb them and the discovery would be documented and reported as part of the ongoing archaeological work at SERC. This monitoring process would ensure that the proposed project results in **no adverse effect to historic properties**. Consultation with the Maryland SHPO on this project was initiated by a letter dated June 3, 2010. The Maryland SHPO reviewed project information and concurred with the finding of no adverse effect on July 7, 2010 (copies in Appendix B).

3.5.3 Project 3: Murray Laboratory

The APE for this project (see map 2 in Appendix C) contains the existing Murray Building (b. 1962), proposed for demolition and replacement, as well as the following buildings: Johnson (b. 1989); Barclay (b. 1992); Willey (b. 1982); Weese (b. 1962); and Old Johnson (b. 1935). None of these buildings is listed on the National Register of Historic Places. As explained in Section 3.3.3.1, a draft National Register nomination form for the town of Gothic was prepared in 1978 but was never completed. Three of the buildings in the APE are older than or close to 50 years and might potentially be eligible for listing in the National Register: Murray, Weese, and Old Johnson.

Because Murray is proposed for demolition, it was evaluated for National Register eligibility using Form 1403 (Colorado Cultural Resource Survey) per the Colorado SHPO's request in its letter dated June 24, 2010 (copy in Appendix C). Murray does not meet National Register Criteria A, B, C, or D. While RMBL as a whole can be considered to have made a significant contribution to science in American history (Criterion A), the Murray Laboratory by itself does not possess significance in this regard. It is one of three existing laboratories currently in use at RMBL and while it is heavily utilized, it was built to provide space for rudimentary microscope work and protection for people working in the property's harsh mountain environment. Murray Laboratory is not associated with the lives of any persons significant in the history of the United States (Criterion B): the laboratory facilities at RMBL serve as a mere bridge between the home institutions of scientists and the natural systems where their research is conducted. Murray Laboratory a pre-fabricated log building and does not embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values (Criterion C). Nor is it likely to yield information important in prehistory or history (Criterion D). Therefore, Murray Laboratory is not eligible for listing in the National Register of Historic Places. The eligibility of Weese and Old Johnson was not evaluated. For the purposes of this evaluation, they may be presumed eligible.

As the Murray Building is not eligible for listing in the National Register, its demolition would not constitute an adverse effect under Section 106. The construction of a new facility at the same location would not result in adverse effects to historic properties for the following reasons: no existing building, other than Murray, would be demolished or otherwise altered as part of the proposed action; the new building would be designed in a manner and with materials consistent with those of the existing buildings in Gothic: it would be a single-story structure clad in a combination of wood, stone and concrete with a sloped metal roof that would easily blend in with the rest of the facility while remaining distinctive enough to avoid mistaking it for a historic structure. Thus, there would be no visual adverse effects. Finally, as explained in Section 3.3.3.1, the area of ground-disturbance within the APE has low archaeological potential. Additionally, should archaeological resources be discovered during construction, work would cease and RMBL would consult with the Colorado SHPO to evaluate the find.

Therefore, the proposed project would result in **no adverse effects to historic properties**. After reviewing project information, the Colorado SHPO concurred with this finding by letter dated July 28, 2010 (copy in Appendix C). Additionally, informal consultation with Ms. Joanne Williams, Gunnison County Director of Community Development and Mr. David Primus, Chair of the Gunnison County Historic Preservation Commission has indicated that the County has no concern about the project or foresees any adverse effects to historic resources.

3.5.4 Project 4: Moe Pond Laboratory

This only building in the APE for this project is the existing laboratory building, a wood shed on concrete blocks erected in 1967. This building is not eligible for listing in the National Register. The APE contains what appear to be foundation remnants. In spring 2010, a Phase 1a and b survey was conducted to determine whether National Register-eligible archaeological resources may be present. The survey found no significant archaeological deposits or artifacts. It was submitted for review to the New York SHPO. In a response dated July 27, 2010, the SHPO requested that more field work be conducted (copy in Appendix D). Following further informal consultation with the SHPO, the report was revised and submitted for final review. In a letter dated August 6, 2010 (appendix D), the SHPO found that the site does not qualify for listing in the National Register, and that, therefore, the project would have **no effect** on historic properties.

3.5.5 Project 5: Wawona Field Station Renovations

As explained in Section 3.3.5.1, Building 4050, proposed for renovations and upgrades, is a contributing element to the National Register-listed Wawona Historic District. The building is operated by UC-Merced under a Special Use Permit from the National Park Service (NPS), which own the property. Review and approval of the proposed work by NPS would be required before it can proceed. NPS will review the potential effects of the proposed renovations and upgrades pursuant to the *Programmatic Agreement Among the National Park Service at Yosemite, the California State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding Planning, Design, Construction, Operations and maintenance, Yosemite National Park, California* (1999) and the *Service-wide Programmatic Agreement Among the National Park Service (U.S. Dept. of the Interior), the Advisory council on Historic Preservation, and the National Conference of State Historic Preservation Officers* (1995). Only those project elements approved by NPS will be implemented. Compliance with the terms and conditions under which NPS will approve the project will ensure that it results in **no adverse effect** to historic properties.

3.5.6 Project 6: Northwest Indian College Laboratory

The proposed laboratory would be constructed in the Phase II area of the new South Campus. As explained in Section 3.3.6.1, the entire South Campus site was evaluated for the presence of historic properties in 2004 as part of an environmental assessment for the entire campus master plan. All identified resources were located in the Phase I area and by letter dated April 19, 2004, the Lummi Nation Tribal Historic Preservation Officer (THPO) concurred with the mitigation measures to be implemented to avoid any adverse impacts to these resources (copy in Appendix E). Since there are no historic properties in the APE for this project, there would be **no historic properties affected** by the proposed action. A letter was sent to the THPO requesting comments on this project on May 6, 2010 and the Draft EA was submitted for review. No responses have been received.

3.5.7 Project 7: Multi-site Cyber-infrastructure Improvements

As explained in Section 3.3.5.2, while the different reserves where the proposed cyber-infrastructure improvements would be implemented are known to, or may, contain archaeological resources, the potential for adverse effects to known or unknown archaeological resources is minimal for the following reasons: the very small footprint of ground disturbance; the careful placement of the proposed equipment outside known archaeological areas and review by each reserve's staff of the archaeological sensitivity of the spots where installing new equipment would require digging; and, in case of inadvertent discovery, interruption of all activities and evaluation of the find by a qualified archaeologist in consultation with the California SHPO and other parties, as appropriate. Of the buildings on or near which new equipment would be installed, only one is known to be eligible for listing in the National Register: the Shane Telescope Dome at the UC Observatory/Lick Observatory, on which a six-foot diameter parabolic microwave antenna would be installed. In May 2010, UC Santa Cruz prepared a *Finding of Effect and CEQA Impacts Analysis* for this action. The analysis concluded that “the proposed project would not materially detract from any of the character defining features of the Shane Telescope Dome, and because it would not alter the characteristics that qualify it for listing in the National Register of Historic Places and California Register of Historical Resources, including its setting, the installation of project components would cause no substantial adverse change to the resource.” No other buildings where new equipment would be installed are known or likely to be eligible for listing in the National Register because of their recent construction (e.g., Tipton Building) or the substantial alterations they have undergone (Staples Cabin). In a letter dated July 14, 2010 (Appendix F), the California SHPO, after reviewing project information, concurred that the project would have **no effect on historic properties**.

3.5.8 .Project 8: Microwave Relay Antenna

The APE at two of the three sites where the proposed antennas would be installed – Anderson Mesa and Happy Jack – contains no National Register-listed or -eligible historic properties. At neither site would the proposed action involve any significant amount of ground-disturbing work. Both sites are operated by Lowell Observatory under Special Use Permits from the US Forest Service. The Forest Service has reviewed the activities proposed at the Anderson Mesa and Happy Jack sites under the *Programmatic Agreement Regarding Cultural Property Protection and Responsibilities Among The New Mexico Historic Preservation Division, and Arizona State Historic Preservation Office, and Texas State Historic Preservation Office, and Oklahoma State Historic Preservation Office, and The Advisory Council on Historic Preservation, and the United States Department of Agriculture, Forest Service, Region 3*, dated April 2, 1990 and determined that they do not “have the potential to cause effects on historic properties...."as defined in 36 CFR 800.3(a) and (a)(1); FSM R-3 2361.24.1.c.” A copy of this finding is in Appendix G.

As explained in Section 3.3.8.1, the APE at Mars Hill includes a National Register-listed historic district and National Historic Landmark (NHL). The water tank on which the proposed antenna would be mounted, built in 1994, is not a contributing element to the district. It currently has a ladder and power source available at the location where the antenna would be installed and no ground-disturbing activities would be required to connect the antenna. Installing the proposed antenna would have no direct effect on any of the contributing historic resources. Nor would it have adverse visual effects, for the reasons stated in Section 3.3.8.2. Therefore, the proposed action would not alter, directly or indirectly, any of the characteristics of the site that qualify it for listing in the National Register, nor would it result in cumulative effects that would alter the historic integrity of the site. The installation of equipment designed to facilitate continued scientific research at Lowell Observatory is fully compatible with the historic significance of the property as a scientific campus dedicated to astronomical research.

The following consulting parties were identified and consulted: the National Park Service (for the Mars Hill site, which contains an NHL); the US Forest Service (for the Anderson Mesa and Happy Jack sites); the Federal Communications Commission; the City of Flagstaff Historic Preservation Commission; the Fort Mojave Indian Tribe; the Havasupai Tribe; the Hopi Tribe; the Hualapai Tribe; the Navajo Nation; the Yavapai-Apache Nation; the Yavapai-Prescott Indian Tribe; and the Pueblo of Zuni.

The US forest Service, as indicated above, has conducted its own review of the project under the 1990 Programmatic Agreement with respect to the Anderson Mesa and Happy Jack sites and found that the proposed action has no potential to affect historic properties. The Federal Communications Commission has declined to participate in the review process and informally indicated its intention to adopt NSF's finding, as needed, for any future decisions it may have to make with respect to the proposed antennas. The Yavapai-Prescott Indian Tribe and Hopi Tribe have expressed no concerns with respect to the proposed action. The other parties have not responded to the original letters or follow-up calls placed after 30 days.

On this basis, it is expected that the project would **have no adverse effects on historic properties**. Project information was submitted to the Arizona SHPO for review and concurrence (letter sent on August 5, 2010). The SHPO returned the letter with a stamp indicating concurrence dated August 13, 2010 (copy in Appendix G).

3.5.9 Project 9: Greenhouse Replacement

There are no National Register-listed historic properties at UCSB or the APE for the project. Because Building 539, which would be demolished to construct the proposed 2,700-square-foot greenhouse, was built in 1961 and would be 50 years old at the time of implementation, its eligibility was evaluated. In the 1960s and subsequent years, the building was used by renowned plant scientist Katherine Esau (1898-1997) to conduct botanical research. Eligibility under Criterion B was considered but dismissed because, although the building's appearance and layout have remained the same since professor Esau worked there, all the equipment and other documents or artifacts that have survived from her tenure at UCSB have been moved to the Cheadle Center for Biodiversity and Ecological Restoration, also on the Main Campus. Several former associates of Professor Esau have indicated that they do not consider the building to be significantly associated with her work. Building 539 is now used for administrative functions and has retained only a minimal connection with the memory of Professor Esau. The building is not eligible under Criterion A because it is not associated with events that have made a significant contribution to the broad patterns of American or Californian history. It is not eligible under Criterion C because it does not embody the distinctive characteristics of a type, period, or method of construction. Finally, it is not eligible under Criterion D because it is not likely to convey information important in prehistory or history. Therefore, Building 539 is not eligible for listing in the National Register of Historic Places. As explained in Section 3.3.9.1, because of previous disturbance, the potential for archaeological resources to be present within the APE is minimal. Therefore, **no historic properties would be affected**. The SHPO concurred with this finding by letter dated July 27, 2010 (copy in Appendix H).

3.5.10 Project 10: St. Anthony Falls Laboratory

As explained in Section 3.3.10.1, SAFL is a contributing element to the National Register-listed St. Anthony Falls Historic District. As stated in Section 3.3.10.2, some of the proposed renovations have the potential to affect the historic integrity of the SAFL facility and, indirectly, of the historic district. Consultation was conducted with the following parties: SAFL; The Minnesota SHPO; the National Park Service; the Minneapolis Heritage Commission; and the Minneapolis Riverfront Corporation. NSF also invited comments from the Minnesota Indian Affairs Council and the following Native American tribes: the Flandreau Santee Sioux, Lower

Sioux Indian Community Council, Prairie Island Indian Community, Santee Sioux Nation, Sisseton-Wahpeton Oyate of the Lake Traverse Reservation, Spirit Lake Tribal Council, and Upper Sioux Community of Minnesota. To date, no expressions of interest have been received from the tribes.

At a meeting held on June 15, 2010 and during previous and subsequent discussions, the parties agreed that at this stage, there is no sufficient information to meaningfully evaluate the intensity of the potential effects of the proposed action on the historic integrity of the building. Additionally, the parties understood that plans at a sufficient level of detail to allow for review and evaluation could not be developed before the proposed ARI-R2 funding is obtained. Therefore, pursuant to 36 CFR 800.14(b)(1)(ii), the parties have executed a Programmatic Agreement (PA) that defines the process through which the proposed improvements will be reviewed and approved prior to being implemented to ensure that any potential adverse effects are avoided, minimized, or mitigated. A copy of the PA and associated correspondence is provided in Appendix I.

3.6 Air Quality

3.6.1 Introduction

Air quality can be affected by the air pollutants emitted by vehicular traffic and other transportation activities (mobile sources) and those emitted by exhaust stacks and vents connected to furnaces, boilers, or generators (stationary sources). Smoke from open burning, dust from soil-disturbing activities, and noxious odors also affect air quality.

Air quality in any given location is defined by the concentration of various pollutants in the atmosphere, generally expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). The significance of a pollutant concentration is determined by comparing it to federal and/or state ambient air quality standards. These standards represent the maximum allowable atmospheric concentrations that can occur while still protecting public health and welfare with a reasonable margin of safety.

The US environmental Protection Agency (EPA), under the requirements of the 1970 Clean Air Act (CAA) as amended in 1977 and 1990, has established National Ambient Air Quality Standards (NAAQS) for six contaminants, referred to as criteria pollutants (40 CFR 50). These pollutants are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} – diameter equals to or is less than 10 microns and $PM_{2.5}$ - diameter equals to or is less than 2.5 microns), lead (Pb), and sulfur dioxide (SO_2). The NAAQS are defined as the maximum acceptable ground-level concentrations over applicable averaging periods for an individual criteria pollutant. Ozone is a secondary pollutant formed in the atmosphere by photochemical reactions of precursors pollutants: nitrogen oxides (NO_X) and volatile organic compounds (VOCs). The NAAQS are shown in Table 3-7.

All but one of the states where the projects considered in this EA are located have adopted the NAAQS for their own air quality standards. However, the California Air Resources Board (CARB) has established state standards, termed the California Ambient Air Quality Standards (CAAQS), for the CAA criteria pollutants as well as other pollutants for which there are no national standards. The CAAQS are shown in Table 3-7 as well.

Existing air quality conditions at the different project sites are determined by the NAAQS status for the county or region where each site is located. Areas with air pollutant concentrations below the NAAQS for a criteria pollutant are designated in attainment for this pollutant; areas where a criteria pollutant level exceeds the NAAQS are designated in nonattainment. The majority of the proposed projects are in areas where all regulated pollutant concentrations are below the NAAQS; however, several locations are in a nonattainment area for O_3, PM_{10} and/or $PM_{2.5}$ as shown in Table 3-8.

Table 3-7 - National and California Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards	National Standards[a]	
			Primary[b]	Secondary[c]
Ozone	8-hour	0.07 ppm	0.075ppm	Same as Primary
	1-hour	0.09 ppm	---	---
Carbon Monoxide	8-hour	9 ppm	9 ppm	None
	1-hour	20 ppm	35 ppm	---
Nitrogen Dioxide	Annual	0.03 ppm	0.053 ppm	Same as Primary
	1-hour	0.18 ppm	0.1 ppm	None
Sulfur dioxide	Annual	---	0.03 ppm	---
	24-hour	0.04 ppm	0.14 ppm	---
	3-hour	--	---	0.5 ppm
	1-hour	0.25 ppm	0.075 ppm	None
PM_{10}	Annual	20 µg/m^3	---	---
	24-hour	50 µg/m^3	150 µg/m^3	Same as Primary
$PM_{2.5}$	Annual	12 µg/m^3	15 µg/m^3	Same as Primary
	24-hour	---	35 µg/m^3	Same as Primary
Lead	Rolling 3-Month Average	---	0.15 µg/m^3	Same as Primary
	Quarterly Average	---	1.5 µg/m^3	Same as Primary
	30-day average	1.5 µg/m^3	---	---

Notes:

(a) Other than for ozone, PM_{10} and $PM_{2.5}$ and those based upon annual averages, standards are not to be exceeded more than once per year. The ozone standard is attained when the fourth highest eight hour concentration in a year, averaged over three years is equal to or less than the standard.PM_{10} should not to be exceeded more than once per year on average over 3 years. The $PM_{2.5}$ 24-hour standard is attained when the annual highest 98th percentile of 24-hour concentration over 3 years is below 35 µg/m^3. One-hour NO_2 standard is based on the 98th percentile level over 3 years. The one-hour SO_2 standard is based on the 99th Percentile level over 3 years.
(b) Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. Each state must attain the primary standards no later than 3 years after that state's implementation plan is approved by the EPA.
(c) Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a "reasonable time" after the EPA approves the implementation plan.

µg/m^3 = micrograms per cubic meter
$PM_{2.5}$ = particulate matter equal to or less than 2.5 microns in diameter
PM_{10} = particulate matter equal to or less than 10 microns in diameter
ppm = parts per million

Table 3-8 - NAAQS Attainment Status by Research Institution Location

Project	Location	Air Basin	NAAQS Status		
			O_3	PM_{10}	$PM_{2.5}$
Project 1	Lincoln Co., ME		A	A	A
Project 2	Anne Arundel Co., MD	Baltimore	N (Moderate)	A	N
Project 3	Gunnison Co., CO		A	A	A
Project 4	Otsego Co., NY		A	A	A
Project 5	Mariposa Co., CA	Mariposa and Tuolumne (Southern Mtn)	N (Moderate)	A	A
Project 6	Whatcom Co., WA		A	A	A
Project 7					
Angelo Coast Range	Mendocino Co., CA		A	A	A
Blue Oak Ranch	Santa Clara Co., CA	San Francisco Bay Area	N (Marginal)	A	N
Coal Oil Point	Santa Barbara Co., CA		A	A	A
CSFRS Sagehen	Nevada Co., CA	Nevada (Western Part)	N (Moderate)	A	A
CSFRS Chickering	Placer Co., CA	Sacramento	N (Severe)	A	N
Dawson	San Diego Co., CA	San Diego	N (Moderate)	A	A
Elliott Chaparral	San Diego Co., CA	San Diego	N (Moderate)	A	A
Hastings	Monterey Co., CA		A	A	A
James San Jacinto	Riverside Co., CA	Riverside (Coachella Valley)	N (Serious)	N (Serious)	A
Landels	Monterey Co., CA		A	A	A
Motte Rimrock	Riverside Co., CA	Los Angeles South Coast Air Basin	N (Severe)	N (Serious)	N
Santa Cruz Island	Santa Barbara Co., CA		A	A	A
Sedgwick	Santa Barbara Co., CA		A	A	A
Sweeney Granite	San Bernardino Co., CA	Los Angeles-San Bernardino (Western Mojave)	N (Moderate)	A	A
Valentine Camp	Mono Co., CA	Mammoth Lake	A	N (Moderate)	A
SNARL	Mono Co., CA	Mammoth Lake	A	N (Moderate)	A
Boyd Deep Canyon	Riverside Co., CA	Riverside (Coachella Valley)	N (Serious)	N (Serious)	A
Project 8	Coconino Co., AZ		A	A	A
Project 9	Santa Barbara Co., CA		A	A	A
Project 10	Hennepin Co., MN		A	A	A

Notes:
A = Attainment
N = Nonattainment with classifications in parentheses
Project locations in non-attainment areas are highlighted.

In areas where the NAAQS are exceeded, the CAA requires the preparation of a State Implementation Plan (SIP) that details how a state will attain the standards within a mandated time frame. Specific requirements and compliance dates are based on the severity of the air quality standard violation.

Under Section 176(c) of the act, a project is in "conformity" if it corresponds to a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS, and achieving the expeditious attainment of the standards. Conformity further requires that such activities would not:

1. Cause or contribute to any new violation of any standard in any area.
2. Increase the frequency or severity of any existing violation of any standard in any area.
3. Delay the timely attainment of any standard or any required interim emission reduction or other milestone in any area.

The EPA published final rules on general conformity (40 CFR Parts 51 and 93 in the Federal Register on November 30, 1993) that apply to federal actions in areas in nonattainment for any of the criteria pollutants. The rules were last revised on March 24, 2010. They specify *de minimis* emission levels by pollutant, as presented in Table 3-9, to determine the applicability of conformity requirements for a project. A formal conformity determination is required when the annual net total of direct and indirect emissions from a federal action occurring in a nonattainment area equals or exceeds the applicable annual *de minimis* levels. If a federal action meets the *de minimis* requirements, it is exempt from further conformity analysis pursuant to 40 CFR Part 93.153 and is considered to have minimal air quality impacts. Several projects sites are located in nonattainment areas and, therefore, a quantitative general conformity applicability analysis is required for those projects.

Table 3-9 - *De Minimis* Thresholds in Nonattainment Areas

<table>
<tr><th>Pollutant</th><th>Degree of nonattainment</th><th>De Minimis (tons/year)</th></tr>
<tr><td rowspan="5">O_3 (VOCs and NO_x)</td><td>Serious</td><td>50</td></tr>
<tr><td>Severe</td><td>25</td></tr>
<tr><td>Extreme</td><td>10</td></tr>
<tr><td>Marginal and Moderate (outside an ozone transport region)</td><td>100</td></tr>
<tr><td>Marginal and Moderate (outside an ozone transport region)</td><td>50</td></tr>
<tr><td>CO</td><td>All</td><td>100</td></tr>
<tr><td>PM_{10}</td><td>Moderate</td><td>100</td></tr>
<tr><td>$PM_{2.5}$</td><td>Nonattainment</td><td>100</td></tr>
<tr><td>SO_2 or NO_2</td><td>All</td><td>100</td></tr>
<tr><td>Lead</td><td>All</td><td>25</td></tr>
</table>

For those projects located in attainment areas, no quantitative impact thresholds have been defined. Air quality impacts from these projects are evaluated qualitatively based on the intensity definitions presented in Table 3-10.

Table 3-10 - Air Quality Impact Intensity Scale

Intensity	Description
Negligible	The alternative would result in a change to air quality that would be so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would result in a detectable change to air quality, but the change would be small and localized and of little consequence.
Moderate	The alternative would result in a measurable and consequential change to air quality. Mitigation measures may be necessary to offset adverse impacts and likely be successful.
Major	The alternative would result in a substantial change to air quality; the change would be measurable and result in a severely adverse or major beneficial impact. Extensive mitigation measures to offset adverse impacts would be needed to offset adverse impacts and their success could not be guaranteed.
Duration:	Short-term – occurs only during the construction period. Long-term – occurs or continues after the construction period.

3.6.2 All Projects: Proposed Action Alternative

3.6.2.1 Construction-Related Short-Term Impacts

All projects would have **negligible** (Projects 2, 5, 7, 8, and 10) **to minor** (Projects 1, 3, 4, 6, and 9) **short-term direct negative impacts** because of the air emissions that would result from the construction activities associated with each project. The principal pollutants emitted during typical construction projects are PM_{10} and $PM_{2.5}$ from the fugitive dust created during clearing, grubbing, excavation, and grading; demolition of structures and pavement; vehicle travel on unpaved roads; and material blown from unprotected graded areas and stockpiles. Generally, the distance that particles drift from their source depends on their size, emission height, and wind speed. About 50 percent of fugitive dust is made up of relatively large particles, greater than 100 microns in diameter. These particles are responsible for the reduced visibility often associated with construction as well as the nuisance caused by the deposition of dust on vehicles and in exterior areas. Given their relatively large size, these particles tend to settle within 20 to 30 feet of their source. Smaller particles, less than 100 microns in diameter, can travel several hundred feet before settling to the ground, depending on wind speed. A secondary source of pollutants during construction is from engine exhaust of construction equipment generating precursors to O_3.

However, construction-related emissions are, by definition, temporary and would cease after the building is complete. Additionally, they are unevenly distributed and generally highest during the early stages of construction decreasing quickly after the earth-moving activities associated with site preparation and foundation work end. Finally, standard best management practices (BMP) – such as watering to control dust plumes, covering trucks when hauling dust, seeding dirt piles if not removed immediately, re-vegetate disturbed land as soon as possible, and limiting as much as possible equipment and vehicle idling – would be implemented to minimize impacts while they last. This, in conjunction with the modest to minimal size of all the projects ensures that construction-related adverse impacts on air quality remain minor for those projects involving building demolition and construction (Projects 1, 3, 4, 6, and 9) and negligible for those projects involving primarily renovation work or the installation of communication equipment (Projects 2, 5, 7, 8, and 10).

3.6.2.2 Operational Long-Term Impacts

Long-term adverse impacts to air quality may result from the creation of a new source of air emissions or an increase in the use of an existing source. Projects 2, 5, 7, 8, and 10, which involve the renovation of existing facilities or the installation of communication equipment, would do neither. Therefore, **Projects 2, 5, 7, 8, and 10 have no potential to have long-term impacts** on air quality. The other projects, which involve the construction of new facilities that would have to be heated, cooled, and ventilated, could result in long-term impacts to air quality. The impacts of these projects would range from none to minor, as explained below. Because air quality is a regional concern affected by conditions over a large area, the cumulative impacts that each project would generate when considered along with past, present, and foreseeable future projects cannot be readily evaluated. However, because all the projects that have the potential to generate some air emissions in the long term are located in attainment areas, and these emissions, as explained below, would be at most minor, it can be expected that any adverse cumulative impacts to air quality would be no more than minor.

Project 1: COBCC Building

This project would have **minor direct long-term negative impacts**. Because the proposed COBCC building would not have its own boilers but would be served, along with the rest of the Bigelow Laboratory campus, by the gas-powered central plant to be constructed as part of Phase I of the new campus, its specific impacts on air quality cannot be meaningfully distinguished from those of the large campus. Overall, the operation of the campus, including the proposed COBCC building, would generate air emissions; however, because the new campus would replace the existing campus, the new emissions would be partly offset by the end of the existing ones. Additionally, sustainability measures incorporated in the design would minimize long-term emissions by minimizing the building’s energy requirements. Coupled with building-based energy recovery, this centralized approach to energy management is expected to considerably reduce the Laboratory’s annual operational costs. Bigelow Laboratory projects that the annual heating and cooling cost savings for the new laboratory would exceed 45% of the cost of a conventional laboratory of the same size. The minimization of energy costs would translate directly into minimization of the air emissions associated with heating and cooling the building. The new laboratory would have a number of ducted fume hoods discharging through roof vents. The hoods would be used for biological and geo-chemical sample processing. The laboratory would install hoods that are designed to reduce and neutralize any discharge of noxious fumes with makeup air. Based on the above considerations, the long-term impacts on air quality from the operation of the proposed COBCC building and new Bigelow Laboratory Campus would be minor.

Project 3: Murray Laboratory

This project would have **negligible long-term direct negative impacts** on air quality. Heating and cooling for the proposed new building would be provided by a highly energy-efficient ground coupled geothermal heat pump. The new building would be larger than the existing Murray building but it would also be more energy efficient. Chemicals would be intermittently used in the new facility, as they are in the existing laboratories, though operations involving highly volatile chemicals are conducted at off-site locations. The proposed new laboratory would incorporate chemical fume hoods for intermittent use during the sample preparation process and have the necessary equipment to provide intermittent air, gas, or vacuum service for select analytical procedures. Because of the nature of the work conducted at the site, such needs would be occasional, though somewhat more common than under current conditions. However, it would not reach such levels as to become a concern. Any impacts to local air quality from the use of the hoods would be negligible.

Project 4: Moe Pond Laboratory

This project would have **negligible long-term direct negative impacts** on air quality. The new laboratory at the Upper Research Station would be more versatile than the existing one and provide opportunities for more research-related activities. To support this increased activity, it would be fitted with a fume hood and a six-kilowatt propane-fired fuel cell with battery storage bank and electrical inverter to provide the electricity. Thus, the proposed action may result in a small increase in the emissions generated at the site. However, the new laboratory would be a small facility with limited energy needs and it would not be continuously in use. Under New York regulations, stationary or portable internal combustion engine powered by diesel or natural gas that are located outside any severe ozone nonattainment areas and have maximum mechanical power rating of less than 400 brake-horsepower are exempted from air permitting requirements (6 NYCRR III Subpart 201-3.2). The proposed fuel cell is expected to fall below this threshold. Any impacts on local air quality would be negligible.

Project 6: Northwest Indian College Laboratory

This project would result in **no long-term impacts** to air quality. Operation of the new laboratory would result in no new air emissions because the building would generate its own electricity for heating, cooling, and lighting through a 26-kW photovoltaic system installed on the roof. The system would be capable of generating approximately 28,600 kWh per year. Based on the electrical consumption of similar facilities, it is expected that this would actually generate a surplus relative to the building’s needs (NWIC, 2009).

Project 9: Greenhouse Replacement

This project would result in **no long-term impacts** to air quality. Operation of the new greenhouses would not result in an increase in air emissions. No new stationary emission source would be added to those already present on campus. While the new greenhouses would be larger than the existing ones, potentially requiring more energy to maintain at the required temperature, any increase in energy consumption would be largely offset by the more efficient climate-control systems and the elimination of Building 539. Therefore, there would be no impacts.

3.6.3 All Projects: No Action Alternative

The No Action Alternative has no potential to affect air quality at any of the project sites because no construction activities would take place and no new facilities would be built and operated. Existing conditions would continue as at present along with current operations and their associated emissions. There would be **no impacts**.

3.6.4 Clean Air Act Conformity

A General Conformity Rule (GCR) analysis was performed for those projects that would take place in non-attainment areas (see Table 3-8). The analysis was conducted in accordance with the guidance provided in the final rules for *Determining Conformity of General Federal Actions to State or Federal Implementation Plans* (USEPA, November 30, 1993 and March 24, 2010). Under the GCR, reasonably foreseeable emissions associated with all operational and construction activities, both direct and indirect, must be quantified and compared to the annual *de minimis* applicable to the pollutants for which the area is in nonattainment (the *de minimis* thresholds are shown in Table 3-9). Per the GCR, if the emissions of a criteria pollutant (or its precursors) do not exceed the *de minimis* level, the federal action has minimal air quality impact and is determined to conform for the pollutant under study; no further analysis is necessary. Conversely, if the total direct and indirect emissions of a pollutant are above the *de minimis* level, a formal general conformity determination is required for that pollutant.

Emissions would result from the operation of construction equipment, trucks, and workers' commuting vehicles during the construction phase of the projects. There would be no operational emissions once the projects are completed. To estimate construction-related emissions, the type of equipment that would be used, the likely duration of each activity, and manpower requirements were projected based on the available project information described in Chapter 2 and using planning level estimating factors provided in the 2003 *RSMeans Facilities Construction Cost Data* manual. All constructions activities were assumed to take place within one calendar year.

Emissions from construction equipment were modeled based on estimated hours of equipment use and emission factors for each type of equipment from the EPA's NONROAD emission factor model (2008). The emission factors predicted by this model (in grams of pollutant per hour per horsepower) were multiplied by the estimated running time and equipment average horsepower to calculate the total grams of pollutant from each piece of equipment. Finally, the total grams of pollutant were converted to tons of pollutant.

The USEPA recommends the following formula to calculate hourly emissions from nonroad engine sources including cranes, backhoes, etc.:

Mi = N x HP x LF x EFi

where:

Mi = mass of emissions of ith pollutants during inventory period;
N = source population (units);
HP = average rated horsepower;

LF = typical load factor; and
EFi = average emissions of ith pollutant per unit of use (e.g., grams per horsepower-hour).

Emission factors for trucks (including dump and delivery trucks that were modeled as heavy-duty diesel vehicles) were predicted using the EPA Mobile 6.2 Emission Factor model (October 2002) with the national default input parameters. The modeled emission factors were then multiplied by the projected vehicle operation hours to determine total vehicular emissions.

The modeled annual NO_x and VOC (O_3 precursors), PM_{10}, $PM_{2.5}$ and SO_2 ($PM_{2.5}$ precursor) emissions from the construction activities associated with each of the projects are shown in Tables 3-11 and to 3-13. As can be seen, annual emissions would not exceed the applicable *de minimis* criteria. Therefore, a formal conformity determination is not required for the proposed action and air quality impacts would not be significant.

Table 3-11 - Total Annual Emissions - Project 2

Emission Source	Pollutant Emissions (tons/year)			
	SO_2	$PM_{2.5}$	NO_x	VOC
Construction Equipment	0.02	0.07	0.94	0.24
Motor Vehicles	0.00	0.01	0.41	0.05
Total Emissions	0.02	0.08	1.34	0.28
***De Minimis* Level**	100	100	100	50

Table 3-12 - Total Annual Emissions - Project 5

Emission Source	Pollutant Emissions (tons/year)			
	SO_2	$PM_{2.5}$	NO_x	VOC
Construction Equipment	0.06	0.02	0.06	0.02
Motor Vehicles	0.02	0.00	0.02	0.00
Total Emissions	0.08	0.02	0.08	0.02
***De Minimis* Level**	100	100	100	100

Table 3-13 - Total Annual Emissions - Project 7

Emission Source	Pollutant Emissions (tons/year)			
	SO_2	$PM_{2.5}$	NO_x	VOC
Construction Equipment	0.00	0.01	0.01	0.16
Motor Vehicles	0.00	0.00	0.00	0.04
Total Emissions	0.00	0.01	0.01	0.20
***De Minimis* Level**	100	70	100	25

3.7 Noise

Noise, which can be defined as unwanted sound, is a common impact of many daily activities. Common sources of noise include traffic and other modes of transportation such as trains and aircraft; construction activities involving the use of heavy equipment; and industrial activities. While noise is a common feature of modern life, it has the potential to become disruptive when it reaches a given intensity. Noise intensity is generally measured in decibels (dB) that can be weighted to better reflect actual perception. The most common weighted unit is the A-weighted dB (dBA), which takes into account the response of the human ear to noise frequency. The significance of noise impacts is a function of the intensity of the noise associated with a proposed action and the presence of noise-sensitive receptors whose activities may be disrupted by the noise. Sensitive receptors include residences, schools, hospitals, places of worship, and recreational areas. Most of the project sites are located well away from any sensitive receptors.

None of the proposed projects would result in any significant long-term increase in the amount or intensity of noise generated at the project sites. All the projects involving non-trivial amounts of construction work would generate noise from the operation of mechanical equipment and the movement of trucks and workers' vehicles to and from the site. According to the Occupational Safety and Health Administration (OSHA), noise levels typically range from 93 dBA to 107 dBA at construction sites. The noise generated by construction tools typically ranges from 65 dBA to 110 dBA. A heavy truck typically creates a noise level of approximately 90 dBA at a distance of 50 feet, and a "backup" alarm on a truck can range from 90 to 95 dBA. By definition, however, these impacts are intermittent and temporary. Additionally, noise levels depend heavily on atmospheric conditions and decrease quickly with distance from the site through divergence, atmospheric absorption, shielding by intervening structures, and absorption and shielding by ground cover.

Because of the low potential of the projects comprising the proposed action to generate noticeable noise impacts, these impacts are evaluated qualitatively only based on the scale shown in Table 3-14.

Table 3-14 - Noise Impact Intensity Scale

Intensity	Description
Negligible	The alternative would result in a change to noise levels that would be so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would result in a detectable change to noise level, but the change would be small and localized and of little consequence.
Moderate	The alternative would result in a measurable and consequential change to noise levels and may cause annoyance. Mitigation measures may be necessary to offset adverse impacts and likely be successful.
Major	The alternative would result in a substantial change to noise levels; the change would be measurable and result in a severely adverse or major beneficial impact. Extensive mitigation measures to offset adverse impacts would be needed and their success could not be guaranteed.
Duration:	Short-term – occurs only during the construction period. Long-term – occurs or continues after the construction period.

3.7.1 Project 1: COBCC Building

3.7.1.1 Affected environment

The site of the proposed COBCC building and the larger, future Bigelow Laboratory campus is currently undeveloped and harbors no noise generating activities. The primary source of noise in the vicinity is from construction activities and vessel idling at the nearby boatyards, Washburn & Doughty and Hodgdon Yachts, located to the north and northwest of the project site, respectively. The surrounding land uses consist of residential single-family year-round and seasonal homes.

Chapter 375 Section 10 of Maine's Site Location Development Law, Control of Noise specifies that routine operation of a new development must not exceed 75 dBA at any time of day at the property line. The regulation also includes restrictions regarding noise levels (depending on the duration) during night-time construction activities. Noise related to "Watercraft while underway" and forest management is exempt from this regulation.

The Town of Boothbay's Noise Ordinance, Section 5.1.12 of the Administrative Code prohibits unreasonable noise, specifically during nighttime hours between 9 PM and 7 AM. Unreasonable noise includes excessive sound that disturbs or endangers the neighboring community. This includes unnecessarily revving engines and using vehicles without noise-preventing mufflers. Applications for a Special Sound Permit can be submitted for authorization of any noise that would otherwise be considered unreasonable.

3.7.1.2 Impacts of the Proposed Action Alternative

The project would have **moderate short-term direct and negligible long-term direct adverse impacts** on noise levels. There would be no indirect impacts. Construction of the proposed COBCC would generate noise from the operation of construction equipment, trucks, and personal vehicles. The noisiest phase of the project would be early, when the site is cleared of vegetation and the building's foundations are laid out. Because of the shallowness of the soils in the project area, blasting would be required before laying out foundations. This would be done for the entire campus and all measures included in the blasting permit would apply to the site of the COBCC building. All blasting would be performed under the supervision of a licensed professional and prior to conducting it, the project contractor would be required to submit an impact assessment, including vibration and noise, and a blasting plan documenting compliance with all applicable standards and requirements (Bigelow, 2009). Blasting operations would cause bursts of loud noise that may cause temporary annoyance among the site's neighbors. However, the following factors would contribute to minimizing this adverse effect: the project site is located near the center of the property and noise and vibrations would be attenuated by distance and the surrounding forest; blasting operations would be conducted during the day at times when the noise is least likely to disturb people in their homes; the dates and times of the blasting operations would be advertised in advance; finally, these operations would take place over a short period of time and cease entirely once the site is cleared. Noise levels would considerably decrease after this phase is complete and would be those typical of a medium scale construction project. No construction activities would take place at night. Any noise would continue to be muffled by the surrounding forest. Overall, therefore, construction-related noise impacts would be moderate. In the long term, the new COBCC building itself would not generate more than a negligible amount of noise. It would be a research laboratory and no noisy activities would take place there. The noise generated by the operation the building would be indistinguishable from the noise generated by the campus at large, which is explained in Section 3.7.1.4 below.

3.7.1.3 Impacts of the No Action Alternative

Under the No Action Alternative, ARI-R2 funding would not be available to finance the construction of the proposed COBCC building. This would have **no impacts** on noise levels.

3.7.1.4 Cumulative Impacts of the Proposed Action

Each construction phase of the new campus would generate temporary noise. Blasting would occur once, as part of the site preparation. Because the phases would be implemented sequentially, short-term construction-related impacts would not generate cumulative impacts. In the long term, as the new campus approaches build-out, several new sources of noise would be created on the site. These include:

- Exterior air cooled chillers near the central plant. These would be located in the interior of the property, a little more than 200 feet from the nearest residence. The next closest property line is 300 feet away and the property is not occupied. Noise impacts from the chillers would be minimized by the presence of a forested buffer, surrounding buildings, and landscaping.

- Biodiesel emergency generators: grade exhaust silencers would be used to minimize noise, discharging away from surrounding property toward the interior of the campus.

- Research vessel: engines would be turned off while the vessel is docked; when in operations, the noise would be similar to that generated by a tugboat or the larger boats launched from the nearby shipyards. At the most, the vessel would be used around six times a year.

- Pumps in the marine operations building: high-efficiency pumps with low noise and vibrations would be selected.

Overall, therefore, noise levels on the property would increase relative to existing conditions, but a number of measures would be taken to ensure that the impacts remain minor and do not result in the disturbance or annoyance of the property's neighbors. Compliance with Section 10 of Maine's Site Location Development Law would ensure that noise impacts are properly addressed. Bigelow Laboratory anticipates that the project would be classified as a "Development with Minor Sound Impact."

The cumulative contribution of the proposed COBCC building to future noise levels would be minimal, as it would generate no noticeable noise in and of itself. Therefore, there would be only **minor long-term direct adverse cumulative impacts** on noise.

3.7.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

3.7.2.1 Affected Environment

Most of the SERC property is undeveloped. Noise levels are low and typical of a rural area, with transportation-related noise dominating (road and air traffic). Anne Arundel County does not have a noise ordinance but is contemplating developing one to control increasing noise levels in the more urbanized portions of the county.

3.7.2.2 Impacts of the Proposed Action Alternative

The proposed action would have **negligible short-term direct adverse impacts** from the operation of the construction equipment that would be used to perform the proposed work. The small scale of each project component, short duration of the construction activities, and remoteness of most of the project sites would ensure that impacts are negligible. There would be **no long-term impacts** or indirect impacts as no new source of noise would be introduced.

3.7.2.3 Impacts of the No Action Alternative

Under the No Action Alternative, none of the proposed renovations or upgrades would take place. This would not result in an increase in noise levels at SERC. Therefore, there would be **no impacts**.

3.7.2.4 Cumulative Impacts of the Proposed Action

The proposed action would not result in noise impacts once construction is completed. Therefore, it would generate **no cumulative impacts**.

3.7.3 Project 3: Murray Laboratory

3.7.3.1 Affected Environment

RMBL is located in a remote part of Colorado that is only accessible by vehicular traffic during limited times of the year. Ambient noise levels are those typical of a rural residential area and are generally low, dominated by transportation (personal and work vehicles) and building maintenance activities, with the occasional burst of louder noise from, for instance, chainsaw wood cutting.

3.7.3.2 Impacts of the Proposed Action Alternative

This project would have **minor short-term and negligible long-term direct negative impacts**. There would be no indirect impacts. Implementation of the proposed action would result in some construction noise, particularly during the early phases of the project, when the existing Murray building is demolished and the foundations of the new laboratory are laid out. The noise and vibrations from this work may temporarily disturb or annoy the occupants or users of the nearby buildings, but RMBL is the only occupant of the site and could plan ahead to minimize this impact on its own staff and visitors through the scheduling of the noisiest work during downtimes. In general, the moderate scale of the project, short duration of the construction period, lack of any need for particularly noisy activities such as pile driving or blasting or for nighttime work, and the remoteness of RMBL would ensure that any noise impacts would remain minor.

In the long term, the new building's small mechanical exhaust fans to be set up to support the chemical hoods and the HVAC system would generate some noise, similar to that generally produced by the mechanical systems of a small residential or business building. Such impacts would be barely noticeable.

3.7.3.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new Murray Laboratory would not be built. This would not cause any change to noise levels. There would be **no impacts**.

3.7.3.4 Cumulative Impacts of the Proposed Action

The current, low noise level at RMBL is the long-term result of past projects and activities at the site. There are current ongoing or foreseeable future projects that would create any noticeable new source of noise at the site. Adding the negligible noise impacts of the proposed action to those of past, present, and future projects at RMBL would make no noticeable difference. There would be **negligible long-term direct adverse cumulative impacts**.

3.7.4 Project 4: Moe Pond Laboratory

3.7.4.1 Affected Environment

The current noise environment at the Upper Research Station on Moe Pond is that typical of a rural, forested environment. The property is remote from major development centers or transportation facilities. An intermittent source of noise in the area is the nearby Sportsmen's Club, which has skeet ranges. However, use of the ranges is occasional. Neither Cooperstown nor Otsego County has a noise ordinance.

3.7.4.2 Impacts of the Proposed Action Alternative

This project would have **negligible short-term and long-term direct negative impacts** Construction of the proposed new laboratory at the Upper Research Station would generate some noise from the operation of construction equipment and travel of trucks and workers' vehicles to and from the project site. Because of the small scale of the project and remote location of the laboratory, these noise impacts would be barely noticeable. They would stop entirely when construction is complete.

In the long term, operation of the new facility would not generate any noise other than what is generally associated with the operation of a small research facility. No noisy activities would be conducted at the site, which would function in part as an observation spot for bird life, requiring reasonably quiet conditions. The exhaust vents and the generator would intermittently add some noise compared to existing conditions, but it would not be noticeable outside the immediate vicinity of the building.

3.7.4.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new laboratory facility would not be built and use of the existing building would continue as at present. This would have **no impact** on noise levels.

3.7.4.4 Cumulative Impacts of the Proposed Action

The existing low noise levels at the site are the result of past projects and development. There are no ongoing or foreseeable future projects that would add one or more ambient noise sources. Therefore, **cumulative impacts on noise would be** the same as those of the proposed action and would be **negligible**.

3.7.5 Project 5: Wawona Field Station Renovations

3.7.5.1 Affected Environment

Noise levels at Wawona are those generally associated with a touristic area and are dominated by vehicular traffic. They vary with the time of the year, being greatest in the summer when the park is most visited and lowest in the winter, when the park is less frequented or closed. Occasional noise is also generated by routine maintenance operations. WFS does not generate any significant noise other than that associated with the daily activities of its researchers and students (e.g., driving) and the daily maintenance of its facilities.

3.7.5.2 Impacts of the Proposed Action Alternative

The project would have **minor short-term and no long-term direct negative impacts** on noise. There would be no indirect impacts. The short-term noise would result from the use of light construction equipment for the proposed interior renovation works and the movement of trucks and personal vehicles. Some elements of the proposed action – such as the removal of the existing concrete flooring and the small amount of trenching required, would be noisier than the rest, but would not last for a long time. All noise would cease once the project is complete. Therefore, impacts would remain minor. In the long term, there would be no changes to existing noise levels and, therefore, no impacts.

3.7.5.3 Impacts of the No Action Alternative

Under this alternative, the proposed renovation would not be implemented and existing conditions would continue as at present. This would result in no change to noise levels and **no impacts**.

3.7.5.4 Cumulative Impacts of the Proposed Action Alternative

The proposed project would not result in noise impacts once construction is completed. Therefore, it would generate **no cumulative impacts**.

3.7.6 Project 6: Northwest Indian College Laboratory

3.7.6.1 Affected Environment

Noise levels in the project area are those typical of a low-density urban or dense suburban area. Kwina Road and Lummi Shore Road are both major arterials. In addition to traffic on these roads, noise sources include Bellingham Airport, located approximately three miles east of the project site and the Burlington Northern Santa Fe railroad, located approximately 2.5 miles east. At the College itself, the main source of noise is vehicular traffic.

Noise sensitive receptors near the project site include the college's classrooms, the child care center and student housing built as part of the Phase I development of the South Campus, and St. Joachim's Church near the northeast corner of the South Campus. A Head Start child development center, health clinic, and tribal center are located farther away along Kwina Road.

3.7.6.2 Impacts of the Proposed Action Alternative

The project would have **minor short-term and no long-term direct negative impacts**. Construction of the proposed new laboratory would generate noise from the operation of construction equipment, trucks, and workers' vehicles traveling to and from the site. Overall, these impacts would be minor because of the small size of the proposed facility and short duration of the construction campaign (five months, with the noisiest activities occurring over a much shorter time in the early stages of the project). No pile driving or blasting would be required and work would take place only during normal working hours. Overall, the noise from the construction of the proposed facility would be typical of that generated by a small scale construction project. Although it is possible that the project could become a temporary source of annoyance to students and teachers in the nearby buildings, no hearing protection measures or the relocation of classroom or research activities would be required. If needed, signs warning students of high noise levels could be posted at the construction site by the construction contractor. In the long term, the new research facility would not generate any significant amount of new noise as it would not create any source of noise.

3.7.6.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new laboratory facility would not be built. Existing conditions would continue and there would be **no impacts** on noise levels.

3.7.6.4 Cumulative Impacts of the Proposed Action

The proposed project would not result in noise impacts once construction is completed. Therefore, it would generate **no cumulative impacts**.

3.7.7 Multi-site Cyber-infrastructure Improvements

3.7.7.1 Affected Environment

While the setting of each reserve varies and with it, the nearest sources of noise, in general, by their very nature, the reserves are mostly undeveloped, with noise levels that are typical of natural or rural areas. Near roadways and access points, the main source of noise is vehicular traffic. At those reserves with permanently or intermittently occupied residential, administrative, or research facilities, routine maintenance activities, such as repairs or grass mowing, may occasionally generate some noise as well.

3.7.7.2 Impacts of the Proposed Action

Implementation of the proposed cyber-infrastructure improvements would result in **negligible short-term and no long-term direct adverse impacts**. There would be no indirect impacts. Installing the various pieces of cyber-equipment proposed for the reserve would cause barely noticeable amounts of noise at each of the project sites. Most excavation work would be conducted using hand augers. No heavy equipment would be needed. Where equipment or antennas are to be set up on existing structures, power tools may be used. In each case, installing the proposed structures or devices would require very little time and any noise would stop quickly. In the long term, no new noise source would be created. Therefore there would be no noise impacts.

3.7.7.3 Impacts of the No Action Alternative

Under the No Action Alternative, none of the proposed improvements to the reserves' cyber-infrastructure would be implemented. This would create no noise and have **no impact** on noise levels.

3.7.7.4 Cumulative impacts of the Proposed Action

The proposed action would generate negligible impacts at multiple, widely scattered locations during the installation phase, and no impact following its completion. Therefore, it would generate **no cumulative impacts** when considered along with past, present, and future projects.

3.7.8 Project 8: Microwave Relay Antennas

3.7.8.1 Affected Environment

Noise levels at Lowell Observatory's three sites are those typical of a research campus, and are dominated by vehicular traffic and daily maintenance activities. Consistent with their function, all three sites are fairly remote and distant from either noise sources or sensitive receptors.

3.7.8.2 Impacts of the Proposed Action Alternative

This project would have **negligible short-term and no long-term direct negative impacts**. There would be no indirect impacts. Installing the proposed microwave antennas at the Mars Hill and Happy Jack sites would not require using heavy equipment and would generate minimal, short-lived noise. The proposed replacement of the existing antenna tower at the Anderson Mesa site with a monopole would generate somewhat more noise as trucks and possibly a crane would be required to remove the tower from the site. However, this would also be a very short-lived impact. Lowell Observatory could minimize any potential vibration-related impacts on the nearby astronomical facilities through scheduling or other measures, as needed. Therefore, construction-related impacts would be negligible. There would be no long-term impacts as no new source noise would be created.

3.7.8.3 Impacts of the No Action Alternative

The proposed microwave antennas would not be installed under this alternative. This would have **no impact** on noise levels.

3.7.8.4 Cumulative Impacts of the Proposed Action

The proposed project would not result in noise impacts once construction is completed. Therefore, it would generate **no cumulative impacts**.

3.7.9 Project 9: Greenhouse Replacement

3.7.9.1 Affected environment

Noise levels on UCSB's Main Campus and the project site are those typical of a dense suburban area and are dominated by the noise generated by on- and off-site transportation facilities, including streets and roadways and the nearby Santa Barbara Airport. Building systems and area maintenance activities also contribute to ambient noise.

3.7.9.2 Impacts of the Proposed Action Alternative

The project would have **minor short-term and no long-term direct negative impacts**. No indirect impacts are expected. Construction of the proposed new greenhouses and the associated demolition of Building 539 would result in temporary construction noise, particularly during the early stages. The noise would be intermittent and temporary and would quickly decrease as one moves away from the construction site. Although the construction work could become a temporary source of annoyance to students and teachers in the nearby buildings, it would not require hearing protection measures or the relocation of classroom or research activities. If needed, signs warning students of high noise levels could be posted at the site by the construction contractor. Thus, short-term impacts would remain minor. Once completed, the new greenhouses would not generate any new noise. Thus, there would be no long-term impacts.

3.7.9.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new greenhouses would not be built and the existing structure would remain in use. This would have **no impact** on noise levels.

3.7.9.4 Cumulative Impacts of the Proposed Action

The proposed project would not result in noise impacts once construction is completed. Therefore, it would generate **no cumulative impacts**.

3.7.10 Project 10: St. Anthony Falls Laboratory Renovations

3.7.10.1 Affected Environment

SAFL is located in a dense urban area and noise levels at the project site are those typical of such areas, with traffic noise dominating. The nearby Xcel Energy hydroelectric plant is another source of noise in the area. The nearest noise sensitive receptor is condominiums, located approximately 600 feet east of the project site, beyond the electric substation. The SAFL laboratory does not generate any noise beyond that typically associated with the operation and maintenance of a large research facility.

3.7.10.2 Impacts of the Proposed Action Alternative

The project would have **negligible short-term and no long-term direct negative impacts**. Most of the activities proposed under this alternative consist of interior renovation work, which would generate noise impacts that would not be noticeable outside the SAFL building. Construction of the proposed instrument gantry at the OSL may require some minor excavation work to install the supporting rail system. This would generate temporary, localized noise impacts that are not likely to reach beyond the vicinity of the OSL, which lies between SAFL and the Mississippi River. In the context of an active urban area, these noise impacts, in addition to being temporary, would be negligible. In the long term, the proposed renovations and improvements would not cause any increase in the noise generated by the SAFL facility. There would be no impacts.

3.7.10.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed renovations and upgrades would not take place. This would have **no impact** on noise levels.

3.7.10.4 Cumulative Impacts of the Proposed Action

The proposed project would not result in noise impacts once construction is completed. Therefore, it would generate **no cumulative impacts**.

3.8 Earth Resources

Earth resources include the physical features of project sites, such as the geological substrate, topography, or soils. In general, adverse impacts to these resources occur as a result of ground-disturbing activities, such as blasting, excavating, and grading associated with substantial construction projects. Projects involving no or trivial amounts of construction work have no potential to result in any noticeable such impacts. Several of the projects included in the proposed action fall in that category:

- Project 2: Renovation of existing structures and very minor excavation for the proposed towers.

- Project 5: Building renovation with some minor trenching adjacent to the building.

- Project 7: Installation of communication infrastructure requiring at most digging small holes over a few square feet.

- Project 8: Setting up antennas on existing buildings and replacing an existing tower at the same location.

- Project 10: Building renovation and construction of a movable gantry in an area artificially created by adding fill to the original bedrock, with no natural soils.

The remaining projects involve non-trivial, though minor, construction, which is the main source of potential impacts on earth resources. The primary concern, for such projects, is soil erosion during the early stage of construction. However, the risk of erosion is typically minimized through the use BMPs such as:

- Adding protective cover, such as mulch or straw, to exposed soil.

- Implement site-grading procedures that limit the time that soils are exposed prior to being covered by impermeable surfaces or vegetation.

- Erecting erosion and sediment control barriers

- Implement temporary impoundments to catch soil eroded from the site prior to flowing into the drainage network.

The measures typically taken to control fugitive dust mentioned in Section 3.6.2.1 also contribute to minimizing the risk of erosion.

Table 3-15 shows the evaluation scale for impacts to earth resources.

Table 3-15 - Earth Resource Impact Intensity Scale

Intensity	Description
Negligible	The alternative would result in a change to the topography or soils so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would result in a detectable change to the topography or soils, but the change would be small, localized, and of little consequence.
Moderate	The alternative would result in a measurable and consequential change to the topography or soils. Mitigation may be needed to offset adverse impacts and would be relatively simple to implement and likely be successful.
Major	The alternative would result in a substantial change to the topography or soils. Extensive mitigation measures to offset adverse impacts would be needed and their success could not be guaranteed.
Duration:	Short-term – occurs only during the construction period. Long-term – occurs or continues after the construction period.

3.8.1 Project 1: COBCC Building

3.8.1.1 Affected Environment

The future new Bigelow Laboratory campus and proposed COBCC building are located on the Atlantic coast of Maine. The campus site is within coastal lowlands composed of rugged bedrock overlain with glacial-marine deposits (silt and clay) and glacial till deposited by retreating glaciers at the end of the Pleistocene Era (Thompson and Borns, 1985). Bedrock geology on the southeastern portion of the site is comprised of the Bucksport Formation and, on the northwestern portion of the site, consists of the Cape Elizabeth Formation (Sebago Technics, 2010a).

The topography of the site is variable, with moderate to steep slopes (3 to 45 percent) with ledge outcrops. The majority of slopes are between 8 and 15 percent and steep slopes are located on the eastern side of the property towards the shoreline (Sebago Technics, 2010b). The central portion of the property has relatively flat topography. Elevations range from approximately 114 feet above sea level on the western side of the property to approximately 7 feet on the shoreline (Sebago Technics, 2010b).

According to the United States Geological Survey (USGS) National Seismic Hazard Program mapping, the earthquake peak ground acceleration that the project area can expect during the next 50 years with two percent probability is 10 percent standard gravity, which equates to very low earthquake hazard potential (USGS, 2008).

Soils on the COBCC site developed from glacial till deposits over shallow bedrock and are typically less than two feet deep (Sebago Technics, 2010b). Test pits excavated as part of a subsurface exploration by Sebago Technics (Sebago Technics, 2010a) in November 2009 encountered four soil units overlying bedrock throughout the site, including (in order of increasing depth) forest mat, topsoil, glacial till, and weathered bedrock. Forest mat included leaves, pine needles, and other organic material, with a thickness ranging from 0.2 to 0.4 feet. Topsoil was comprised of brown silty sand with roots and organics, from 0.3 to 0.8 feet thick.

Glacial till included brown silty sand with gravel and some cobble and boulders, ranging in thickness from 1.2 to 1.8 feet. Weathered bedrock was comprised of cobble- and gravel-sized granitic rock fragments, with a thickness of 1.2 to 1.8 feet.

According to data from the Natural Resources Conservation Service (NRCS), soils throughout the project facility consist of the Lyman Rock Outcrop-Tunbridge Complex (with slopes from three percent to 45 percent), which are comprised of fine sandy loam soils that are somewhat excessively drained (United States Department of Agriculture [USDA] NRCS, 1987). Soils within the footprint of the COBCC building consist of the Lyman Rock Outcrop Complex (8 to 15 percent slopes) (Sebago Technics, 2010b).

The project area is not located in or near prime and unique farmland (USDA NRCS, 1987). The Lyman Rock Outcrop-Tunbridge Complex is comprised of soils poorly suited to farming due to droughtiness, surficial rocks, slope, and the shallow depth of bedrock (USDA NRCS, 1987).

3.8.1.2 Impacts of the Proposed Action Alternative

The project would **have minor short-term and long-term direct adverse impacts** on earth resources. No indirect impacts are expected. The proposed COBCC building would disturb about 5,450-square-foot or 0.13-acre area of soil and bedrock for the building and an additional approximately 9,650-square-foot or 0.22-acre on three sides of the building that would become lawn after construction. Because of the shallow depth of bedrock, blasting of bedrock would be necessary to ensure that the building's foundation is secure. Because of the blasting and shallow soils, the potential for runoff is high. However, the same BMPs that will be implemented for the construction of the campus would be used for the construction of the proposed COBCC building (see Section 3.8.1.3). Therefore, short-term, construction-related impacts would remain minor. In the long term, an area of approximately 0.13 acres would be developed to support the building: natural soils would be removed and the natural topography would be altered over about 0.35 acres. While these impacts would be noticeable, they would be localized and of little consequence, affecting only a small portion of the overall 63-acre site, most of which would remain in its current condition.

3.8.1.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed COBCC building would not be funded through the ARI-R2 program. The other campus facilities would be constructed as planned, however, with impacts as described in Section 3.8.1.4. Not constructing the proposed COBCC building would not in and of itself affect earth resources. Therefore, the No Action Alternative would have **no impact** on these resources.

3.8.1.4 Cumulative Impacts of the Proposed Action

No past projects have been implemented at or near the project site, as the entire Farnham Point property is currently undeveloped. The only foreseeable future project (other than the proposed action) is the construction of the rest of the campus, with the impacts described in Section 3.8.1.3. This would affect approximately 14 acres of the property: although the site of the proposed COBCC building would remain unbuilt, it still would be cleared and graded as part of the larger construction. As previously noted, because of the shallowness of the soil layer, blasting would be required to lay out the facilities' foundations. Blasting operations would be conducted in accordance with the blasting plan developed as part of the permitting process. As noted above, because of the need for blasting and the shallow soils, the potential for runoff during construction is high. Consequently, a site-specific Erosion and Sedimentation Control Plan was prepared as part of the Site Location of Development Act permit application submitted in November 2009 in accordance with the No Adverse Effect Standard of the Site Location Law (Erosion and Sedimentation Control), 06-096 Code of Maine Rules (CMR) 375.5 (Bigelow, 2009). The site must and would be maintained to prevent erosion and sediment runoff (including installation of control measures prior to the beginning of construction activities) in accordance with the Maine Erosion and Sediment Control Law (Title 38 Maine Revised Statutes Annotated [MRSA] Section 420-C) and the Natural Resources Protection Act (NRPA). Implementation of the Erosion and Soil Control Plan would ensure that short-term adverse impacts to the site surface and the potential for erosion from the site during construction remain minor. In the long term, soils and topography would be altered over about 14 acres. This would represent a change of about 22 percent of the entire site. The affected soils are not of special quality (they are not classified as prime or unique farmland) and most of the new facilities would be in the central part of the property, where the existing topography is already relatively level. Therefore, construction of the campus would result in minor adverse impacts to earth resources. Adding the impacts of the proposed action would not make a noticeable difference since even if the COBCC building were not built, the site would be cleared and graded as part of the larger development. Therefore, there would be **minor short-term and long-term direct adverse cumulative impacts.**

3.8.2 Project 3: Murray Laboratory

3.8.2.1 Affected Environment

RMBL's proposed new Murray Laboratory would be located in Gunnison County, Colorado within the unincorporated Gothic town site. Gothic is situated at the confluence of Copper Creek and the East River, located west of Gothic Mountain, at an approximate elevation of 3,000 m (9,469 feet) above mean sea level (msl) in the central Rocky Mountains.

The geologic age of the region is Cenozoic and the dominant soil component is identified as Parlin (RBML, April 2010). The soils in the vicinity of the proposed laboratory building were formed in glacial moraine deposits of mixed origin and consist of sandy clay loam subsoils generally of shale origin, intermixed with small to medium cobbles.

On the Gunnison County Geographic Information System (GIS) Geologic Hazard map the area in the vicinity of Gothic is identified as having unstable slopes, but does not fall directly within a hazard zone (Gunnison County, 2006). The project is not located within an avalanche area (RMBL, April 2010). The project site is generally level.

The National Resource Conservation Service has not identified prime or unique farmland within or near the project site.

3.8.2.2 Impacts of the Proposed Action Alternative

The proposed project would have **negligible short-term and long-term direct adverse impacts** on earth resources. There would be no indirect impacts. During the demolition of the existing building and site preparation for the construction of the new one, underlying soils would be disturbed. The small size of the affected area (about 5,000 square feet or 0.11 acres), the generally flat character of the site, and the use of standard BMPs such as erosion control barriers would minimize the risk of soil erosion and be addressed in the application for a building permit from Gunnison County, consistent with Article 11 of the Gunnison County Land Use Resolution, Resource Protection Standards. Construction-related impacts, therefore, would be negligible. In the long term, any natural soil within the proposed building's footprint would be removed or altered, and the local topography would be altered by the minor grading and leveling required to construct the new facility. These impacts would very small, limited to the portion of the footprint not already occupied by the existing building, very localized, and of little significance.

3.8.2.3 Impacts of the No Action Alternative

Under the No Action Alternative, the new Murray Laboratory would not be constructed and the Murray and Willey buildings would continue to be used. This would have **no impacts** on earth resources.

3.8.2.4 Cumulative Impacts of the Proposed Action

Past projects at RMBL have created the existing conditions on the property with respect to topography and soils. Future projects, particularly new construction, would generate some additional long-term impacts as open areas are replaced with facilities. However, this would affect very small areas, similar to that affected by the proposed new laboratory. Overall, impacts to earth resources at RMBL have been and are expected to remain minor. The proposed construction of the new Murray Laboratory would add only a small area to the total. Therefore, there would only be **minor long-term direct adverse cumulative impacts**.

3.8.3 Project 4: Moe Pond Laboratory

3.8.3.1 Affected Environment

The Upper Field Station, where Moe Pond Laboratory is located, lies within the Allegheny Plateau, where elevations range from 1,200 to 2,000 feet above sea level. The station is located at an elevation of 1,660 feet in the Susquehanna watershed, in the rolling hills just west of the southern tip of Otsego Lake. The area is not in a seismically active region. The soils of the Cooperstown region of Otsego County are derived from Pleistocene glacial till. The project site is within an area of Mardin channery silt loam. The Soil Survey of Otsego County, New York (USDA and Cornell University, 2006) describes this soil as a very deep, strongly sloping, moderately well drained soil found on hilltops and hillsides in glaciated uplands. It formed in firm glacial till derived from sandstone, siltstone, and shale. It is moderately permeable in the surface layer and the upper part of the subsoil and slow or very slow in the lower part of the subsoil and in the substratum. The seasonal high water table is found at a depth of 1.2 to 2 feet from November through May and the depth to bedrock is more than 60 inches. There is no flooding associated with this soil. The project site is not located in or near prime or unique farmland. Owner/operators with projects covered under the New York State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity are required to develop and implement a Stormwater Pollution Prevention Plan (SWPPP) that meets criteria set forth by the New York State Department of Environmental Conservation (NYSDEC). All SWPPPs must include practices consistent with the New York Standards and Specifications for Erosion and Sediment Control. If the area of ground disturbance is less than one acre, no sediment and erosion control permit is required.

3.8.3.2 Impacts of the Proposed Action Alternative

The proposed project would have **negligible short-term and long-term direct adverse impacts** on earth resources. Construction of the proposed new laboratory would result in temporary, localized impacts from the ground disturbing activities associated with the construction. The small size of the project area and the implementation of standard BMPs to minimize the risk of soil erosion would ensure these impacts are negligible. The proposed laboratory would be 635 square feet; even allowing for a larger construction area, this is well below the one-acre threshold; therefore, an SPDES permit would not be required. In the long term, the topography and soils within the footprint of the new building would be permanently altered. Because of the small size of the building, this impact would be negligible.

3.8.3.3 Impacts of the No Action Alternative

Under the No Action Alternative, the existing laboratory building would remain in use. There would be no construction and **no impact** on earth resources.

3.8.3.4 Cumulative Impacts of the Proposed Action

The construction of the proposed laboratory is the only project that would affect earth resources at the Upper Research Station. Therefore, **cumulative impacts** are the same as the impacts of the proposed action and would be **adverse and negligible**.

3.8.4 Project 6: Northwest Indian College Laboratory

3.8.4.1 Affected Environment

The Lummi Reservation is within an area comprised of Pleistocene (Ice Age) ocean and river deposits blanketed by more recent deposits from the Nooksack River. The Reservation consists of low-lying lands with few steep slopes and little topographic relief. The maximum elevation on the Lummi Peninsula is approximately 180 feet above mean sea level. The topography of the project site is nearly level with slopes less than 5 percent in a southwest to northeast direction. There are no special geological or topographic features on the site.

Soils within the project site have been mapped as Laxton loams, which are moderately deep, well drained soils on outwash terraces (USDA NRCS, 1992). In these soils, permeability is moderate in the upper part of the soil and very rapid in the substratum. The water table is seasonally high, which results in moist soils with a moderate degree of puddling. The soils have a moderately high runoff potential because of slow infiltration rates.

All construction activities on the Lummi Indian Reservation are subject to National Pollutant Discharge Elimination System (NPDES) General Construction Permit and Lummi Code of Laws (LCL) Title 17 Water Resources Protection Code. The NPDES Permit requires the owner/operator to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) that meets the criteria set forth by the Lummi Natural Resources Department. All SWPPPs must included erosion and sediment control BMPs. If the area of ground disturbance is less than one acre, NPDES General Construction Permit is not required.

The project site is not located in or near prime or unique farmland (USDA NRCS, 1992).

3.8.4.2 Impacts of the Proposed Action Alternative

The proposed project would have **negligible short-term and long-term direct adverse impacts** on earth resources. Construction activities could result in soil erosion, but the level topography of the project site, the small size of the construction, and the implementation of standard erosion control BMPs in compliance with permit requirements would minimize this impact, which would remain negligible. In the long term, any natural soil within the proposed building's footprint would be removed or altered. This impact would very small, localized, and of little significance.

3.8.4.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new laboratory building would not be constructed. There would be no ground-disturbing activities and **no impacts** to earth resources.

3.8.4.4 Cumulative Impacts of the Proposed Action

Past projects at NWIC's South Campus have created the existing conditions on the property with respect to topography and soils. Future projects, i.e., the construction of the Phase II facilities would generate some additional long-term impacts as open areas are replaced with buildings and natural soils are removed (topography would be little affected because of the generally flat character of the area). Nearby projects, such as the Tribal Center and a residential development (Kwina Apartments) planned on Kwina Road would also add to those impacts. The proposed laboratory would add very little to them (about 3,270 square feet). There would be only **minor long-term direct adverse cumulative impacts**.

3.8.5 Project 9: Greenhouse Replacement

3.8.5.1 Affected Environment

The general geology of the coastal mesa (where the project site is situated) consists of a relatively thin cap of Pleistocene age, marine and non-marine terrace deposits overlying Tertiary age sedimentary rocks. The marine terraces are wave-abraded surfaces that are typically covered with marine sands and alluvium. Locally, non-marine deposits consisting of alluvium and artificial fill materials overlie the terrace deposits (UC Santa Barbara, 2008).

The Santa Barbara area is seismically active including a large number of active and potentially active faults. The project site is situated between the Briggs Lineation/Campus Fault and the Goleta Point Fault. The Briggs Lineation/Campus Fault is a buried southeast-facing scarp on the marine terrace platform. The Goleta Point Fault has been identified by highly fractured bedrock at Goleta Point and a fault located in the area of the Goleta gas field east and northeast of the Main Campus (UC Santa Barbara, 2008). No known earthquake faults with the potential for surface rupture, as delineated on the Alquist-Priolo Earthquake Fault Zoning Map issued by the California State Geologist, are mapped in the project area (State of California, Department of Conservation, 2010).

The topography of the project site is flat with an elevation of approximately 35 feet above sea level. Soils within the project site and surrounding area have been extensively disturbed by the construction of the existing buildings and pavements.

3.8.5.2 Impacts of the Proposed Action Alternative

The project would have **negligible short-term and no long-term direct adverse impacts**. It would disturb less than a tenth of an acre of previously urbanized soil. While demolition and construction activities would create a potential erosion risk, standards BMPs, the flatness of the site, and the short duration of the work would minimize this temporary risk; impacts would be negligible. In the long term, new pavements and buildings would replace the existing ones. No previously undisturbed soils would be affected. There would be no impacts.

3.8.5.3 Impacts of the No Action Alternative

Under the No Action Alternative, no ground-disturbing activities and no demolition or construction activities would occur. There would be **no impact** to earth resources.

3.8.5.4 Cumulative Impacts of the Proposed Action

The project would have no long-term impacts on earth resources. Therefore, it would generate **no cumulative impacts** on those resources.

3.9 Water Resources

Water resources include bodies of surface waters (streams, rivers, and lakes) as well as water stored underground (groundwater). Impacts to surface waters may occur directly, when an action would require physically disturbing the bed or banks of a water bodies or involve altering the chemical or biological characteristics of the water; or they may occur indirectly, when an action would result in the discharge of pollutants in the water. In particular, such indirect effects can result from an increase in the amount, or deterioration in the quality, of stormwater runoff discharging to a body of surface water. Impacts to groundwater similarly can be direct (from projects that would involve substantial withdrawals) or indirect (through the infiltration of pollutants).

For the purposes of this EA, water resources also include the following when relevant:

- Floodplains: floodplains are belts of low, level ground present on one or both sides of a stream channel and subject to either periodic or infrequent inundation by floodwater. Excessive development may alter floodways, increase flood elevations, or cause pollution if contaminants are carried off. At the same time, facilities constructed in floodplains risk being damaged in case of flooding. Executive Order (EO) 11988 (Floodplains Management) regulates development in floodplains. The EO requires federal agencies to identify and consider practicable alternatives for to the location of incompatible facilities in areas identified as 100-year floodplains. The 100-year floodplain is the area that, any given year, has a one percent probability of flooding.

- Wetlands: wetlands are ecosystems that are transitional between the terrestrial and aquatic ecosystems, being flooded and/or saturated near the ground surface for extended periods. Specific physical, chemical, and biological features characterize these areas. Wetlands provide habitat for many animal and plant species, and play a crucial role in filtering runoff and removing pollutants before they reach surface waters. Therefore, a number of federal laws, regulations, and policies regulate activities in wetlands, namely:

  (1) Section 404 of the Clean Water Act (CWA), which directs that the US Army Corps of Engineers (USACE) require permits for the discharge of dredged and fill material into "waters of the United States," a term that includes rivers, lakes, and most streams and wetlands. Wetlands are defined by the USACE as: "…those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands generally include swamps, marshes, bogs, and similar areas.

  (2) EO 11990, Protection of Wetlands, which requires federal agencies to take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

(3) The North American Wetlands Conservation Act, 16 USC 4408, which requires the restoration, management, and protection of wetlands and habitats for migratory birds on Federal lands.

Any action requiring a Section 404 CWA permit also requires a Section 401 water quality certification from the responsible state authority. Not every activity affecting wetlands requires a Section 404 permit/Section 401 water quality certification. Only those activities involving the discharge of dredged or fill material into a "water of the United States," a term that includes most wetlands, require these approvals.

Several of the projects included in the proposed action have no potential to affect water resources and are not considered further in this section, consistent with 40 CFR 1501.7(a)(3). They include:

- Project 5, which consists of renovation to an existing building, limited trenching just outside the building, and installing solar panels just behind it, all well away from any water resources.

- Project 7, which involves setting up data transmission equipment at diverse locations generally on high ground and with minimal ground disturbance.

- Project 8, which involves installing two microwave antennas on existing buildings and replacing an existing antenna tower well away from any body of water.

- Project 9, which involves new construction within an already almost entirely impervious area without any natural or artificial water features present on or near the site.

- Project 10, which involves mostly renovation work in an existing building and minor construction along an artificial stream segment constructed and used for the purpose of conducting experiments.

None of these projects could directly or indirectly affect any surface water bodies or groundwater; none would create any significant amount of new impervious surface, or create an obstacle to floodways, or lead to the filling of a wetland area requiring a permit under Section 404 of the CWA. The potential impacts of the other projects are evaluated using the intensity scale shown in Table 3-16.

Table 3-16 - Water Resource Impact Intensity Scale

Intensity	Description
Negligible	Implementation of the alternative would have impacts so small so small that they would not be of any measurable or perceptible consequence; they would be well below water quality standards or criteria and within historical or desired water quality conditions.
Minor	Implementation of the alternative would impacts water resources (chemical, physical, or biological), but the impact would be small and of little consequence, well below water quality standards or criteria and within historical or desired water quality conditions.
Moderate	Implementation of the alternative would result in a measurable and consequential impact to water resources (chemical, physical, or biological), but the impact would be at or below water quality standards or criteria. Historical baseline or desired water quality conditions would be temporally altered. Mitigation measures may be necessary to offset adverse impacts and likely be successful.
Major	Implementation of the alternative would result in a substantial impact to water resources (chemical, physical, or biological); the impact would be frequently altered from the historical baseline or desired water quality conditions. Chemical, physical, or biological water quality standards or criteria would temporarily be slightly and singularly exceeded. Extensive mitigation measures to offset adverse impacts would be needed and their success could not be guaranteed.
Duration:	Short-term – occurs only during the construction period. Long-term – occurs or continues after the construction period.

3.9.1 Project 1: COBCC Building

3.9.1.1 Affected Environment

The site of the new Bigelow Laboratory campus and COBCC building is in the Damariscotta River Watershed near the mouth of the river, less than two miles upstream of its confluence with the Gulf of Maine. The Damariscotta River flows in a north-south direction along the east side of the new campus site. Water quality in the Damariscotta River in the vicinity of the project site is classified as SB, the second highest estuarine and marine water class (SA is the first). Designated uses include recreation in and on the water, fishing, aquaculture, propagation and harvesting of shellfish, navigation, and an unimpaired habitat for fish and other estuarine and marine life (Statute 38 MRSA Section 465-B). The section of the Damariscotta River in the vicinity of the towns of Newcastle and Damariscotta (north and upriver of the project area) is currently listed as impaired by bacteria in the State of Maine (Maine Department of Environmental Protection [DEP], 2008). The lower Damariscotta River, in the vicinity of the Bigelow property, is closed to shellfish harvesting due to pollution (bacteria) and is designated as Area Number 23-C by the Maine Department of Marine Resources (DMR) (DMR, 2010). The Damariscotta River is not designated as a Wild and Scenic River (United States Fish and Wildlife Service [USFWS], 2010).

A wetland delineation was conducted in 2009 for the entire campus site. There are two jurisdictional streams and several acres of wetlands, including a vernal pool on the Farnham Point property. The wetlands are classified as PFO1E, seasonally saturated forested wetland dominated by broad-leaved deciduous trees and saplings (Sebago Technics, 2010b). There are no wetlands on the proposed COBCC building site. The nearest wetland area is approximately 250 feet from the site.

The COBCC site is not located within the 100-year floodplain. The Flood Insurance Rate Map for the Town of Boothbay, Maine indicates that the project site is within the C-zone, which is an area subject to minimal flooding (FEMA, 1986). Most of the campus site, including the site of the proposed COBCC building, is currently pervious. Stormwater percolates through the ground.

3.9.1.2 Impacts of the Proposed Action Alternative

Construction of the proposed COBCC building would have **no direct and negligible short-term and long-term indirect adverse impacts** on water resources. There would be no direct impacts, as no body of water would be physically or chemically altered to construct or operate the new laboratory. The proposed building is not within the floodplain and no wetlands would be filled to construct it. With regard to indirect impacts from potential soil erosion during construction, the Erosion and Sedimentation Control Plan prepared for the site would apply to the construction of the COBCC and as a result, impacts would be negligible. In the long term, construction of the building would result in the conversion of approximately 0.13 acre that would remain mostly pervious under no action condition to impervious surface. While this would increase slightly the amount of stormwater runoff generated by the site, the increase would be small. All stormwater management measures defined for the entire site would apply, as appropriate, to the COBCC building. Impacts from the building would be negligible.

3.9.1.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed COBCC building would not be funded through the ARI-R2 program. Therefore, it would not be built. The rest of the new Bigelow Laboratory campus would be constructed as planned. Not constructing the COBCC building would have no direct impact on water resources. It would result in a slightly lesser amount of new impervious surface on the site (about 0.13 acres) than would otherwise be the case but the difference this would make in the overall generation of runoff at the site would be barely noticeable. Therefore, the No Action Alternative would have a **negligible long-term indirect positive impact** on water resources.

3.9.1.4 Cumulative Impacts of the Proposed Action

The only past, present, and reasonably foreseeable future projects in the ROI other than the proposed project is the construction of the rest of the new Bigelow Campus. This is expected to result in moderate long-term direct and indirect adverse impacts on water resources. Direct impacts from the construction of the in-water facilities have been or will be addressed and mitigated through compliance with CWA permitting requirements as would be those on wetlands. The proposed action would have no direct impacts on water resources, and, therefore, would generate **no direct cumulative impacts** on these resources.

A Stormwater Management Plan and a Stormwater Management Inspection, Maintenance & Inspection Plan were prepared as part of the Site Location of Development Act permit application submitted by Bigelow Laboratory in November 2009 and revised in February 2010 (Bigelow, 2009). The Stormwater Management Plan describes how the project would meet performance standards for stormwater management in accordance with Maine's Stormwater Management Law (Title 38 MRSA Section 420-D) and the Maine DEP rules, Chapters 500 and

502. The Stormwater Management Inspection, Maintenance & Inspection Plan outlines inspection and maintenance procedures for erosion and sediment controls and describes pre- and post-construction housekeeping requirements. Proposed drainage patterns would be consistent with the existing drainage patterns. Stormwater management BMPs would be used to treat stormwater runoff and mitigate peak stormwater flow to protect the Damariscotta River. Any long-term indirect impacts would be moderate. Adding the COBCC building to the site would make no noticeable difference: the plans and measures they contain were developed for and would apply to the entire campus, including this building. Therefore, there would be only **moderate long-term indirect adverse cumulative impacts** to water resources from the increase in stormwater runoff.

3.9.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

3.9.2.1 Affected Environment

SERC is located on the Rhode River, a subwatershed of the Chesapeake Bay. SERC uses the Rhode River's watershed and subestuary as a model system to measure the environmental responses of linked ecosystems in a coastal landscape to climate change and human impacts. SERC's land holdings comprise the lower one-third of the watershed, including the stream discharge points for all of the component watersheds and 16.7 miles of shoreline with tidal wetlands.

The stream monitoring weirs that would be rehabilitated under the proposed action are located on non-perennial freshwater streams, most of which flow into Muddy Creek and its tributaries, Many Fork Branch, South Fork, Williamson Branch, Bluejay Branch, and North Fork. Stream weirs are also located on non-perennial streams that flow into Fox Creek and Sheepshead Cove. All of these streams and creeks flow into the Rhode River.

Parts of SERC lie with the 100-year floodplain and at least part and possibly all of the proposed replacement storage shed site lies within the 100-year floodplain (FEMA, 1983). The CO_2 Laboratory adjacent to the proposed storage shed was elevated above flood level when it was built.

Tidal wetlands –estuarine marshes – line the Rhode River and the lower part of Muddy Creek. Higher elevations in the tidal wetlands, where SERC's boardwalks are located, are typified by narrow-leafed cattails (*Typha angustifolia*), saltmeadow hay (*Spartina patens*), groundsel tree (*Baccharis halmifolia*), marsh elder (*Iva frutescens*), threesquare (*Scirpus* spp.), and reed grass (*Phragmites australis*). Saltmarsh cordgrass (*Spartina alternifolia*) can be found along the tidal creeks that meander through the marshes, such as the one where a tidal flux monitoring station is located.

The salt marsh boardwalks proposed for rebuilding and one tidal flux station to be rehabilitated are located on estuarine marshes on the south side of the Muddy Creek/Rhode River subestuary. Two of the tidal flux stations are located in the Mill Swamp area on tidal branches of Muddy Creek.

3.9.2.2 Impacts of the Proposed Action Alternative

The proposed action would have **negligible short-term direct adverse impacts** on water resources and **no long-term direct impacts**.

Replacing two existing boardwalks that serve tidal wetland research projects would have short-term impacts on the estuarine wetlands in the work area. To minimize these impacts, replacement would occur in winter when marsh plants are dormant and the marsh surface is frozen. Any construction operations or machinery would be placed on “swamp mats” to distribute weight and minimize impact on the marsh surface. Repair of three tidal flux stations and eight non-tidal stream weirs would also be done in such a way as to minimize impacts. The work would be conducted at the end of summer when the non-tidal streams normally do not flow, and flows are lower in the tidal streams. Because of the risk of thunderstorms, the excavation work in the streambeds would be accomplished quickly—normally within two days. No trees or woody vegetation would be cut. Therefore, short-term impacts would be negligible. Because the proposed boardwalks would replace existing boardwalks in the same location, there would be no long-term direct impacts. The replacement boardwalks would be similar in design to the existing boardwalks, and like the newest one, they would be constructed using decking that consists of fiberglass grating, which reduces shading and allows for more light and air circulation than is the case with the existing boardwalks. The proposed upgrades to the flux stations and stream weirs would not change the footprint or function of those structures, and, therefore, would result in no long-term direct impacts.

It is estimated that reconstruction of the marsh boardwalks would temporarily disturb about 6,000 square feet (0.14 acres) of wetland. Rehabilitation of the stream weirs and two inland tidal flux stations would temporarily disturb about 3,340 square feet (0.08 acres) of areas in and around streams. Reconstruction of the tidal flux station on the marsh would temporarily affect about 700 square feet (0.02 acres) of tidal marsh and creek. Construction, therefore, would temporarily disturb 0.16 acres of tidal wetlands and 0.08 acres of non-tidal streams. Because less than one acre of wetlands would be disturbed, the proposed action would fall under a US Army Corps of Engineers General Permit for filling wetlands. In compliance with Sections 404 and 401 of the Clean Water Act, SERC would file a Joint Federal/State Application for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland with the Maryland Department of the Environment’s Regulatory Services Coordination Office and the US Army Corps of Engineers. This permit would cover the proposed rebuilding of the boardwalks and rehabilitation of the stream weirs and tidal flux stations – all in their current locations. Construction would not start until the permitting process is complete.

The proposed storage shed would be within the 100-year floodplain. However, according to Anne Arundel County’s Final Draft Article 16 Floodplain Management regulations, an uninhabited accessory structure, such as the proposed shed, can be built within the 100-year floodplain if it is less than 600 square feet in size (the proposed shed would be 500 square feet in size). The electrical systems for both the CO_2 lab and the shed would be elevated above flood level and would be fully equipped with ground-fault interrupter systems as part of the project up-grade of the electrical system. SERC would adhere to county regulations governing flood management as part of the process of securing building permits. Therefore, direct adverse impacts on the floodplain would be negligible.

The proposed action also would have **negligible short-term and long-term indirect impacts on water resources**.

Because less than 5,000 square feet of land would be disturbed, a State of Maryland erosion and sediment control plan would not be required. Further, implementation of each of the project components would take place quickly, so that activities at any one site would not leave the ground exposed for more than a few days. Additionally, any short-term construction-related impacts would be minimized as appropriate through the implementation of best management practices, including, though not limited to, placing sediment barriers or traps on exposed soil areas. Application of BMPs, as appropriate, would ensure that any short-term indirect adverse impacts on water from soil erosion and sedimentation are minimal and negligible. Potential long-term indirect impacts to water quality due to increase stormwater runoff after the completion of the project also would be negligible because of the small scope of the construction projects that would create new impervious surfaces.

All of SERC except for the small Contees Wharf area on the Rhode River -- which is categorized as Limited Development Area -- is categorized as a Resource Conservation Area under the State of Maryland's Critical Area Program. All of the project components considered together and separately would have little impact on stormwater management in the Critical Area. Two components involve buildings: renovation of the existing 1,295-square-foot CO_2 Research Lab, which would include improvements (refurbish downspouts, and install rain barrels and drywell for runoff) to reduce runoff; and construction of a new 500-square-foot storage shed, which would barely change existing conditions because the shed would replace three existing sheds and a small area of graded, heavily-compacted driveway. Reconstruction of existing tidal flux stations and stream weirs would have no long-term impact on stormwater. Construction of the data communication towers would have negligible impact on soil erosion and stormwater runoff because the towers and, therefore, the excavations for the twenty-eight 3x3x3.5-square-foot footers would be widely scattered. Excavated dirt would be removed from the site after being examined for archaeological resources.

SERC qualifies as a "Research Area Water-Dependent Facility" under Maryland law (Code of Maryland Regulations 27.01.03.09) for the State of Maryland Critical Area Program because it is a research facility with a mission to study coastal ecosystems. All of the proposed project components described above support that mission. To the extent possible, SERC has located non-water dependent structures and facilities outside of the 100-foot Buffer adjacent to the shoreline and wetlands. Some facilities, however, must be located within the Buffer because they serve research projects located in the tidal wetlands associated with the Rhode River. The CO_2 laboratory building serves as the hub for a series of long-term projects studying the effects of higher CO_2 levels on marsh plant growth. The proposed shed to be located adjacent would be used for storage of CO_2 canisters, an upgraded electrical system for the experiments, and a composting toilet for research personnel. No trees would be cut down for renovation of the laboratory nor for construction of the proposed shed, which replaces existing portable sheds. The data communication tower that would serve the tidal flux monitoring station on the tidal wetland may be located in the Buffer, but no trees would be removed to accommodate the slender, 3-foot-diameter tower. Although the placement of the guy wires may require cutting a few tree branches, the tower would be sited to minimize impacts to trees and shrubs.

3.9.2.3 Impacts of the No Action Alternative

Implementing the No Action Alternative would have **no impact** on water resources, as no activities would take place that could affect these resources.

3.9.2.4 Cumulative Impacts of the Proposed Action

Past projects at SERC have had minor direct and indirect adverse impacts on water resources, mostly through the construction of structures in streams and wetlands and the construction of facilities and other impervious areas. Present and foreseeable future projects may be expected to add some impervious surface to the property, but their collective footprint is unlikely to be sufficient to make these impacts more than negligible. Additionally, SERC is a site specifically devoted to the study of ecological conditions in the Rhode River watershed and is careful to minimize any impacts from its actions that could adversely affect these conditions. Therefore, any combined adverse impacts from past, present, and foreseeable future projects can be expected to remain minor. As explained in Section 3.9.2.2, the impacts of the proposed action would be negligible. When added to the impacts of past, present, and foreseeable future, there would make a substantial difference. There would be **minor long-term direct and indirect adverse cumulative impacts** on water quality.

3.9.3 Project 3: Murray Laboratory

3.9.3.1 Affected Environment

Two water bodies flow through Gothic: the East River, which originates at Schofield Pass (10,707 feet) approximately four miles northwest of the town and terminates approximately 34 miles downstream at the confluence of the Gunnison River; and Copper Creek, which runs for approximately 6 miles and terminates at the confluence of the East River in Gothic. Copper Creek is less than one-tenth of a mile from the proposed project site; however, it is separated from it by an unpaved road, vegetation, and topography. Neither stream is designated as Wild and Scenic River.

There are no designated sole source aquifers in the State of Colorado. The RMBL operates a public water system, which is permitted under the jurisdictional authority of the Water Quality Control Division of the Colorado Department of Health. Dr. Ian Billick, Executive Director of RMBL, indicated that near surface groundwater is present in locations overlying bedrock primarily in lower elevation areas or in close proximity to riparian or wetland areas. In the vicinity of the proposed project site, Dr. Billick did not anticipate that groundwater would be encountered at maximum extent of footing depth (to bedrock or four feet, whichever is less) or utility excavation (RMBL, 2010).

Stormwater in Gothic predominately percolates directly to the ground surface. In areas in close proximity to the East River or Copper Creek, some sheet flow does occur during snowmelt.

There are no conventional stormwater conveyance devices, such as dry wells, catch basins, or storm sewer systems, in the area. Currently, stormwater falling on the Murray Laboratory roof runs off roof eaves to the ground where the water percolates through the ground surface.

Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) were reviewed to determine if the project area is within a designated floodplain. The Gothic town site is outside FEMA FIRM coverage (RMBL, 2010). However, other evidence based on elevation and soils indicate that the RMBL is not located in an area subject to flooding (RMBL, 2010).

Wetlands are located to the north and south of the proposed project site in the RMBL (RMBL, 2010, Appendices E and G). Wetlands and riparian areas were delineated in 2005 by Richards Inspections LLC and were approved by the US Army Corps of Engineers, Montrose District (RMBL, 2006). There are no wetlands identified within or adjacent to the proposed project site.

3.9.3.2 Impacts of the Proposed Action Alternative

The project would have **no direct and negligible short-term and long-term indirect adverse impacts** on water resources. The nearest surface water bodies to the project site are the East River, located approximately 880 feet to the east across County Road 317, and Copper Creek, located approximately 340 feet south to southeast across an unnamed gravel and dirt surfaced access road. Neither of these water bodies nor any other surface waters would be directly affected by the proposed replacement of Murray Laboratory. No groundwater withdrawal is anticipated as part of the planned project. If a geothermal system is installed for heating or air conditioning purposes, it would most likely consist of a closed loop system that extends into vertical subsurface drilled shafts. Any subsurface drilling required to facilitate the installation of a geothermal system would be completed in accordance with applicable code and permitting requirement. The project area does not contain or is adjacent to wetlands, and is not within the floodplain.

Indirect impacts from increased stormwater flows would be minimal. During construction, some short-term impacts may occur because of increased sediment loading but, as explained in Section 3.8.2.2, construction-related erosion impacts would be negligible. In the long term, the construction of the new laboratory would result in a very slight increase in impervious area (about 60 feet by 20 feet). The additional runoff from this increase would be negligible and easily absorbed through the surrounding ground.

3.9.3.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new Murray Laboratory would not be constructed, and RMBL would continue to use the space in the existing Murray and Willey buildings for laboratory functions. This would cause **no impact** to water resources, as no construction activities would take place.

3.9.3.4 Cumulative Impacts of the Proposed Action

Past projects at Gothic and RMBL have had minor indirect adverse impacts on water resources due to the addition over time of impervious surfaces to the site, although the change has not been such as to require the development of any stormwater management systems. Ongoing and foreseeable future projects are planned and executed in accordance with the Laboratory's Facilities Master Plan, which identifies buildable areas and takes into account sensitive resources such as wetlands. Current plans (see Section 3.2.3.4) are not of a scale to create concerns about a significant increase in impervious surfaces at the site. Therefore, the combined adverse impacts from past, present, and foreseeable future projects other than the proposed action can be expected to remain minor. Adding the negligible indirect impacts of the proposed action to those of those projects would not noticeably affect this conclusion. The very small amount of impervious surface added would generate a trivial amount of runoff that would be easily absorbed by the ground. The cumulative impacts of the proposed action when considered along with those of past, present, and future action would be **adverse, indirect, long-term, and minor**.

3.9.4 Project 4: Moe Pond Laboratory

3.9.4.1 Affected Environment

The project site is located in the Otsego Lake watershed, approximately 280 feet west of Moe Pond. Otsego Lake's watershed contains the headwaters of the Susquehanna River Basin. The main branch of the Susquehanna is in a broad, flat valley, while headwater streams tend to be more steeply sloped. There are no designated scenic rivers or special status waters in the vicinity of the project.

Moe Pond is an artificial impoundment created by the damming of a natural wetland in 1939 (NY dam inventory No. 1269). It is a warm polymictic water body with 38.6 acres of surface water in a 360-acre watershed that drains to Otsego Lake. It is a Restricted Access Experimental Research Area, so it can remain undisturbed for the purpose of continuous study. The pond supplies water to several fire hydrants at the Cooperstown Farm Museum.

The closest surface water to the proposed action is a tributary of Moe Pond, which is classified as a Class C water by NYSDEC, which is the classification for waters supporting fisheries and suitable for non-contact activities (NYSDEC, 2010). It is an unprotected water as defined by Title 5 of Article 15 of NYS Environmental Conservation Law and, therefore, a stream disturbance permit is not required (NYSDEC, 2010).

Groundwater in Otsego County is drawn from three kinds of aquifers: bedrock, glacial till, and glacial outwash. The glacial outwash commonly yields the greatest amount of water and provides several smaller communities with public water supplies. Some individual homeowners in valleys have wells drilled in outwash aquifers, but the bedrock aquifer is the most commonly used and widely available source of water for individual homeowners in Otsego County. No well drilling permits are required in Otsego County, but use of a certified driller is required so that the well logs are filed with the county.

There is little stormwater runoff from facilities at the project site, as the field station includes an unpaved gravel road and open grass-covered area located within a mixed, second or third growth deciduous-coniferous forest. The only impervious surface at the site is the roof of the existing building which covers approximately 612 square feet. The building has no gutters or downspouts. Runoff from the site infiltrates into the ground or moves by sheet flow toward Moe Pond.

Review of the Otsego County GIS Mapping system (Otsego County, 2010) indicates that the project site is not located in a 100-year flood zone. A site inspection by a qualified wetland scientist found that there is no evidence of state or federal wetlands or other waters-of-the United-States in the immediate area of the project. Approximately 700 feet west of the project location, there are two connected “kettle-hole” glacial ponds of approximately 5.6 acres and 9 acres that contain open water, floating bog, shrub-scrub wetland, and emergent wetland habitat (New York State regulated freshwater wetland CP-19). NYSDEC classifies and regulates wetlands in New York State pursuant to 6 NYCRR Parts 663 and 664. Regulated wetlands must be at least 12.4 acres in area and must be dominated by hydrophytic vegetation. Smaller wetlands having “unusual local importance as determined by the Commissioner” may also be regulated by the state. There are other small wetlands within a mile of the project location, with the closest federal wetland/ located approximately 280 feet east of the project site.

3.9.4.2 Impacts of the Proposed Action Alternative

The project would have **negligible short-term and long-term, direct and indirect adverse impacts** on water resources. Construction of the proposed new laboratory would involve no activity in or immediately adjacent to a body of surface water. Along with the new laboratory, a groundwater well would be drilled to supply non-drinking water. As noted above, well drilling does not require a permit in Otsego County; however, in compliance with the applicable requirements, a certified driller would be hired to conduct the operation. Given the size of the laboratory, withdrawals from the well are likely to be minimal and not expected to noticeably affect the availability of groundwater in the area. This direct impact to groundwater, therefore, would be negligible. As the proposed project is not located within a flood zone, there would be no impacts pertaining to floodplains. There are no wetlands on or adjacent to the proposed project site. NYS-regulated freshwater wetland CP-19 is located 700 feet from the site. A permit is required for any disturbance within the wetland area or within 100 feet of the boundary. Therefore, it is not expected that a permit would be required.

In the short term, during construction, runoff sediment loading may increase slightly, with potential indirect impact to water resources. However, erosion would be minimized and negligible, as explained in Section 3.8.3.2. Because the new building would be larger than the existing one, there would be in the long term a slight increase in impervious surface at the site. However, the building would be surrounded by undeveloped land fully capable of absorbing the resulting slight increase in runoff. Indirect impacts, therefore, would be negligible.

3.9.4.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed Moe Pond Laboratory would not be constructed. Therefore, there would be **no impact** on existing water resources.

3.9.4.4 Cumulative Impacts of the Proposed Action

Past activities at the Upper Research Station have resulted in the current condition of the site with respect to water resources. There are no known projects in the vicinity of the proposed project site that could, in conjunction with the proposed action, result in noticeable cumulative impacts to water resources. Therefore, cumulative impacts would be the same as those of the proposed action and would be **long-term, adverse, and negligible**.

3.9.5 Project 6: Northwest Indian College Laboratory

3.9.5.1 Affected Environment

The Lummi Peninsula, where the project site is located, is an upland area that lies partially between the floodplains of the Lummi and Nooksack rivers. It is drained by short, intermittent streams and numerous springs that drain to the river and Lummi Bay and Bellingham Bay in the Puget Sound. There are no significant surface water bodies in the immediate vicinity of the project site. The nearest stream is located approximately 1,500 feet south of the site. Two small drainage ditches occur more than 500 feet from the project site, off Lummi Shore Road. The Nooksack River and the Lummi River are approximately 1.3 miles from the site.

The Lummi Reservation is underlain by unconsolidated sediments that consist of clay, silt, sand, gravel, and boulders. Groundwater is obtained primarily from sand and gravel outwash deposits in the unconsolidated sediments. Although two potable groundwater systems occur on the Lummi Reservation, the project site overlays a non-potable system in the floodplains of the Lummi and Nooksack Rivers, which contain a saline surface aquifer. There is one community well and one domestic well near the intersection of Kwina Road and Lummi Shore Road, which is approximately 900 feet from the project site. The well classification in this area is “marginally favorable” for developing fresh groundwater supplies (Lummi Nation, 2008).

The project site is currently entirely pervious. Soils on the site have slow infiltration rates and have been mapped as having a moderately high runoff potential. Stormwater from the larger NWIC property discharges to a large wetland located east of the campus and eventually to Bellingham Bay. The South Campus Master Plan includes the construction of new stormwater facilities such as directed roof drainage, detention ponds, infiltration fields, and bio-swales to manage the runoff from the new buildings and impervious surfaces (NWIC, 2004).

The project site is located between the floodplains of the Nooksack and Lummi rivers. Based on FEMA’s Flood Insurance Rate Maps (FIRMs), it is classified as a moderate to low flooding risk area. The site is located within the un-shaded Zone X, which is an area of minimal flood hazard outside the 500-year floodplain and protected by levee from 100-year (FEMA, 2010).

The EA prepared in 2004 for the South Campus master plan indicates that 30 acres of the South Campus site were surveyed for wetlands (including the Phase II area) and that two small wetlands were identified south of the Phase II area. The closest one was 150 feet from the southern boundary of the area (NWIC, 2009) and between 300 and 500 feet from the site of the proposed laboratory.

3.9.5.2 Impacts of the Proposed Action Alternative

The project would have **no direct and negligible short-term and long-term indirect adverse impacts** on water resources. There are no surface waters on or near the project site. The project does not involve any groundwater withdrawal, nor is it likely to cause groundwater contamination. It is not located in the 100-year floodplain. There are no wetlands on or adjacent to the project site. Therefore, there is no potential for direct impacts to water resources.

In the short term, during construction, runoff sediment loading may increase slightly, with potential indirect impacts to water resources. However, construction-related erosion would be minimal and negligible, as explained in Section 3.8.4.2. In the long term, construction of the proposed laboratory would turn a currently open, fully pervious site into an impervious area. However, the building footprint would be small (about 3,270 square feet) and the new building would be easily incorporated into the existing and planned stormwater management system for the South Campus. Any impacts, therefore, would be negligible.

3.9.5.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new laboratory building would not be constructed. This would cause **no impact**s to water resources.

3.9.5.4 Cumulative Impacts of the Proposed Action

Past projects at NWIC and surrounding area have had minor indirect adverse impacts on water resources due to the addition over time of impervious surfaces. Ongoing and future projects, including the construction of Phase II of the new campus, would add to these impacts. However, the provision of appropriate stormwater management systems in accordance with applicable permitting requirements ensure that any long-term impact remain minor, as documented in the EA prepared in 2009 for the construction of the phase II facilities (NWIC, 2009). Adding the negligible indirect impacts of the proposed action to those of those projects would not noticeably affect this conclusion. The very small amount of impervious surface added would generate a trivial amount of runoff that would be easily absorbed by the existing and planned stormwater system. Thus, the cumulative impacts of the proposed action when considered along with those of past, present, and future action would be **negative**, **indirect, long-term, and minor**.

3.10 Biological Resources

Biological resources include plants, animals, and their habitats. Impacts to such resources can result from the direct destruction of individuals, for example during site clearing operations as part of a construction project; or, indirectly, from the destruction or alteration of the habitat that supports a given species. Threatened and endangered species are addressed in Section 3.11 of this EA pursuant to Section 7 of the Endangered Species Act (ESA).

Several of the projects included in the proposed action have no potential to have any impact on biological resources because of the lack of any significant habitat within the area affected by the project. They include:

- Project 5, which consists of renovations to an existing building, some trenching near the building, and installing solar panels just behind the building.
- Project 8, which consists of installing microwave antennas on two existing structures and replacing an existing antenna tower at the same location with a monopole.
- Project 9, which consists of new construction at a site already fully developed and containing no natural habitat.
- Project 10, which consists of renovations to an existing building and minor construction along an artificial stream used to conduct experiments.

Consistent with 40 CFR 1501.7(a)(3), biological resources are not considered further for these projects.

The potential impacts of the other projects on biological resources are evaluated on the intensity scale shown in Table 3-17.

Table 3-17 - Biological Resource Impact Intensity Scale

Intensity	Description
Negligible	The alternative would impact biological resources at the lowest level of detection.
Minor	The alternative would result in a detectable change to biological resources, however the impact would be small, localized, and of little consequence.
Moderate	The alternative would result in a readily apparent change to biological resources over a relatively wide area. Mitigation measures may be necessary to offset adverse impacts and likely be successful.
Major	The alternative would result in a substantial change to the character of the biological resource over a large area. Extensive mitigation measures to offset adverse impacts would be needed and their success could not be guaranteed.
Duration:	Short-term – occurs only during the construction period. Long-term – occurs or continues after the construction period.

3.10.1 Project 1: COBCC Building

3.10.1.1 Affected Environment

The future campus site, which includes the COBCC building site, consists of coniferous upland forest, dominated by white spruce (*Picea glauca*), eastern hemlock (*Tsuga canadensis*), balsam fir (*Abies balsamea*), and white pine (*Pinus strobus*). Common wildlife likely to be present in this area includes white-tailed deer (*Odocoileus virginianus*), weasel (*Mustela* spp.), raccoon (*Procyon lotor*), skunk (family *Mephitidae*), opossum (family *Didelphidae*), fox (*Vulpes* spp.), American marten (*Martes americana*), and cottontail rabbit (*Sylvilagus* spp.). The campus site also contains riparian habitat and deciduous forested wetland. State-published mapping was reviewed for the presence of seabird nesting areas, shorebird feeding and roosting areas, and bald eagle (*Haliaeetus leucocephalus*) habitat, none of which were located in the vicinity of the Farnham Point property (Maine DEP, 2010).

According to the Maine Department of Inland Fisheries & Wildlife (MDIFW letter to K. Smith, Terrence J. DeWan & Associated, October 22, 2009), the campus site contains a Significant Wildlife Habitat, a mapped deer wintering area (DWA) – designated DWA 020771. In December 2009, MDIFW staff biologists conducted a DWA survey to evaluate the condition of this deer habitat (MDIFW, 2009). The survey found that habitat conditions in the DWA were excellent, meeting “the department’s criteria to be considered a moderate or high value deer wintering area” due to the large softwood trees and high percentage of crown closure. The extensive canopy helps reduce snow depths in the winter, allowing for greater mobility for wintering deer than open areas where more snow can accumulate. Subsequently, Boyle Associates was hired by Bigelow Laboratory to perform an independent assessment of the deer habitat, which was conducted on February 3, 2010. The survey indicated that there is no physical evidence or historical data that shows that this area has been functioning as a DWA within the past ten years, and that the statutory criteria for determining that the DWA is a Significant Wildlife Habitat have not been met. However, Bigelow Laboratory recognized that the area has the potential to serve as deer wintering habitat (Letter from D. Betts, Knickerbocker Group to MDIFW, March 29, 2010).

3.10.1.2 Impacts of the Proposed Action Alternative

The project would have **negligible short-term and long-term direct adverse impacts** on biological resources. There would be no indirect impacts. Construction of the proposed COBCC building would likely take place after all or most of the campus site has been cleared and, therefore, the short-term impacts associated with construction would be negligible, following on the long term impacts from the development outlined in Section 3.10.1.4. In the long term, about 0.13 acres that would otherwise (under no action conditions) remain open but would nevertheless be cleared and landscaped as the rest of the new campus is constructed, would be occupied by the proposed building. This would represent a loss of potential habitat for the common species that might otherwise use the area (e.g., squirrels or rabbits) but the loss of a landscaped area near a building would be of no lasting consequence and these common species would be able to relocate and continue to use the remaining open areas.

3.10.1.3 Impacts of the No Action Alternative

The No Action Alternative would have **no impact** on biological resources. Under this alternative, the proposed COBCC building would not be built. This has no potential to affect biological resources. The rest of the campus would be constructed as planned (see Section 3.10.1.4); the site where the proposed COBCC building would otherwise be would remain open, although it would be cleared and likely landscaped.

3.10.1.4 Cumulative Impacts of the Proposed Action

The current condition of biological resources at the Farnham Point is the result of the history of the property, which have left it forested as described in Section 3.10.1.1. The only ongoing and foreseeable future project other than the proposed action is the construction of the rest of the new Bigelow Laboratory campus. Constructing the new campus would result in the clearing of approximately 14 acres of forest and the loss of approximately 14 acres of potential deer wintering habitat. Approximately 50 acres of undeveloped land, however, would be preserved as part of the Contract Zoning Agreement between Bigelow Laboratory and the Town of Boothbay (Town of Boothbay, 2006). This area would remain unfragmented forest and continue to connect with another undeveloped property to the south. Additionally, to compensate for the loss of the 14 acres, Bigelow Laboratory will implement a compensation plan that includes the following measures:

- Sustainable campus design would be utilized, including keeping exterior lighting to a minimum and utilizing passive and solar energy for future buildings.

- The undeveloped portion of the property would be managed for softwood growth, which is preferred deer wintering habitat. A forest management plan would be prepared with assistance from MDIFW.

- Access into the deer wintering area would be restricted during severe winter conditions following notification from MDIFW that the area is being or could be used by deer. Signs would be posted at trailheads, and neighbors would be notified of this temporary restriction.

- A public education component of the compensation plan would include posting education materials regarding wildlife habitat along the recreational trails and in research buildings.

This impact of this construction, therefore, can be expected to be moderate, direct, long-term, and negative. Adding the impacts of the proposed action would not make a noticeable difference. As explained in Section 3.10.1.2, the replacement of a small, landscaped area (about 0.13 acre) by a building would result in the loss of some marginal habitat, a negligible long-term adverse impact. Therefore, **cumulative impacts on biological resources would be, long-term, direct, negative, and moderate.**

3.10.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

3.10.2.1 Affected Environment

SERC is the largest, contiguous undeveloped land holding on the western shore of the Chesapeake Bay in Maryland. SERC's 2,650 acres include forests in varying stages of succession, fresh and estuarine wetlands, croplands and pastures, rendering the site a microcosm of coastal ecological systems. Research, administrative, and educational buildings are clustered and take up a small portion of the site.

Areas not covered by wetlands or maintained as pasture and cropland are covered by Eastern deciduous coastal plain forest. Tree canopy species that dominate SERC's forests include tulip poplar (*Liriodendron tulipifera*), sweet gum (*Liquidambar styraciflua*), white oak (*Quercus alba*), southern red oak (*Q. falcata*), beech (*Fagus grandifolia*), red maple (*Acer rubrum*), black oak (*Q. velutina*), and ash species (*Fraxinus* spp.).

Wildlife typically found in Eastern deciduous coastal plain forests include white-tailed deer (*Odocoileus virginianus*), gray fox (*Urocyon cineroargenteus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), wild turkey (*Meleagris gallapavo*), Eastern gray squirrel (*Sciurus carolinensis*), an array of small mammals, and many bird species. Bald eagles, protected by the Bald and Golden Eagle Protection Act, forage at SERC, and there is one active bald eagle nest, several hundred feet from one of the stream flux stations to be repaired. Open waters adjacent to the SERC site are known historic waterfowl concentration areas.

Because of the extensive forest cover in large, relatively unbroken tracts on SERC, much of the site is designated by the Maryland Department of Natural Resources as habitat for coastal forest interior dwelling birds (FIDS) and associated wildlife. FIDS include species such as Scarlet Tanager, Wood Thrush, Pileated Woodpecker, and Barred Owl that require large, unbroken tracts of forest to breed successfully. Forest interiors are defined as being forest areas more than about 300 feet from the edge of a forest.

3.10.2.2 Impacts of the Proposed Action Alternative

The project would have **negligible short-term and long-term direct adverse impacts** on biological resources. There would be no indirect impacts. No forest would be cleared and no trees would be disturbed. At most, some tree branches may be cut to align the guy wires for the proposed data communication towers. Each tower would be micro-sited in order to minimize impacts to trees. A bald eagle's nest active in spring 2010 at SERC is several hundred feet from the nearest project component, a stream weir rehabilitation. It is unlikely that nesting eagles would be disturbed by the short construction period with construction confined to a small area next to a road. Further, the work is proposed to take place in late summer (August and September), when the nesting period would be over. Therefore, any impacts on nesting eagles would be negligible. The small amount of construction associated with the proposed repairs and upgrades is not likely to disturb any waterfowl that may present on the open waters off the SERC site. Most of the work would take place inland or on the salt marsh, far from open waters.

With respect to impacts on FIDS, all of the proposed project components are near existing roads (ranging from paved two-lane to one-lane gravel). Therefore, the parts of the forests where project components would be renovated or erected are not totally undeveloped or unused, although use levels are low. Implementing the proposed small-scale improvements would not lead to forest fragmentation. Tidal and stream flux monitoring stations are visited weekly to collect data, so some human disturbance takes place already in these areas. The automation of the data collection process that the proposed new communication infrastructure would make possible would reduce the number of times SERC staff must visit the stations, thus reducing the frequency of such disturbance. The 120-foot tall antenna towers would be located in the forest but are most likely to be built in fall or winter of 2010-2011, prior to the spring nesting season. If digging for the tower and guy wire footers and erection of the towers extends into the spring, some localized short-term disturbance of FIDS could occur. However, construction activities at any one site would be short-lived and impacts would be negligible. Each of the repair and construction projects would be accomplished in a short time span. The tidal flux stations (two are in forest) and stream weirs (most are in forest) repairs, would likely take place in late summer, at the very end or after the breeding season.

3.10.2.3 Impacts of the No Action Alternative

Under the No Action Alternative, none of the proposed improvements would be implemented. Existing conditions would continue as at present. This would result in **no impacts** to biological resources.

3.10.2.4 Cumulative Impacts of the Proposed Action

The current condition of biological resources at SERC is the result of the diverse history and past uses of the property, including, depending on the area, farming. Since it became the property of the Smithsonian Institution and dedicated to ecological research, most of the site has been left undisturbed. Ongoing and foreseeable projects outlined in the current master plan (see Section 3.2.2.4) can be expected to result in no more than minor adverse impacts to biological resources because of their limited scope and SERC's interest in minimizing any disturbance that might diminish the site's value as a center for ecological research. Therefore, past, present, and reasonably foreseeable future projects other than the proposed action can be expected to have minor long-term adverse impacts. Adding the negligible impacts expected to result from the proposed action would not result in a noticeably higher level of impact. Therefore, there would be **minor long-term direct adverse cumulative impacts** on biological resources.

3.10.3 Project 3: Murray Laboratory

3.10.3.1 Affected Environment

The vegetation surrounding the site of the proposed laboratory can be characterized as subalpine meadow, consisting of a mix of subalpine grasses and forbs, and a sagebrush/mesic (moderately moist) mountain shrub mix. Vegetation has been disturbed around existing buildings as well as on the trails that are interspersed between buildings. The area north of the existing Murray building that the addition would cover is used for experiments and contains a weather station on a concrete pad (see Figure 1-4b).

Wildlife species typical of a subalpine ecosystem are present within Gothic and surrounding areas; however, the proposed project site itself is not known to serve as niche habitat for any particular wildlife species. As the town has been occupied for over 120 years, wildlife populations are thought to have adapted to the presence of humans and RMBL, consistent with its mission, is very careful to minimize any impacts to wildlife on a continual basis. Marmots (*Marmota* spp.), picas (*Ochoton* spp.) and other small rodents as well as red foxes (*Vulpes vulpes*) are commonly observed in the vicinity of the Murray building. Larger mammals known to be present in the general area include mountain lions (*Puma concolor*) or black bears (*Ursus americanus*). As reported in Section 1.2.2.3, a black bear once broke into the building.

RMBL maintains a herbarium (http://www.rmbl.org/herbarium/index1.html) that lists vegetation of concern that has been identified within the 1,300-acre site. A species of *Rumex* (buckwheat family) has been observed near the existing Murray Building (RMBL, 2010). This plant is considered uncommon at high elevations such as Gothic and it has been proposed that the current building's roof drip and continual shade were providing a microclimate for this species.

3.10.3.2 Impacts of the Proposed Action Alternative

The project would have **negligible short-term and long-term direct adverse impacts**. During construction, higher noise levels and general activity near the site likely would exceed what local wildlife populations have become accustomed to. The larger mammals known to occupy the surrounding area like mountain lion or black bear are primarily nocturnal or crepuscular and would be unaffected by this activity. Additionally, these animals are better kept away from inhabited buildings. Smaller mammals found closer to the site on a regular basis, such as pica and marmots, would be more sensitive to changes in activities during the construction phase. These short-term impacts would be negligible, however, as they would not extend very far from the construction site and would affect only a small area of limited value as habitat. Additionally, they would cease entirely after construction is complete. In the long-term, the small amount of vegetation currently in the undeveloped portion of the project's footprint would be permanently lost. Because of the small size of the project footprint and because it is in an area that has very limited value as habitat and is not likely to be essential to the survival of any individual animal, let alone species, this loss is unlikely to affect in any way the greater ecosystem. As much as possible, the area where *Rumex* was observed would be avoided. Long-term impacts, therefore, would be negligible.

3.10.3.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new Murray Laboratory would not be constructed and RMBL would continue to use the space in the existing Murray and Willey buildings for laboratory functions. This would have **no impact** on biological resources.

3.10.3.4 Cumulative Impacts of the Proposed Action

Past actions since the foundation of Gothic and RMBL have resulted in the current condition of biological resources, outlined in Section 3.10. 3. 1. Present and foreseeable future projects (see Section 3.2.3.4), particularly those involving new construction, would likely result in some impacts similar to those of the proposed action described in Section 3.10.3.2. In general, RMBL is careful to minimize any adverse impacts from its activities on the environment that it is its mission to study. Thus, RMBL's Facilities Master Plan includes re-vegetation provisions to be implemented in association with new construction projects when appropriate (RMBL, 2006). Altogether, therefore, past, present, and foreseeable future actions at RMBL can be expected to result in no more than minor long-term adverse impacts to biological resources. The proposed action would add very little to these impacts and the difference would be barely noticeable. Thus, there would be only **minor, long-term direct adverse cumulative impacts** on biological resources.

3.10.4 Project 4: Moe Pond Laboratory

3.10.4.1 Affected Environment

The project site is located in an area of disturbed mixed coniferous and deciduous trees with an understory dominated by invasive species such as honeysuckle (*Lonicera* spp.) and buckthorn (*Rhamnus* spp.). The existing laboratory building is located within a small clearing mostly devoid of standing trees – though a large white pine (*Pinus strobus*) is present within the footprint of the proposed building – and there are several large excavations around the site where various farmstead buildings once stood, evidence of past disturbance. The surrounding forest is home to a wide variety of songbirds; bald eagles may overfly the area, though they are not known to nest nearby. Common mammal species such as white-tail deer or red fox likely are present in the general vicinity, but the project site is too small and disturbed to provide any significant foraging or breeding habitat for any species.

3.10.4.2 Impacts of the Proposed Action Alternative

The project would have **negligible short-term and long-term direct adverse impacts** on biological resources. No indirect impacts are expected. During construction, higher noise levels and general activity near the site likely would result in some disturbance to the local wildlife. These short-term impacts would be negligible as they would not extend very far from the construction site and would affect only a small area for a short time. In the long term, a small area of low shrub and grass would be lost to make room for the new laboratory; the only tree of some size that would have to be felled is a white pine. No significant fragmentation of the forest would result from the project. Although bald eagles may occasionally be present in the area, the project would not noticeably affect any habitat they may use for nesting or foraging. Thus, impacts would be negligible.

3.10.4.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new laboratory would not be built and existing conditions would continue. This would cause **no impact** to biological resources.

3.10.4.4 Cumulative Impacts of the Proposed Action

Past actions, including the construction of Moe Pond, a man-made body of water, have created the current conditions at the Upper Research Station, which is mostly undeveloped and used for ecological research. There are no ongoing or reasonably foreseeable future projects planned there other than the proposed action. Therefore, cumulative impacts would be the same as those as the impacts of the proposed action and would be **adverse and negligible**.

3.10.5 Project 6: Northwest Indian College Laboratory

3.10.5.1 Affected Environment

The location of the proposed building is partly forested, party open, being on the edge between the cleared, developed Phase I area and the yet undeveloped Phase II area of the South Campus. The surrounding forest is characterized by mature second- to third-growth mixed deciduous/coniferous forest (NWIC, 2009). Dominant tree species include bigleaf maple (*Acer macrophyllum*), black cottonwood (*Populus balsamifera* spp. *trichocarpa*), western red cedar (*Thuja plicata*), and red alder (*Alnus rubra*). Lesser amounts of western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*) and paper birch (*Betula papyrifera*) also occur in the overstory. Dominant shrubs include red elderberry (*Sambucus racemosa*), common snowberry (*Symphoricarpos albus*), salmonberry (*Rubus spectabilis*), Indian plum (*Oemleria cerasiformis*), gooseberry (*Ribes* spp.), vine maple (*Acer circinatum*), and thimbleberry (*Rubus parviflorus*). Common herbaceous layer species include stinging nettle (*Urtica dioica*), common ladyfern (*Athyrium felix-femina*), false lily of the valley (*Maianthemum dilatatum*), twistedstalk (*Streptopus* spp.), and Pacific bleeding heart (*Dicentra formosa*). Common wildlife known or likely to be present on the NWIC campus includes deer (family *Cervidae*), raccoons (*Procyon lotor*), squirrels (family *Sciuridae*), chipmunks (*Tamias* spp.), and various song birds and raptors.

3.10.5.2 Impacts of the Proposed Action Alternative

The project would have **negligible short-term and long-term direct negative impacts** on biological resources. It would have no indirect impacts. In the short term, construction activities likely would result in some disturbance to any wildlife present in the area. However, these short-term impacts would be negligible as they would affect a very small site on the edge of the developed, Phase I area of the campus that has very limited value as habitat and is not likely to be essential to the survival of any individual animals. In the long term, the proposed new laboratory would be constructed on a site that would otherwise remain vacant, although it would be cleared along with the surrounding area to allow for the construction of the planned Phase II facilities. The space between the facilities would likely consist of maintained lawn. Therefore, under the Proposed Action Alternative, a small portion of the campus would permanently change from maintained lawn to developed with a laboratory facility. While this would represent a negative impact because of the loss of the lawn, which might provide some foraging space for small mammal, rodent, or bird species, this impact would be negligible because of the marginal value of such habitat.

3.10.5.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed new laboratory building would not be constructed. This would have **no impact** on biological resources. Phase II of the South Campus development would proceed as planned, meaning that the area would eventually be cleared and developed. The site of the proposed laboratory, which is within the Phase II area, would presumably remain open and vegetated with grass lawn.

3.10.5.4 Cumulative Impacts of the Proposed Action

Past actions at and near NWIC have created the current environment on and near the campus, which is characterized by fairly large forested areas interspersed with medium-density development, particularly along Kwina Road. Ongoing and foreseeable future projects (see Section 3.2.6.4) would result in the loss of some of the existing forest. Based on the analyses contained in the EA prepared in 2009 for the Campus Phase II development (NWIC, 2009), these long-term direct negative impacts are expected to be moderate. Adding the negligible impacts from constructing the proposed laboratory would not make a substantial difference, especially since the project site would be cleared anyway, and the only difference would be that it would be occupied by a small building rather than open. Therefore, **long-term cumulative impacts would be moderate and negative**.

3.10.6 Project 7: Multi-site Cyber-Infrastructure Improvements

3.10.6.1 Affected Environment

All of UCNRS's reserves contain many valuable biological resources that justified their inclusion in the reserve system and cover the full range of plant and animal life found in California. A summary description of each of the 17 reserves affected by the proposed project may be found in Table 2-1. Preserving and studying these resources is an essential part of the reserves' mission.

3.10.6.2 Impacts of the Proposed Action Alternative

The project would have **negligible short-term and long-term direct negative impacts**. There would be no indirect impacts. In general, because of the small footprint, the proposed improvements are not expected to result in any noticeable long-term or short-term disturbance of plant or animal life on the reserves. At the most, some minor vegetation removal may be required to install a new piece of equipment but as much as possible, the proposed communication devices would be placed in open areas requiring no or minimal modification to the site. Because it is the reserves' primary mission to manage natural resources, the placement and installation of the new radios and devices would be planned and conducted under the supervision and guidance of the Reserve directors and specialized personnel, as needed to minimize any risk of accidental impact to plant or animal life. For instance the proposed installation of new radios on trees at the Angelo Reserve would be conducted under the guidance of an arborist to avoid damaging the trees (Angelo Reserve, 2010). As another example, at the Landels-Hill Big Creek Reserve, the project area was surveyed on foot on May 15, 2010 (Landels-Hill Big Creek Reserve, 2010). Native and non-native plant species encountered were recorded. No vertebrates were seen at the site. In addition to the field survey, the California Natural Diversity Database and the California Native Plant Society online database were searched for special status wildlife and plant species. Plant and wildlife species lists were compiled and assessed with regard to their presence or potential to be in the project area based on ongoing institutional species lists maintained by research biologists and frequent observations by resident staff biologists. The survey concluded that no special-status plants animals are known to occur in the project area nor were observed on the project site. Smith's blue butterfly (*Euphilotes enoptes smithi*), a federal endangered species, may fly through the repeater area but the project would not impact this species' habitat. Hoary bats (*Lasiurus cinereus*) (no special status, but present on reserve list) may forage on the project site but no roosting habitat exists for this species on the site. Therefore, the project would not affect either of these two species. To ensure that the work is conducted in a manner consistent with the Reserve's mission to support research and education in protected habitats, resident biologists who live on site would be available throughout the project to monitor for potential impacts. Thus, this project is expected to have no adverse impacts on biological resources.

Similar review procedures have been or would be followed at each of the 17 reserves selected for cyber-infrastructure upgrades, as needed, with reserve biologists ensuring that biological resources are minimally impacted by the proposed action. Therefore, any short-term and long-term adverse impacts to biological resources are expected to be negligible.

3.10.6.3 Impacts of the No Action Alternative

Under the No Action Alternative, the proposed cyber-infrastructure improvements would not take place. This would have **no impact** on biological resources.

3.10.6.4 Cumulative Impacts of the Proposed Action

Past actions at the reserves have resulted in the current environment. Like the proposed cyber-infrastructure project, ongoing and future activities at the reserves are intended and designed to enhance their ability to perform their scientific mission and are implemented in a manner that minimizes any impacts to the resources which it is the reserves' mission to conserve and study, with negligible adverse impacts resulting. Adding the impacts of the proposed projects to these would not result in greater, noticeable impacts. Thus, **adverse cumulative impacts would be negligible.**

3.11 Threatened and Endangered Species – Section 7 Review

Section 7 of the Endangered Species Act (ESA) directs federal agencies to ensure that actions they authorize, fund, or carry out do not jeopardize the continued existence of a listed endangered or threatened species or designated or proposed critical habitat (protected resources). Implementing regulations at 50 CFR 402 specify that federal agencies must review their actions and determine whether a proposed action may affect a listed species or critical habitat. Agencies consult with the US Fish and Wildlife Service (USFWS) and, for marine protected resources, the National Marine Fisheries Service (NMFS) to determine whether protected resources are present in or near the project area, which may be affected by the proposed action. If the federal agency determines that a project would have "no effect" on a listed species or critical habitat, there is o need for further consultation with USFWS or NMFS. If the federal agency determines that a project "may affect" a listed species or its critical habitat, then consultation pursuant to Section 7 must be initiated.

This section contains a description of NSF's review of each component of the proposed action for effects to protected resources. Because of the small scale of each project, the action area is considered to consist of the project site and its immediate surroundings. As explained below, none of the projects would have an effect on protected resources. Therefore, the proposed action would have **no effect** and requires no formal consultation under Section 7.

3.11.1 Project 1: COBCC Building

In response to a query from Bigelow Laboratory, USFWS (Maine Field Office), in a letter dated October 27, 2009 provided the following information with regard to protected resources in the project area (copy in Appendix A):

- The project site is within the range of the Gulf of Maine Distinct Population Segment of the Atlantic salmon (*Salmo salar*); however, the site is within the HUC-10 watershed Damariscotta River not designated as critical habitat for the Atlantic salmon. Critical habitat was not designated in East Boothbay because the rivers and streams in this area are not currently occupied by the Atlantic salmon. Therefore, the Atlantic salmon would not be expected to occur near the proposed project site.

- Bald eagles (*Haliaeetus leucocephalus*) may occur in the vicinity of the project. Although no longer listed as federally threatened, the bald eagle is protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

In a response to AECOM dated June 21, 2010 (copy in Appendix A) to a letter sent on May 6, 2010, NMFS provided the following information:

- The Gulf of Maine Distinct Population Segment of anadromous Atlantic salmon was jointly listed by NMFS and USFWS. Listed Atlantic salmon could be present in the Damariscotta River in the vicinity of the proposed project site. The entire occupied range of the Gulf of Maine Distinct Population Segment in which critical habitat is designated is within the State of Maine. The Damariscotta River in the vicinity of East Boothbay, Maine occurs within designated critical habitat for Atlantic salmon.

- A population of the federally endangered short-nose sturgeon (*Acipenser brevirostrum*) is known to exist in the Penobscot River. Short-nose sturgeons are also known to occur in the Kennebec-Androscoggin-Sheepscot estuarine complex and individuals have been documented to migrate between the Penobscot River and the Kennebec complex. The best available information indicates that short-nose sturgeon may occasionally be found in the Damariscotta River, particularly during the warmer months.

Construction of the proposed COBCC building has no potential to affect the Atlantic salmon or its habitat. The project does not involve, nor would it enable or induce, any in-water work. Any indirect impacts on water quality from stormwater runoff, as explained in Section 3.9.1.2, would be negligible. For the same reasons, the project would not affect the short-nose sturgeon. Therefore, the project would have **no effect** on protected resources. Following clarification on the scope of the proposed action and review of the previous consultation conducted by Bigelow Laboratory with USFWS and the US Corps of Engineers for the development of the campus, NMFS concurred that since the same BMPs would apply to the COBCC building as would apply to the entire site, there would be no effect (email from Trent Liebich, NOAA, to Jessica Hunt, AECOM, dated July 16, 2010; copy in Appendix A). There are no bald eagle nests on the site and the project has no potential to result in a bald eagle “take.”

3.11.2 Project 2: Renovations and Upgrades to Environmental Change Study Infrastructure

On May 26, 2010, a letter was sent to the USFWS (Chesapeake Bay Field Office) requesting review of the site for listed species and critical habitat and comments on the proposed project. To date, no response has been received. Review of the USFWS (Chesapeake Bay Field Office)’s website and Maryland Department of Natural Resources website (MDNR, August 2010) indicated that the only ESA-listed species known to occur in Anne Arundel County, where SERC is located, is the threatened swamp pink (*Hellonius bullata*). The following aquatic species are also listed as possibly occurring in the Chesapeake Bay: Short-nose sturgeon (endangered); loggerhead turtle (*Caretta caretta*) (threatened); and Atlantic Ridley turtle (*Lepidochelys kempi) (endangered).*

In general, as explained in Section 3.10.2.2, the project would have negligible impacts on biological resources because of its very small, scattered footprint and the micro-siting of the proposed towers. It would have negligible impacts on water resources and would not affect the listed aquatic species. The swamp pink has not been reported to be present at SERC. Additionally, it is an obligate wetland species that can grow only in wetlands with perennially saturated – but not flooded – soils. The proposed project does not involve activities in this type of environment. Therefore, the project would have **no effect** on protected resources.

3.11.3 Project 3: Murray Laboratory

A letter was sent to the USFWS (Western Colorado Field Office) on May 17, 2010 requesting information on protected resources in the vicinity of the project area. To date, no response has been received. Review of the USFWS (Mountain-Prairie Region, May 2010) indicates that the following ESA-species occur in Gunnison County:

- Bonytail (*Gila Elegans*), endangered
- Canada Lynx (*Lynx Canadensis*), threatened
- Colorado pikeminnow (*Ptychocheilus lucius*), endangered
- Greenback cutthroat trout (*Oncorhynchus clarki stomias*), threatened
- Gunnison's prairie dog (*Cynomys gunnisoni*), candidate
- Humpback chub (*Gila cypha*), endangered
- Razorback sucker (*Xyrauchen texanus*), endangered
- Uncompahgre fritillary butterfly (*Boloria acrocnema*), endangered
- Yellow-billed cuckoo (*Coccyzus americanus*), candidate

As explained in Section 3.10.3.2, the project would have negligible adverse impacts on biological resources because of its small footprint (about 5,000 square feet), part of which is occupied by the existing Murray Laboratory, part is immediately adjacent to the building and used for field experiments. The bonytail, Colorado pikeminnow, greenback cutthroat trout, humpback chub, and razorback sucker are fish species with no potential to be directly or indirectly affected by the project, which would have negligible impacts on water resources. Because of its small size and disturbed character, the project site does not contain any valuable habitat for the Canada Lynx or Gunnison's prairie dog. The yellow-billed cuckoo requires forested habitat (NAU, 2006). The Uncompahgre fritillary butterfly is exclusively associated with patches of snow willows (USFWS, 1994), which are not present in or near the project site. Therefore, the project is not expected to affect any of the listed species that are known to occur in Gunnison County or their habitat. It would have **no effect** on protected resources.

3.11.4 Project 4: Moe Pond Laboratory

On May 5, 2010, a letter was sent to the USFWS to request information on the presence of listed species or critical habitat on or near the project site. USFWS responded (May 14, 2010) by referencing their website. The web site listed the following two following species as present in Otsego County:

- The bog turtle (*Clemmys muhlenbergii*), threatened. It is known historically from northern Otsego County but is now thought to be extinct in the county.

- The bald eagle, delisted but protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

As explained in Section 3.10.4.2, the project would have negligible adverse impacts on biological resources because of its small size and the lack of valuable habitat on the site. The project site contains no habitat that could support the bog turtle: this semi-aquatic species favors habitat with cool, shallow, slow-moving water, deep soft muck soils, and tussock-forming herbaceous vegetation. In New York, the bog turtle is generally found in open, early successional types of habitats such as wet meadows or open calcareous boggy areas generally dominated by sedges (*Carex* spp.) or sphagnum moss (NYDEC, 2010). The project would have negligible impacts n water resources and is not likely to indirectly affect bog turtle habitat. Therefore, the project would have **no effect** on protected resources. There are no bald eagle nests on the site and the project has no potential to result in a bald eagle "take."

3.11.5 Project 5: Wawona Field Station Renovations

This project mostly consists of interior and exterior renovations to an existing building, minor trenching in areas immediately adjacent to the building, and installing solar panels in open area just behind the building. It has not potential to affect biological resources in any noticeable ways and, therefore, would have **no effect** to protected resources. The State of California Clearinghouse indicated that no California agencies submitted comments on the proposed action, supporting this conclusion.

3.11.6 Project 6: Northwest Indian College Laboratory

On May 6, 2010, letters were sent to the USFWS, NSMFS, and the Lummi Natural Resources Department requesting information on the potential presence of listed species and critical habitat on or near the project site. To date, no responses have been received.

The USFWS (Washington) website (August 2010) lists the following listed species as occurring in Whatcom County:

- Bull trout (*Salvelinus confluentus*), threatened (designated critical habitat in the county)
- Canada lynx (*Lynx canadensis*), threatened.
- Gray wolf (*Canis lupus*), endangered.
- Grizzly bear (*Ursus arctos = U. a. horribilis*), threatened.
- Marbled murrelet (*Brachyramphus marmoratus*), threatened (designated critical habitat in the county).
- Northern spotted owl (*Strix occidentalis caurina*), threatened (designated critical habitat in the county).
- Yellow-billed cuckoo (*Coccyzus americanus*), candidate.

NMFS's web site lists the following listed species as possibly occurring in Washington and Oregon:

- Southern Resident killer whale (*Orcinus orca*), endangered, designated critical habitat.
- Humpback whale (*Megaptera novaeangliae*), endangered.
- Blue whale (*Balaenoptera musculus*), endangered.
- Fin whale (*Balaenoptera physalus*), endangered.
- Sei whale (*Balaenoptera borealis*), endangered.
- Sperm whale (*Physeter macrocephalus*), endangered.
- Steller sea lion (*Eumetopias jubatus*), threatened, designated critical habitat.
- Bocaccio (*Sebastes paucispinis*), endangered in Puget Sound.

- Canary rockfish (*Sebastes pinniger*), threatened in Puget Sound.
- Yellow-eye rockfish (*Sebastes ruberrimus*), threatened in Puget Sound.
- Eulachon (Columbia River smelt) (*Thaleichthys pacificus*), threatened.
- North American green sturgeon (*Acipenser medirostris*), threatened.
- Leatherback sea turtle (*Dermochelys coriacea*), endangered.
- Green sea turtle (*Chelonia mydas*), endangered.
- Olive Ridley sea turtle (*Lepidochelys olivacea*), endangered.
- Loggerhead sea turtle (*Caretta caretta*), threatened.
- Puget Sound chinook salmon (*Oncorhynchus tshawytscha*), threatened.
- Puget Sound steelhead salmon (*Oncorhynchus mykiss*), threatened.

Because the proposed action would take place inland and would have negligible impacts on water resources, there would be no effects to the protected resources under NMFS's jurisdiction. Several studies have been conducted to determine the presence of listed species or their habitat on or near the new NWIC South Campus site as part of previous environmental documentation. These studies include:

- A Biological Assessment Report prepared in 2004 by Douglass Consulting for NWIC to evaluate the effects of the construction of the Phase I campus facilities on protected resources in support of the EA prepared for the new campus master plan and the implementation of Phase I (NWIC, 2004).

- An evaluation conducted in August 2009 by ATSI Aqua-Terr System Inc. of the effects on protected resources of constructing Phase II of the campus in support of the EA prepared for Phase II of the master plan (NWIC, 2009).

- An evaluation conducted in late 2008 by Northwest Ecological Services LLC for the Lummi Housing Authority of the effects on protected resources of constructing a residential development, Kwina Apartments, just west of the South Campus, which was included in the Action Area (appended to NWIC, 2009)

As detailed in these studies, no protected resources were found to be present on the site of the South Campus, and none of the activities evaluated would have effects on such resources. The proposed new laboratory would be constructed within the Phase II area, close to the existing Phase I and planned Phase II facilities. No area not covered by the previous evaluation would be affected and because of its small scale, the project has no potential to affect any protected resources outside the areas covered by the previous studies. Therefore, the project would have **no effect** on protected resources.

3.11.7 Project 7: Multi-site Cyber Infrastructure Improvements

The proposed improvements would take place at 17 reserves in 10 counties. On May 27, 2010, letters were sent to the USFWS offices with jurisdiction over the areas where the reserves are located requesting information on protected resources in these areas and comments on the proposed action. To date, only one response – from the Ventura Office – has been received (letter dated August 11, 2010: copy in Appendix F). Further information was obtained, as available, from USFWS's websites. Multiple protected species are present in the counties where the reserves are located.

However, the replacement of existing data transmission equipment or the placement of new equipment on existing buildings or structures has no potential to have any effects on protected resources. Where new equipment would be installed, as explained in Section 3.10.6.2, this would be planned and conducted under the supervision and guidance of the Reserve directors and specialized personnel to avoid impacts to plant or animal life, particularly any rare or sensitive species that may be present on the reserves. The very small footprint of each piece of equipment ensures that no noticeable amount of vegetation and habitat would be lost. While installing the equipment may result in some temporary disturbance to the local wildlife, it would only be for a very short time. The equipment would not create new conditions, e.g. noise or motion, that could noticeably affect wildlife in the long term. Therefore, the project would have **no effect** on protected resources. The State of California Clearinghouse indicated that no California agencies submitted comments on the project, supporting this conclusion.

3.11.8 Project 8: Microwave Relay Antennas

On May 17, 2010, a letter was sent to USFWS requesting information on protected resources present near the project areas and comments on the potential effect of the proposed action on such resources. The letter included a list of the protected resources known to be present in Coconino County and a description of the project. In a response dated June 22, 2010 (copy in Appendix G), USFWS concurred that the project would have **no effect** on any protected species or their habitat for the following reason: "The proposed microwave relay antenna sites are located within and immediately adjacent to developed areas. The antenna location sites do not support habitat that may be occupied by endangered, threatened, or proposed species or designated critical habitat, either within the footprint of the construction or adjacent to the site."

3.11.9 Project 9: Greenhouse Replacement

On May 7, 2010, a letter was sent to USFWS to request comments on the potential effects of the project on protected resources. The letter described the project and noted that it is located in a developed area of the campus surrounded by buildings and parking lots, with no natural habitat that could be affected. The letter concluded that the project would have **no effect** on listed species. In a response dated June 18, 2010 (copy in Appendix H), USFWS concurred that the project would not affect any federally listed or candidate species.

3.11.10 Project 10: St. Anthony Falls Laboratory

On May 18, 2010, a letter was sent to the USFWS to request information on listed species potentially present in the vicinity of the project area and comments on the proposed project. To date, no response has been received. Based on the list available on the Service's website (August 2010), the following listed species occurs in Hennepin County:

- Higgins eye pearly mussel (*Lampsilis higginsi*), endangered (Mississippi River)

As explained in Section 3.9, this project, which involves mostly renovation work in an existing building and minor construction along an artificial stream segment constructed and used for the purpose of conducting experiments, has no potential to have any direct or indirect impacts on the Mississippi River and any species living in the river. Therefore, the project would have **no effect** on protected resources.

4. Summary of Impacts and Comparison of Alternatives

The proposed action being considered by NSF consists of funding the ten projects the individual impacts of which have been evaluated in Chapter 3 through the ARI-R2 program. The results of this evaluation are summarized in Table 4-1 (including the impacts of the No Action Alternative, for purposes of comparison; to keep the table manageable, direct and indirect impacts are not distinguished). Because of small scale of each of the projects and their wide geographic distribution, it would not be meaningful to add their respective impacts to assess the impacts of the proposed action as a whole. Instead, for each resource, the proposed action's impacts are determined based on the project with the greatest impact for this resource. For instance, if one project out of the ten would have a minor adverse impact on a given resource while all the other projects would have negligible impacts, the proposed action as a whole would be considered to have a minor adverse impact on the resource.

Based on the impact analyses contained in Chapter 3 and summarized in Table 4-1, and following public and agency review of the Draft EA (the comments received and responses are provided in Appendix J), NSF has concluded that the proposed action would not result in significant impacts on the human environment.

Table 4-1 - Summary of Impacts and Comparison of Alternatives

	Land Use	Historic Resources	Visual Quality	Section 106 review	Air Quality	Noise	Earth Resources	Water Resources	Biological Resources	T&E Species Section 7
Proposed Action Alternative										
Project 1	ST: Neg. - LT: Min. + C: Min. +	ST: None LT: None C: None	ST: Neg. - LT: None C: None	No historic properties affected	ST: Min. - LT: Min. - C:Min. -	ST: Mod. - LT: Neg. - C: Min. -	ST: Min. - LT: Min. - C: Min. -	ST: Neg. - LT: Neg. - C: Mod. -	ST: Neg. - LT: Neg. - C: Mod. -	No effect
Project 2	ST: Neg. - LT: Min.+ C: Min. +	ST: None LT: Min. - C: Min. -	ST: Neg. - LT: Neg. - C: Neg. -	No Adverse effect	ST: Neg. - LT: None C: one	ST: Neg. - LT: None C: None	ST: None LT: None C: None	ST: Neg. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Min. -	No effect
Project 3	ST: Neg. - LT: Min. + C: Min. +	ST: None LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. + C: Min. +	No adverse effect	ST: Min. - LT: Neg. - C: Min. -	ST: Min. – LT: Neg. – C: Neg. -	ST: Neg. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Min. -	No effect
Project 4	ST: Neg. - LT: Min. + C: Min. +	ST: None LT: None C: None	ST: Neg. - LT: Neg. + C: Neg. +	No effect	ST: Min. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Neg. -	ST: Neg. - LT: Neg. - C: Neg. -	ST: Neg. - LT: Neg. - C: Neg. -	ST: Neg. - LT: Neg. - C: Neg. -	No effect
Project 5	ST: Neg. - LT: Min. + C: Min. +	ST: Neg. - LT: Min. - C: Min. -	ST: Neg. - LT: None C: None	No adverse effect	ST: Neg. - LT: None C: None	ST: Min. - LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	No effect
Project 6	ST: Neg. - LT: Min.+ C: Min. +	ST: None LT: None C: None	ST: Neg. - LT: None C: None	No historic properties affected	ST: Min. - LT: None C: None	ST: Min. - LT: None C: None	ST: Neg. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Min. -	ST: Neg. - LT: Neg. - C: Mod. -	No effect
Project 7	ST: Neg. - LT: Min.+ C: Min. +	ST: None LT: Neg. - C: Min. -	ST: Neg. - LT: Min. - C: Min. -	No effect	ST: Neg. - LT: None C: None	ST: Neg. - LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	ST: Neg. - LT: Neg. - C: Neg. -	No effect
Project 8	ST: Neg. - LT: Min.+ C: Min. +	ST: None LT: None C: None	ST: Neg. - LT: Neg. - C: Neg. -	No Adverse effect	ST: Neg. - LT: None C: None	ST: Neg. - LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	No effect
Project 9	ST: Neg. - LT: Min.+ C: Min +	ST: None LT: None C: None	ST: Neg. - LT: None C: None	No historic properties affected	ST: Min. - LT: None C: None	ST: Min. - LT: None C: None	ST: Neg - LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	No effect
Project 10	ST: None LT: Min.+ C: Min. +	ST: Neg. - LT: Min. - C: Min. -	ST: Neg. - LT: Min. - C: Min. -	No adverse effect	ST: Neg. - LT: None C: None	ST: Neg. - LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	ST: None LT: None C: None	No effect
Proposed Action	ST: Neg. - LT: Min. + C: Min. +	ST: Neg. - LT: Min. - C: Min. -	ST: Neg. - LT: Min. - C: Min. -	No adverse effect	ST: Min. - LT: Min. - C:Min. -	ST: Mod. - LT: Neg. - C: Min. -	ST: Min. - LT: Min. - C: Min. -	ST: Neg. - LT: Neg. - C: Mod. -	ST: Neg. - LT: Neg. - C: Mod. -	No effect

	Land Use	Historic Resources	Visual Quality	Section 106 review	Air Quality	Noise	Earth Resources	Water Resources	Biological Resources	T&E Species Section 7
No Action Alternative										
Project 1	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 2	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 3	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 4	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 5	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 6	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 7	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 8	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 9	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-
Project 10	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	
No Action	ST: None LT: Min.-	ST: None LT: None	ST: None LT: None	-	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	ST: None LT: None	-

Key:
ST = Short term   Neg.= Negligible   + - Positive
LT = Long term   Min. = Minor   - = Adverse
C = Cumulative   Mod. - Moderate

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6. Acronyms and Abbreviations

ACM	Asbestos Containing Material
ADA	Americans with Disabilities Act
AHERA	Asbestos Hazard Emergency Response Act
APE	Area of Potential Effects
ARC	Ames Research Center
ARI-R2	Academic Research Infrastructure – Recovery and Reinvestment
ARRA	American Recovery and Reinvestment Act of 2009
BCBB	Bigelow Center for Blue Biotechnology
BCEF	Building Condition Evaluation Form
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practice
BORR	Blue Oak Ranch Reserve
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CDOM	Colored Dissolved Organic Matter
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COBCC	Center for Ocean Biogeochemistry and Climate Change
CSFRS	Central Sierra Field Research Stations
CWA	Clean Water Act
dB	Decibel
dBA	A-weighed decibel
DEP	Department of Environmental Protection
DOT	Department of Transportation
EA	Environmental Assessment
ECRF	Environmental Change Research Facility
EO	Executive Order
EPA	Environmental Protection Agency
FAR	Federal Aviation Regulations
FARR	Federal Air Rules for Reservations
FEMA	Federal Emergency Management Agency
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FIRM	Flood Insurance Rate Maps
FPPA	Farmland Protection Policy Act
GCR	General Conformity Rule
GHz	Gigahertz
GIS	Geographic Information System
GR	General Residential
HM	Hazardous Materials
HPWREN	High Wireless Performance Educational Network

HSWA	Hazardous and Solid Waste Amendments
HVAC	Heating, Ventilation and Air-Conditioning
HW	Hazardous Waste
ISL	Indoor StreamLab
ISP	Internet Service Provider
kHz	Kilohertz
LBP	Lead-Based Paint
LEED	Leadership in Energy and Environmental Design
LIBC	Lummi Indian Business Council
LPG	Liquid Petroleum Gas
LRDP	Long-Range Development Plan
MHz	Megahertz
MNRRA	Mississippi National River and Recreation Area
MSDS	Material Safety Data Sheet
msl	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NCED	National Center for Earth-surface Dynamics
NEON	National Ecological Observatory Network
NEPA	National Environmental Policy Act of 1969
NES	Native Environmental Science
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NOAA	National Atmospheric and Oceanographic Administration
NO_X	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPOI	Navy Prototype Optical Interferometer
NPS	National Park Service
NRHP	National Register of Historic Places
NSF	National Science Foundation
NWIC	Northwest Indian College
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSNHP	New York State Natural Heritage Program
O_3	Ozone
OBCC	Ocean Biogeochemistry and Climate Change
OEM	Original Equipment Manufacturer
OSHA	Occupational Safety and Health Administration
OSL	Outdoor StreamLab
Pb	Lead
PM_{10} and $_{2.5}$	Particulate Matter
ppm	Parts Per Million
psf	Pounds Per Square Foot
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act

RF	Radio Frequency
RMBL	Rocky Mountain Biological Laboratory
ROI	Region of Influence
SAFL	St. Anthony Falls Laboratory
SARA	Superfund Amendments and Reauthorization Act
SERC	Smithsonian Environmental Research Center
SHPO	State Historic Preservation Officer
SIPs	State Implementation Plans
SNARL	Sierra Nevada Aquatic Research Laboratory
SNRI	Sierra Nevada Research Institute
SO_2	Sulfur Dioxide
SOP	Standard Operating Procedure
SOZ	Shoreland Overlay Zone
SPDES	New York State Pollutant Discharge Elimination System
SR	State Route
STREON	Stream Experimental and Observational Network
SUNY	State University of New York
SWPPP	Stormwater Pollution Prevention Plan
THPO	Tribal Historic Preservation Officer
TNC	The Nature Conservancy
TSCA	Toxic Substances Control Act
UC	University of California
UCITS	University of California Information Technology Services
UCNRS	University of California Natural Reserves System
UCO	University of California Observatories
UCSB	University of California Santa Barbara
USACE	United States Army Corp of Engineers
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
VOC	Volatile Organic Compound
VSL	Virtual StreamLab
WFS	Wawona Field Station
WPA	Work Progress Administration
XES	Experimental EarthScapes

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7. Preparers

This Environmental Assessment was prepared by:

675 N. Washington Street Suite 300
Alexandria, VA 22314

Key personnel included:

Gregory Austin (Project 4 York Lead); MS, Biology; 10 years of experience

Mark Bowen (Project 5 Lead); MA, Public History, 15 years of experience

Laurent Cartayrade (Project Manager); PhD, History; 10 years of experience

Helen Chernoff (Natural Resources); MS, Biology; 25 years of experience

Elizabeth Copley (Project 7 Lead); MUP, Urban Planning, 34 years of experience

Penelope Douglas (Project 2 Lead; Natural Resources); MA, Geography – Environmental Systems; 40 years of experience

Victor P. Frankenthaler (Water Resources); MS, Geography; 29 years of experience

Kris Gade (Project 8 Lead); PhD, Biology; 10 years of experience

John Guenther (Project 6 Lead); BS, Geology; 23 years of experience

Jessica Hunt (Project 1 Lead) MS, Natural Resources and Water Resources, 13 years of experience

Dave Jury (Project 9 Lead); BA, Geography; 21 years of experience

Bruce Meighen (Project 3 Lead); MA, City Planning, 18 years of experience

Amy Ollendorf (Project 10 Lead); PhD, Ancient Studies; 26 years of experience

Katherine Weber (GIS and Cartography); BA, Geography; 6 years of experience

Lane Willson (Quality Control); Captain, US Navy, Retired; MBA, Finance; 35 years of experience

Fang Yang (Air Quality); MS, Atmospheric Science; 22 years of experience

Art Jung (Program Manager); MS, Environmental Science, 48 years of experience

Appendix A – Project 1

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tjd&a Terrence J. DeWan & Associates Landscape Architects & Planners
121 West Main Street
Yarmouth, Maine 04096
tel. 207.846.0757 fax. 207.846.0675
www.tjda.net

October 22, 2009

RECEIVED
OCT 23 2009
By 1526-02

Robin Stancampiano, Architectural Historian
Review & Compliance/CLG Coordinator
Maine Historic Preservation Commission
55 Capitol Street
65 State House Station
Augusta, ME 04333

RE: MHPC# 1526-02
Bigelow Laboratory for Ocean Sciences, East Boothbay, Maine

Dear Robin,

Bigelow Laboratory submitted an initial request for review on August 2, 2002. MHPC responded with a request for Historic Building Structure Surveys for buildings over 50 years old that were adjacent to the site. The Laboratory project was put on hold at that time but is now moving forward again. Bigelow Laboratory for Ocean Sciences is preparing its State and Federal permits for the development of a new facility on the 62-acre parcel they own in East Boothbay, Maine. The long-range goal is to relocate their current base of operations from West Boothbay Harbor to a new research campus on this site.

We have prepared the Building Structure Surveys as requested and would appreciate your comments regarding possible historic and/or archaeological resources within the vicinity of this project. A portion of the USGS map is enclosed to locate the site.

Please feel free to contact us if you need any clarification or further information. Thank you for your prompt attention.

Sincerely,

Keith B. Smith
TERRENCE J. DEWAN & ASSOCIATES

Based on the information submitted, I have concluded that there will be no historic properties affected by the proposed undertaking, as defined by Section 106 of the National Historic Preservation Act. Consequently, pursuant to 36 CFR 800.4(d)(1), no further Section 106 consultation is required unless additional resources are discovered during project implementation pursuant to 36 CFR 800.13.

Kirk F. Mohney,
Deputy State Historic Preservation Officer
Maine Historic Preservation Commission

10/26/09
Date

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Maine Field Office – Ecological Services
17 Godfrey Drive, Suite #2
Orono, ME 04473
(207) 866-3344 Fax: (207) 866-3351

FWS/Region 5/ES/MEFO

October 27, 2009

Mr. Keith B. Smith
Terrance J. DeWan & Associates
121 West Main Street
Yarmouth, ME 04096

Dear Mr. Smith:

Thank you for your letter dated October 19, 2009 requesting information or recommendations from the U.S. Fish and Wildlife Service (Service). This letter provides the Service's response pursuant to Section 7 of the Endangered Species Act (ESA), as amended (16 U.S.C. 1531-1543), the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d, 54 Stat. 250), and the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667d).

Project Name/Location:	Proposed relocation of the Bigelow Laboratory for Ocean Sciences – East Boothbay, ME
Log Number:	53411-2010-SL-0011

Federally Listed Species

This project occurs within the range of the Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon (*Salmo salar*) in Maine, a federally-endangered species under the joint jurisdiction of the Service and the National Marine Fisheries Service (NMFS) (74 FR 29344; June 19, 2009). The Atlantic salmon GOM DPS encompasses all naturally spawned and conservation hatchery populations of anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River and wherever these fish occur in the estuarine and marine environment. Also included in the GOM DPS are all associated conservation hatchery populations used to supplement these natural populations; currently, such conservation hatchery populations are maintained at Green Lake National Fish Hatchery and Craig Brook National Fish Hatchery. Excluded are landlocked salmon (also *Salmo salar*) and those salmon raised in commercial hatcheries for aquaculture.

The proposed project site, however, is within a HUC-10 watershed (Damariscotta River) that has **not** been designated as critical habitat for Atlantic salmon by NMFS (74 FR 29300; June 19, 2009). Critical habitat was not designated within the town of East Boothbay because the rivers and streams in this area are not currently occupied by Atlantic salmon. Therefore, Atlantic salmon would not be expected to occur near the proposed project site.

Please note that under Section 7 of the ESA, it is the federal action agency's responsibility to determine if a project may affect a federally listed species. For example, if there is a federal permit necessary for this project, that permitting action may provide a "nexus" for Section 7 consultation under the ESA[1]. If the federal action agency determines that a project would have "no effect" on a listed species or critical habitat, they do not need to seek the concurrence of the Service and there is no need for Section 7 consultation. If the federal agency determines that a project "may affect" a listed species or its critical habitat, then consultation pursuant to Section 7 of the ESA should be initiated. For Atlantic salmon and its critical habitat, NMFS and the Service share consultation responsibilities under Section 7 of the ESA, with the Service generally handling projects in the freshwater component of the salmon's habitat and NMFS handling projects in the marine and estuarine environment (generally below the head of tide).

Based on the information currently available to us, no other federally-listed species under the jurisdiction of the Service are known to occur in the project area.

Other Protected Species

Bald eagles (*Haliaeetus leucocephalus*) could occur in the general project area. Please see the enclosed map for the location of the nearest known bald eagle nest. The bald eagle was removed from the federal threatened list on August 9, 2007 and is now protected from take under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. "Take" means to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. The term "disturb" under the Bald and Golden Eagle Protection Act was recently defined within a final rule published in the Federal Register on June 5, 2007 (72 Fed. Reg. 31332). "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle; 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

Further information on bald eagle delisting and their protection can be found at http://www.fws.gov/migratorybirds/baldeagle.htm.

Please consult with our new national bald eagle guidelines, which can found at http://www.fws.gov/migratorybirds/issues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf.

These Guidelines are voluntary and were prepared to help landowners, land managers and others meet the intent of the Eagle Act and avoid disturbing bald eagles. If you believe this project will

[1] Section 7 consultation, however, is only necessary when a federal agency takes a *discretionary* action (e.g., an agency has a choice of whether or not to fund a particular project).

result in taking or disturbing bald or golden eagles, please contact our office for further guidance. We encourage early and frequent consultations to avoid take of eagles.
We have not reviewed this project for state-threatened and endangered wildlife, wildlife species of special concern, and significant wildlife habitats protected under the Maine Natural Resources Protection Act. We recommend that you contact the Maine Department of Inland Fisheries and Wildlife:

Steve Timpano
Maine Department of Inland Fisheries and Wildlife
284 State St.
State House Station 41
Augusta, ME 04333-0041
Phone: 207 287-5258

We also recommend that you contact the Maine Natural Areas Program for additional information on state-threatened and endangered plant species, plant species of special concern, and rare natural communities:

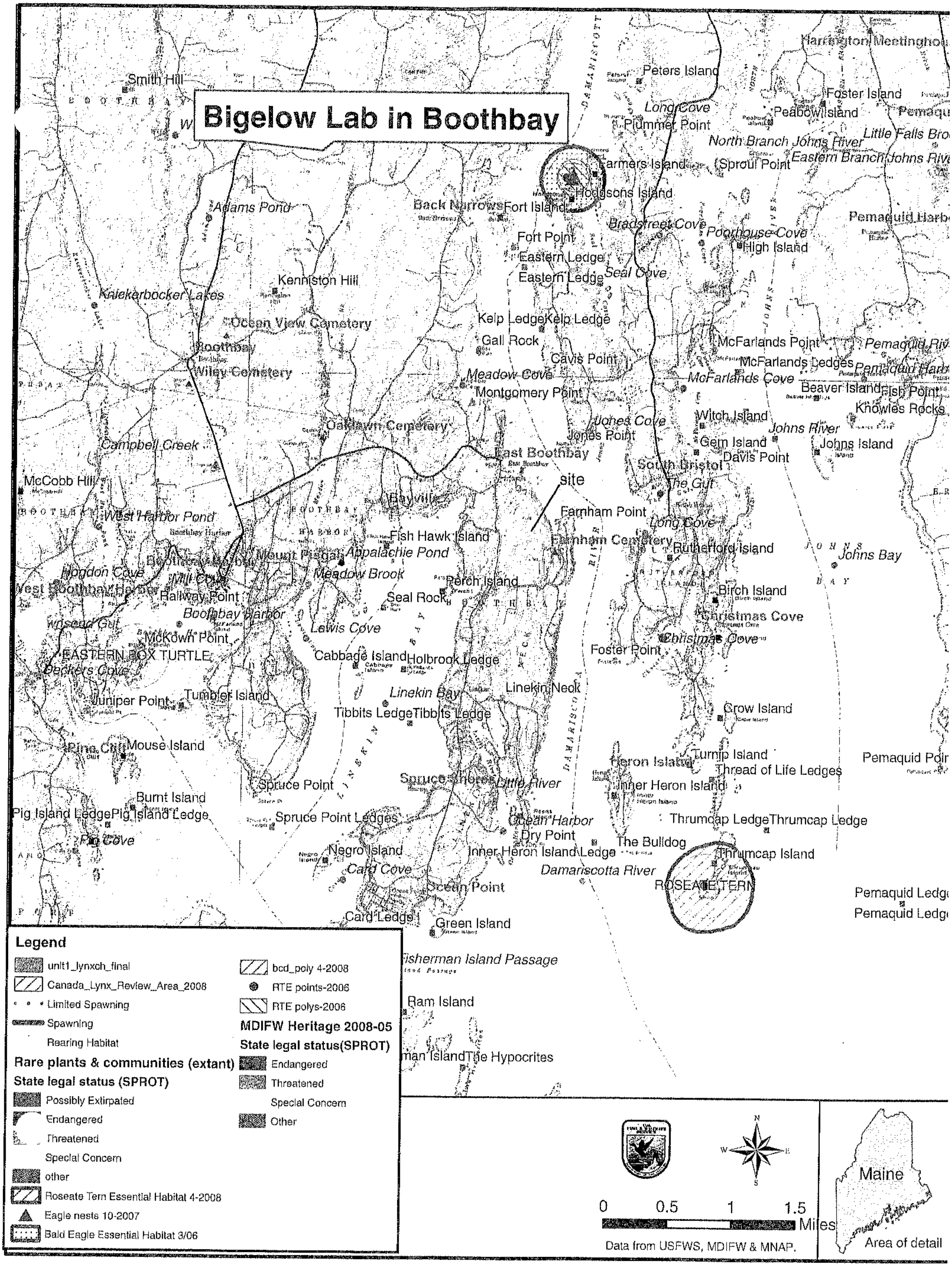
Lisa St. Hilaire
Maine Natural Areas Program
Department of Conservation
93 State House Station
Augusta, ME 04333
Phone: 207 287-8046

If you have any questions about this project, please contact Wende Mahaney at (207) 866-3344, Ext. 118.

Sincerely,

for Lori H. Nordstrom
Field Supervisor

Enclosure



Bigelow Lab in Boothbay
Smith Hill
Peters Island
Harrington Meetinghouse
Foster Island
Long Cove
Peabow Island
Plummer Point
North Branch Johns River
Little Falls Brook
Eastern Branch Johns River
Farmers Island
Sproul Point
Hodgsons Island
Adams Pond
Back Narrows
Fort Island
Bradstreet Cove
Poorhouse Cove
High Island
Pemaquid Harbor
Fort Point
Eastern Ledge
Eastern Ledge
Seal Cove
Kenniston Hill
Knickerbocker Lakes
Ocean View Cemetery
Kelp LedgeKelp Ledge
Gall Rock
McFarlands Point
Boothbay
Cavis Point
McFarlands Ledges
Wiley Cemetery
Meadow Cove
McFarlands Cove
Beaver Island
Fish Point
Montgomery Point
Knowles Rocks
Witch Island
Oaklawn Cemetery
Jones Cove
Johns River
Jones Point
Gem Island
Johns Island
Campbell Creek
East Boothbay
Davis Point
South Bristol
McCobb Hill
site
The Gut
Bayville
West Harbor Pond
Farnham Point
Long Cove
Fish Hawk Island
Farnham Cemetery
Rutherford Island
Johns Bay
Mount Pisgah
Appalachie Pond
Hodgdon Cove
Meadow Brook
Perch Island
Birch Island
West Boothbay Harbor
Mill Cove
Railway Point
Seal Rock
Christmas Cove
Boothbay Harbor
Lewis Cove
Christmas Cove
McKown Point
Foster Point
EASTERN BOX TURTLE
Cabbage Island
Holbrook Ledge
Beckers Cove
Linekin Neck
Linekin Bay
Juniper Point
Tumbler Island
Tibbits LedgeTibbits Ledge
Crow Island
Pine Cliff
Mouse Island
Turnip Island
Pemaquid Point
Heron Island
Thread of Life Ledges
Spruce Point
Spruce Shores
Little River
Inner Heron Island
Burnt Island
Pig Island LedgePig Island Ledge
Spruce Point Ledges
Thrumcap LedgeThrumcap Ledge
Ocean Harbor
Pig Cove
Dry Point
The Bulldog
Negro Island
Inner Heron Island Ledge
Thrumcap Island
Card Cove
Damariscotta River
Ocean Point
ROSEATE TERN
Pemaquid Ledge
Pemaquid Ledge
Card Ledge
Green Island
Fisherman Island Passage
Ram Island
man IslandThe Hypocrites
Legend
unit1_lynxch_final
Canada_Lynx_Review_Area_2008
Limited Spawning
Spawning
Rearing Habitat
Rare plants & communities (extant)
State legal status (SPROT)
Possibly Extirpated
Endangered
Threatened
Special Concern
other
Roseate Tern Essential Habitat 4-2008
Eagle nests 10-2007
Bald Eagle Essential Habitat 3/06
bcd_poly 4-2008
RTE points-2006
RTE polys-2006
MDIFW Heritage 2008-05
State legal status(SPROT)
Endangered
Threatened
Special Concern
Other
N
S
W
E
0
0.5
1
1.5
Miles
Data from USFWS, MDIFW & MNAP.
Maine
Area of detail

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

JUN 21 2010

Jessica Hunt
AECOM
500 Southborough Drive
South Portland, Maine 04106

RE: Bigelow Laboratory

Dear Ms. Hunt:

This correspondence is in response to your letter dated May 6, 2010 requesting information on the presence of listed species or critical habitat under the jurisdiction of NOAA's National Marine Fisheries Service in the vicinity of the proposed construction of a new Center for Ocean Biochemistry and Climate Change (COBCC) for the Bigelow Laboratory for Ocean Sciences to be built in East Boothbay, Lincoln County, Maine. The National Science Foundation (NSF) is preparing an Environmental Assessment for the proposed project. The project is being considered for funding by NSF through the Academic Research Infrastructure-Recovery and Reinvestment Program (ARI-R2), a program funded under the American Recovery and Reinvestment Act of 2009 (ARRA).

The construction would on a 62.8-acre site located on Farnham Cove on the Damariscotta River. The fully built out campus would comprise several buildings as well as parking areas, internal roads, and a pier on the cove.

NMFS Listed Species and Critical Habitat in the Action Area
The Gulf of Maine (GOM) Distinct Population Segment (DPS) of anadromous Atlantic salmon includes all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River. Included are all associated conservation hatchery populations used to supplement these natural populations; currently, such conservation hatchery populations are maintained at Green Lake National Fish Hatchery (GLNFH) and Craig Brook National Fish Hatchery (CBNFH). The GOM DPS of Atlantic salmon was jointly listed by NMFS and the U.S. Fish and Wildlife Service (USFWS). Listed Atlantic salmon could be present in the Damariscotta River in the vicinity of the proposed project site.

Critical habitat for listed Atlantic salmon has been designated pursuant to section 4(b)(2) of the ESA. The critical habitat designation for the GOM DPS includes 45 specific areas occupied by Atlantic salmon at the time of listing that include approximately 19,571 km of perennial river, stream, and estuary habitat and 799 square km of lake habitat within the range of the GOM DPS and in which are found those physical and biological features essential to the conservation of the species. The entire occupied range of the GOM DPS in which critical habitat is designated is within the State of Maine. The Damariscotta River in the vicinity of East Boothbay, Maine occurs within designated critical habitat for Atlantic salmon.

A population of the federally endangered shortnose sturgeon (*Acipenser brevirostrum*) is known to exist in the Penobscot River (NMFS 1998). Between May 2006 and October 2009, over 500 shortnose sturgeon were captured in the Penobscot River by the University of Maine (UM). A preliminary population estimate generated by UM in 2008 based on the 2006-2007 capture data indicates a population size of 1,049 individuals (Lincoln Peterson, 95% CI 673-6939; UM unpublished data). Shortnose sturgeon are also known to occur in the Kennebec-Androscoggin-Sheepscot estuarine complex and individuals have been documented to migrate between the Penobscot River and the Kennebec complex. The best available information indicates that shortnose sturgeon may occasionally be found in the Damariscotta River, particularly during the warmer months.

Section 7 Consultation Process

From your letter it appears that the only component of the construction involving in-water work is the construction of the pier in Farnham Cove. Under Section 7(a)(2) of the ESA, each Federal agency is required to insure that any action they authorize, fund or carry out is not likely to jeopardize the continued existence of any endangered or threatened species. The funding of the proposed project by NSF would be a federal action requiring section 7 consultation. The construction of the pier is likely to require authorization from the New England District of the Army Corps of Engineers (ACOE). As such, NSF and ACOE should determine which agency will be the lead Federal agency for purposes of completing any necessary section 7 consultation.

The lead Federal agency, or their designated non-Federal representative, is responsible for determining whether the proposed action is likely to affect listed species or critical habitat. The Federal agency would then submit their determination along with justification for their determination and a request for concurrence, to the attention of the Section 7 Coordinator, NMFS Northeast Regional Office, Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930. After reviewing this information, NMFS would then be able to conduct a consultation under section 7 of the ESA. Please note that if the lead Federal agency intends to designate a non-Federal representative for the purposes of carrying out informal consultation, a letter explaining the Federal agency's determination must be sent to NMFS.

Technical Assistance for Candidate Species

Candidate species are those petitioned species that are actively being considered for listing as endangered or threatened under the ESA, as well as those species for which NMFS has initiated an ESA status review that it has announced in the *Federal Register*.

Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) occur in the Gulf of Maine and are known to occur in the Penobscot and Kennebec rivers Individual Atlantic sturgeon may be seasonally present in the Damariscotta River. In 2006, NMFS initiated a status review for Atlantic sturgeon to determine if listing as threatened or endangered under the ESA is warranted. The Status Review Report was published on February 23, 2007. NMFS is currently considering the information presented in the Status Review Report to determine if any listing action pursuant to the ESA is warranted at this time. If it is determined that listing is warranted, a final rule listing the species could be published within a year from the date of publication of the proposed rule. Currently, NMFS expects to publish a finding as to whether any listing action is appropriate by the Fall of 2010. As a candidate species, Atlantic sturgeon receive no substantive or procedural protection under the ESA; however, NMFS recommends that project proponents consider implementing conservation actions to limit the potential for adverse effects on Atlantic sturgeon from any proposed project. Please note that once a species is proposed for listing the conference provisions of the ESA apply (see 50 CFR 402.10). As the listing status for this species may change, NMFS recommends that the project proponent obtain updated status information from NMFS prior to the completion of any NEPA documentation or submittal of any request for section 7 consultation.

Essential Fish Habitat
Consultation for Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) may be necessary for this project due to the presence of federally managed species in the project area. If EFH may be adversely affected, NSF must submit an EFH Assessment to NMFS analyzing the effects of the action on EFH and federally managed species. A guide to essential fish habitat designations in the Northeastern United States is located on the Habitat Conservation Division web site at http://www.nero.noaa.gov/hcd/webintro.html. Questions specific to EFH and the need for further coordination can be directed to Lou Chiarella of NMFS' Habitat Conservation Division at (978)282-8277.

We encourage the applicant to work with NMFS as project plans become more developed to identify and evaluate the potential for impacts to the species under NMFS' jurisdiction. Informal discussions can greatly facilitate consultation. Thank you for your inquiry regarding listed species for this project. Please contact Jeff Murphy at (207) 866-7379 should you have any questions concerning this correspondence.

Sincerely,

Mary Colligan

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

EC: Murphy, F/NER3
Crocker, F/NER3
Chiarella, F/NER4

File Code: Sec 7 technical assistance 2010

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Cartayrade, Laurent

Subject: FW: Section 7 Correspondence regarding COBCC Building on Proposed Bigelow Campus

-----Original Message-----
From: Trent.Liebich@noaa.gov [mailto:Trent.Liebich@noaa.gov]
Sent: Friday, July 16, 2010 4:01 PM
To: Hunt, Jessica
Cc: Frankenthaler, Vic; Cartayrade, Laurent
Subject: Re: Section 7 Correspondence regarding COBCC Building on Proposed Bigelow Campus

Jessica,

Considering that you are following the same BMP's as the rest of the campus construction, and those achieved a No Effect determination, I would say a No Effect determination for your portion of the project is appropriate. Unless building plans change, you shouldn't need any further consultation from NMFS.

Let me know if you have any questions,

Trent

Trent Liebich
NOAA Fisheries
Maine Field Station
17 Godfrey Dr., Suite 1
Orono, ME 04473

ph: (207) 866-4238

----- Original Message -----
From: "Hunt, Jessica" <Jessica.Strauss@aecom.com>
Date: Friday, July 16, 2010 3:22 pm
Subject: Section 7 Correspondence regarding COBCC Building on Proposed Bigelow Campus

> Hi Trent,
>
>
>
> I just wanted to follow up with our phone call that we agree there is
> a no effect determination and no further action is required for the
> proposed COBCC building (which is being considered for funding by the
> National Science Foundation) on the proposed Bigelow campus, since the
> same sediment and erosion control measures that will be used on the
> restof the campus would be applied to the COBCC building. As we
> discussed,and as verified by Peter Tischbein at ACOE, the campus has
> already received a no effect determination by ACOE and no further
> action is necessary. In addition, the COBCC is upland and no in-water
> work is required for the construction or operation of the building.
>
>
>
> Do you have any concerns with this?

>
>
>
> Thank you again for all of your time.
>
>
>
> -Jessica
>
>
>
> Jessica Strauss Hunt
>
> Senior Environmental Scientist
>
> AECOM Water
>
> jessica.hunt@aecom.com <mailto:jessica.hunt@aecom.com>
>
> www.aecom.com <http://www.aecom.com>
>
>
> AECOM
>
> 701 Edgewater Drive
>
> Wakefield, MA 01880
>
> T 781.224.6175 F 781.224.5986
>
>
> AECOM
>
> 500 Southborough Drive
>
> South Portland, ME 04106
>
> T 207.541.2034 F 207.775.4820
>
>
>
> Note my e-mail has changed to jessica.hunt@aecom.com. Please update
> youraddress books accordingly.
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> Please consider the environment before printing this page.
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Appendix B – Project 2

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PROJECT REVIEW FORM

MDP

Request for Comments from the Maryland Historical Trust/ MDSHPO on State and Federal Undertakings

MHT USE ONLY		
Date Received:		Log Number:
6/4/10	F NSF DLH	201002866

Print Form

Submit hard copy of form and all attachments to:
Beth Cole, MHT, 100 Community Place, Crownsville, MD 21032

Section A: General Project Information

Project Name: NSF Grant to Smithsonian Environmental Research Center ARRA

County: Anne Arundel

[x] This is a new submittal **OR** This is additional information related Project Log Number:

Section B: Primary Contact Information

Contact Name: Penny Douglas

Company/Agency: AECOM

Mailing Address: 675 N. Washington Street

City: Alexandria

State: Virginia

Zip: 22314

Email: penny.douglas@aecom.com

Phone Number: +1 (703) 706-0117

Ext.:

Section C: Description of Undertaking

Location - Attach a map, preferably a section of a USGS quad, showing the location and boundaries of the project

Address: 647 Contees Wharf Road

City/Vicinity: Edgewater

List all federal and state agencies / programs (funding, permits, licenses) involved in this project (e.g. Bond Bill Loan of 2009, Chapter #; Transportation Enhancement Grant; HUD/CDBG; MDE/COE permit; etc.).

Agency Type	Agency/Program/Permit Name	Project/Permit/Tracking Number (if applicable)
Federal	National Science Foundation	NSF 0963388
	Academic Research Infrastructure-Recovery and	
	Reinvestment Act Program Grant	

Proposed Work - Attach project description, scope of work, site plans / drawings

This project includes (check all applicable): [x] **New Construction** [x] **Demolition** [x] **Remodeling/Rehabilitation**

This project involves: [ ] **State or Federal Rehabilitation Tax Credits**

[ ] **Properties subject to an easement held by MHT, MET, or another entity**

Portion is w/in AA-68 (Cerubeastone Rd. Rural Hist. dist.)

Section D: Identification of Historic Properties

This project involves: [ ] **Properties designated as historic by a local government, listed in the National Register, or included in Maryland Inventory of Historic Properties**

Property/District Name:

The subject property [x] **has** [ ] **has not** been the subject of previous archeological, architectural, or historical investigations.

Please describe: Please see description of previous archeological investigations on the Smithsonian Environmental Research Center site in the enclosed letter

Attachments [x] **Map** [x] **Project Description/Scope of Work** [ ] **Site Plans/Drawings**

[x] **Photographs** - Attach prints or digital photographs showing the project site including images of **all** buildings and structures, preferably keyed to a site plan

[x] **Conditions** - Attach a brief description of past and present conditions of the project area (wooded, mined, developed, agricultural uses, etc) including construction dates of buildings, if known.

MHT Determination MHT Reviewer: Dixie Henry Date: 7/8/10

[ ] There are **NO HISTORIC PROPERTIES** in the area of potential effect

[ ] The project will have **NO EFFECT** on historic properties

[x] The project will have **NO ADVERSE EFFECT** on historic properties

[ ] The project will have **NO ADVERSE EFFECT WITH CONDITIONS**

[ ] **MHT REQUESTS ADDITIONAL INFORMATION**

[ ] The project will have **ADVERSE EFFECTS** on historic properties

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, Maryland 21401
http://www.fws.gov/chesapeakebay

July 16, 2010

Penny Douglas
AECOM
675 North Washington Street
Suite 300
Alexandria, Virginia 22314

RE: Upgrading Equipment and Facilities that Form Parts of the Environmental Change Research Facility

Dear Ms. Douglass:

This responds to your letter, received May 28, 2010, requesting information on the presence of species which are federally listed or proposed for listing as endangered or threatened within the vicinity of the above reference project area. We have reviewed the information you enclosed and are providing comments in accordance with section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*).

Except for occasional transient individuals, no federally proposed or listed endangered or threatened species are known to exist within the project impact area. Therefore, no Biological Assessment or further section 7 Consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to federally protected threatened or endangered species under our jurisdiction. For information on the presence of other rare species, you should contact Lori Byrne of the Maryland Wildlife and Heritage Division at (410) 260-8573.

Effective August 8, 2007, under the authority of the Endangered Species Act of 1973, as amended, the U.S. Fish and Wildlife Service (Service) removed (delist) the bald eagle in the lower 48 States of the United States from the Federal List of Endangered and Threatened Wildlife. However, the bald eagle will still be protected by the Bald and Golden Eagle Protection Act, Lacey Act and the Migratory Bird Treaty Act. As a result, starting on August 8, 2007, if your project may cause "disturbance" to the bald eagle, please consult the "National Bald Eagle Management Guidelines" dated May 2007.

If any planned or ongoing activities cannot be conducted in compliance with the National Bald Eagle Management Guidelines (Eagle Management Guidelines), please contact the Chesapeake Bay Ecological Services Field Office at 410-573-4573 for technical assistance. The Eagle Management Guidelines can be found at:
http://www.fws.gov/migratorybirds/issues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf.

In the future, if your project can not avoid disturbance to the bald eagle by complying with the Eagle Management Guidelines, you will be able to apply for a permit that authorizes the take of bald and golden eagles under the Bald and Golden Eagle Protection Act, generally where the take to be authorized is associated with otherwise lawful activities. This proposed permit process will not be available until the Service issues a final rule for the issuance of these take permits under the Bald and Golden Eagle Protection Act.

An additional concern of the Service is wetlands protection. Federal and state partners of the Chesapeake Bay Program have adopted an interim goal of no overall net loss of the Basin's remaining wetlands, and the long term goal of increasing the quality and quantity of the Basin's wetlands resource base. Because of this policy and the functions and values wetlands perform, the Service recommends avoiding wetland impacts. All wetlands within the project area should be identified, and if construction in wetlands is proposed, the U.S. Army Corps of Engineers, Baltimore District, should be contacted for permit requirements. They can be reached at (410) 962-3670.

We appreciate the opportunity to provide information relative to fish and wildlife issues, and thank you for your interests in these resources. If you have any questions or need further assistance, please contact Devin Ray at (410) 573-4531.

Sincerely,

Leopoldo Miranda
Supervisor

Appendix C – Project 3

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HISTORY Colorado

June 24, 2010

Steve Meacham
Office of Integrative Activities
National Science Foundation
4201 Wilson Boulevard, Room 1270
Arlington, VA 22230

Re: Rocky Mountain Biological Laboratory Murray Modernization Project (CHS #57355)

Dear Mr. Meacham:

Thank you for your correspondence dated June 14, 2010 and received by our office on June 16, 2010 regarding the review of the above-mentioned project under Section 106 of the National Historic Preservation Act (Section 106).

After review of the provided information, we are unable to complete review of your project under Section 106. The submission does not include any information in regards to the Area of Potential Effects (APE), as defined in 36 CFR 800.16(d). We recommend initiating consultation with us on the proposed APE, as stipulated in 36 CFR 800.4(a)(1). We also recommend completing a site form for the Rocky Mountain Biological Laboratory (RMBL) and including an assessment of National Register eligibility. In order to better consult under Section 106, a evaluation and recommendation of National Register eligibility is needed, as stipulated in 36 CFR 800.4(c). We recommend using OAHP site form 1403/Architectural Inventory form which can be found on our website at: http://coloradohistory-oahp.org/crforms/crforms_forms.htm#1403.

We request being involved in the consultation process with the local government, which as stipulated in 36 CFR 800.3 is required to be notified of the undertaking, and with other consulting parties. Additional information provided by the local government or consulting parties might cause our office to re-evaluate our eligibility and potential effect findings. Please note that our compliance letter does not end the 30-day review period provided to other consulting parties.

If we may be of further assistance, please contact Amy Pallante, our Section 106 Compliance Manager, at (303) 866-4678.

Sincerely,

Edward C. Nichols
State Historic Preservation Officer

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HISTORY Colorado

July 28, 2010

Steve Meacham
Office of Integrative Activities
National Science Foundation
4201 Wilson Boulevard, Room 1270
Arlington, VA 22230

Re: Rocky Mountain Biological Laboratory Murray Modernization Project (CHS #57355)

Dear Mr. Meacham:

Thank you for your additional information correspondence dated July 20, 2010 and received by our office by email on July 22, 2010 regarding the review of the above-mentioned project under Section 106 of the National Historic Preservation Act (Section 106).

After review of the provided information, we concur with the recommended finding of not eligible for the National Register of Historic Places for the Murray Laboratory/8000 CR #317. Therefore, we concur with the recommended finding of no adverse effect [36 CFR 800.5(b)] for the proposed project.

If unidentified archaeological resources are discovered during construction, work must be interrupted until the resources have been evaluated in terms of the National Register criteria, 36 CRF 60.4, in consultation with this office.

We request being involved in the consultation process with the local government, which as stipulated in 36 CFR 800.3 is required to be notified of the undertaking, and with other consulting parties. Additional information provided by the local government or consulting parties might cause our office to re-evaluate our eligibility and potential effect findings. Please note that our compliance letter does not end the 30-day review period provided to other consulting parties.

If we may be of further assistance, please contact Amy Pallante, our Section 106 Compliance Manager, at (303) 866-4678.

Sincerely,

Edward C. Nichols
State Historic Preservation Officer

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OAHP1403
Rev. 9/98

COLORADO CULTURAL RESOURCE SURVEY

Architectural Inventory Form

Official eligibility determination
(OAHP use only)
Date ______________________Initials ________
____ Determined Eligible- NR
____ Determined Not Eligible- NR
____ Determined Eligible- SR
____ Determined Not Eligible- SR
____ Need Data
____ Contributes to eligible NR District
____ Noncontributing to eligible NR District

I. IDENTIFICATION

1. Resource number:
2. Temporary resource number:
3. County: Gunnison
4. City: Crested Butte
5. Historic building name: Murray Laboratory
6. Current building name: Murray Laboratory
7. Building address: 8000 CR #317, Crested Butte, CO 81224
8. Owner name and address: Rocky Mountain Biological Laboratory (RMBL); PO Box 519, Crested Butte, CO 81224

II. GEOGRAPHIC INFORMATION

9. P.M. ____6th____ Township ____13 South____ Range __86 West______
   E ½ NW ¼ S ½ NE ¼ NW ¼ NE ¼, Section 3
10. UTM reference
   Zone __13__ NAD83__; __ __ __ __ __ __mE __ __ __ __ __ __ __mN
11. USGS quad name:________________________________ Gothic________________________________

   Year: 2001______ Map scale: 7.5'__X__ 15'____ Attach photo copy of appropriate map section.
12. Lot(s): _________ Block:___________
   Addition: ________Year of Addition: ______
13. Boundary Description and Justification:
   Only the Murray Laboratory and its immediate site were surveyed. For purposes of this inventory, an area extending fifteen feet outside of the building footprint was used to determine the boundary. The building is part of an overall outdoor field research station and there are no divisions, such as lots or property lines between buildings that would be found in a more traditional setting and that would clearly define the site for the Lab. The

III. Architectural Description

14. Building plan (footprint, shape): Rectangular plan
15. Dimensions in feet: Length___46'_____x Width ___27'______
16. Number of stories: Single

17. Primary external wall material(s): Log
18. Roof configuration: Front Gable
19. Primary external roof material: Metal
20. Special features: None

21. General architectural description:

The Murray Laboratory is a pre-fabricated log building located within the center of the Gothic townsite, approximately 300 feet east of CR 317. It is oriented north-south, with the primary entrance on the south façade. The building sits on a concrete foundation which extends approximately 1 foot above grade. Uniform, saddle-notched logs comprise the siding on all sides. Logs are approximately 6 inches in diameter and appear to have been milled to be a consistent diameter. The gable ends have plank siding, with each board butting against the next and with rounded ends that lap over the log siding.

The windows are framed by log slabs on all four sides and have functional wood shutters. The windows are single pane sliding windows and are located on all four facades. The primary entry is centrally located on the south elevations and is enclosed in a small lean-to with a steeply pitched shed roof. It is sided in wide board and batten, with a smooth panel door on the west side. Two windows flank the entry. A second entry door is centered in the north façade.

Exposed rafter ends are visible beneath the eave overhang of the roof. The roof is covered in corrugated metal, and has several small openings for ventilation.

The building contains ten research labs, five individual rooms on each side of the building divided by a narrow corridor that runs the length of the building.

22. Architectural style/building type: Kit building

23. Landscaping or special setting features: The Murray Laboratory is set in the native landscape of alpine meadow. The ground plane is covered with low-growing, native grasses. A narrow, dirt footpath leads to the south-facing front entry. There are no introduced plants or landscaping.

24. Associated buildings, features, or objects: None

IV. Architectural History

25. Date of Construction: Estimate:__________ Actual: 1962
    Source of information: RMBL
26. Architect: N/A
    Source of information: RMBL
27. Builder/Contractor: Unknown

Source of information:

28. Original owner: RMBL

Source of information: RMBL

29. Construction history (include description and dates of major additions, alterations, or demolitions):

None

30. Original location __X__ Moved ____ Date of move(s):

V. HISTORICAL ASSOCIATIONS

31. Original use(s): Research Facility
32. Intermediate use(s): Research Facility
33. Current use(s): Research Facility
34. Site type(s): Laboratory
35. Historical background:

The Murray Laboratory was constructed with National Science Foundation funds in 1962 to supplement other research facilities on the property. Due to limited construction options, it was built using a prefabricated construction kit. The building was constructed at a time when field biology was moving from a focus on description of nature to a more experimental emphasis. The Murray Laboratory was designed for limited mid-summer use during the field season.

At the time of construction, scientists using the RMBL had extensive teaching loads, and the Lab was primarily used during July. The need to accommodate computers, environmental sensors, and the extensive use of chemicals in a field setting had not been envisioned.

36. Sources of information:

RMBL

VI. SIGNIFICANCE

37. Local landmark designation: Yes ____ No __X__ Date of designation: ______

Designating authority:

38. Applicable National Register Criteria:

____ A. Associated with events that have made a significant contribution to the broad pattern of our history;

____ B. Associated with the lives of persons significant in our past;

____ C. Embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or that possess high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction; or

____ D. Has yielded, or may be likely to yield, information important in history or prehistory.

____ Qualifies under Criteria Considerations A through G (see Manual)

__X__ Does not meet any of the above National Register criteria

39. Area(s) of significance: N/A

40. Period of significance: N/A

41. Level of significance: National ____ State ____ Local ______

42. Statement of significance: The Murray Laboratory is one of three lab buildings at RMBL that support scientist's field research. The Lab was built 34 years after the founding of the field station

43. Assessment of historic physical integrity related to significance:

VII. NATIONAL REGISTER ELIGIBILITY ASSESSMENT

44. National Register eligibility field assessment:

Eligible ____ Not Eligible __X__ Need Data __

45. Is there National Register district potential? Yes __X__ No

The Townsite of Gothic and the Rocky Mountain Biological Laboratory have potential as a historic district under Criteria A.

Gothic was founded as a major mining supply point that resulted from an 1879 silver discovery. Prospectors rushed to Gothic Mountain in 1879 after the Gunnison News reported the discovery of "wire silver" a few miles north of Crested Butte in the mountain above Copper Creek. Wire silver was identified as ore that occurs in strands (or wires). In June of 1879, a town clerk recorded approximately 300 people living in the town. A resident wrote to the Rocky Mountain News stating, "Our little town scarcely four months in existence has grown to be quite a place. We have some 150 frame and log houses…At present we have one hotel, three stores, a butcher shop, two stables, all of them doing a good business." (Ben Folgelberg, ed. Colorado History NOW. January 2006.)

The silver rush lasted in the local region until 1893, the year of the Silver Crash. Following the collapse of the silver mining industry, Gothic was essentially abandoned by 1914 and had become a ghost town by the 1920s. Garwood Judd was the sole remaining resident of the town, residing there until 1930.

Founded in 1928 as a non-profit corporation, the Rocky Mountain Biological Laboratory has served as an independent field research station for over eighty years. The RMBL has served scientists and student researchers from approximately 100 higher learning institutions, including 11 from international locations, and 16 other educations institutions, such as high schools.

The RMBL does not hire scientists to do research; rather, scientists come from around the world to use the facilities. RMBL performs three critical functions. First, it provides access to protected research sites, including areas in which to conduct long-term experiments. Second, it provides access to the accumulated knowledge about the ecosystem. Working at the field station allows scientists to collaborate and learn from one another. The third function is to serve a bridge between the home institution of scientists and the natural systems within which they work.

The RMBL has been a leading hub for research on plant-animal and butterflies, including some of the earliest work integrating natural selection, genetics, and biochemistry. Other significant areas of research include mutualisms, physiological ecology, social behavior, and the biological consequences of climate change. Due to RMBL's long history and diversity of scientists, RMBL is a leading institution for long-term studies of ecological and orgnanismal biology. The field station provides scientists access to protected research sites and the research facilities needed to serve as a bridge between field sites and the resources of their home institutions. Researchers have published over 1,300 peer-reviewed articles in a diverse range of study areas.

Of the approximately 280 field station in North American, RMBL is one of only a few independent stations that are not affiliated with a university, college or museum.

Initially, RMBL utilized the former mining town buildings (five of which are still in use). Within a year of founding the RMBL, scientists were constructing structures for cabins and labs from materials primarily salvaged from the former, deteriorating mining buildings. Currently there are 54 cabins used for living quarters, 17 other use buildings, and numerous outhouses. Of the 71 cabins and other use buildings, 37 were constructed prior to 1960, 14 were constructed between 1961 and 1980, with the remainder constructed after 1980.

If there is National Register district potential, is this building: Contributing ___ Noncontributing __X__

46. If the building is in existing National Register district, is it: Contributing ___ Noncontributing ____

VIII. RECORDING INFORMATION

47. Photograph numbers:

    Negatives filed at:

48. Report title: N/A
49. Date(s): May 17, 2010
50. Recorder(s): Eären Hummel
51. Organization: AECOM Design + Planning
52. Address: 240 E. Mountain Ave., Fort Collins, CO 80524
53. Phone number(s): 970-484-6073

NOTE: Please include a sketch map, a photocopy of the USGS quad map indicating resource location, and photographs.

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Map 1

Murray Modernization Project: Existing Buildings

Rocky Mountain Biological Laboratory, Gothic, Colorado

AECOM

July 20, 2010

Map 2

Murray Modernization Project: Area of Potential Effects

Rocky Mountain Biological Laboratory, Gothic, Colorado

July 20, 2010

Not to Scale

Area of Direct Effect

Area of Indirect Effect

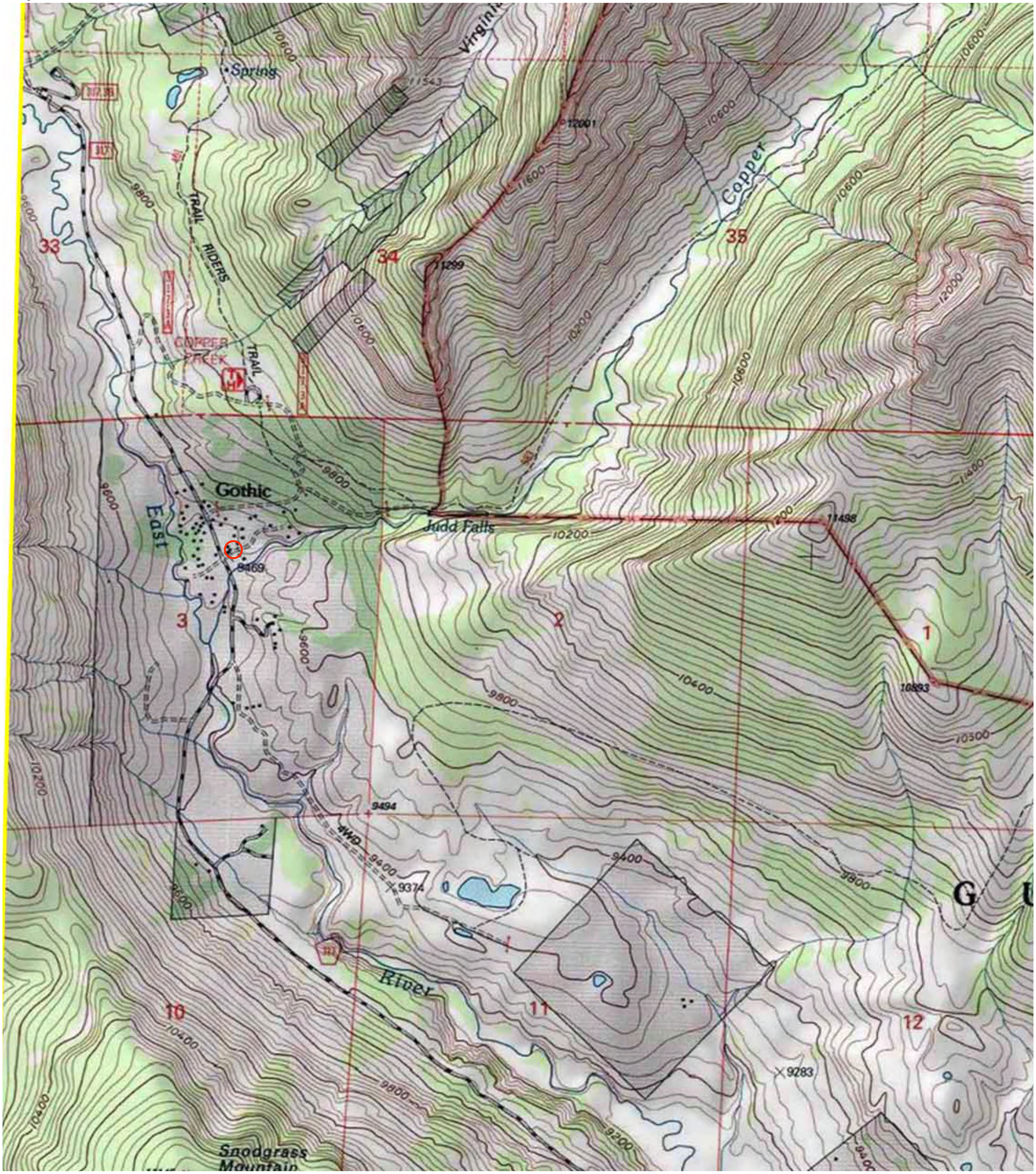
Map 3

Murray Modernization Project: Gothic USGS Quad

Rocky Mountain Biological Laboratory, Gothic, Colorado

AECOM

July 20, 2010



Gothic Quad 2001

1:24,000 7.5

Figure 1. Murray Laboratory, south elevation.


Figure 2. Johnson Laboratory.

Figure 3. Willey Laboratory,

Figure 4. Weese; summer administrative offices.

Figure 5. Looking north toward Murray Laboratory; Willey is on the left and Johnson in on the right.

Figure 6. Looking east from CR 317. Town Hall is in the foreground; views of the Murray Laboratory from CR 317 are blocked by other buildings.

Figure 7. Looking west toward Murray Laboratory from access road near Enders.

Figure 8. Looking west toward Murray Laboratory from access road near Gates.

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Appendix D – Project 4

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NEW YORK STATE · OFFICE OF PARKS · RECREATION · HISTORIC PRESERVATION

New York State Office of Parks, Recreation and Historic Preservation

Historic Preservation Field Services Bureau • Peebles Island, PO Box 189, Waterford, New York 12188-0189
518-237-8643
www.nysparks.com

David A. Paterson
Governor

Carol Ash
Commissioner

27 July 2010

Mr. Gregory T. Austin
AECOM
400 British American Blvd.
Latham, NY 12110

Re: NSF
SUNY Oneonta Upper Research Site Lab
Town of Otsego, Otsego County
10PR04654

Dear Mr. Austin:

The State Historic Preservation Office (SHPO) has reviewed the information submitted for this project (*Phase I Report of Archaeological Investigations of the State University of New York at Oneonta Upland Field Station Renovation Project, Cooperstown, Otsego County, New York*, dated June 2010, prepared by Renee B. Walker, SUNY Oneonta). Our review has been in accordance with Section 106 of the National Historic Preservation Act and relevant implementing regulations.

SHPO has the following requests and recommendations regarding this investigation.

1. Please provide a formal construction plan which shows the limit of all planned, project-related ground disturbance so that a definitive Area of Potential Effects (APE) boundary may be delineated.
2. SHPO recommends that additional fieldwork should be undertaken to achieve a more complete delineation of the historic building foundation.
3. SHPO recommends, in accordance with our 2005 Phase I report requirements, that additional shovel testing should be conducted within one meter of the historic foundation.

SHPO will continue consultation regarding this project once the requested information has been received.

If you have any questions please don't hesitate to contact me.

Sincerely,

Philip A. Perazio, OPRHP
Phone: 518-237-8643 x3276; FAX: 518-233-9049
Email: Philip.Perazio@oprhp.state.ny.us

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OFFICE OF PARKS, RECREATION, HISTORIC PRESERVATION
NEW YORK STATE

David A. Paterson
Governor

Carol Ash
Commissioner

New York State Office of Parks, Recreation and Historic Preservation

Historic Preservation Field Services Bureau • Peebles Island, PO Box 189, Waterford, New York 12188-0189
518-237-8643
www.nysparks.com

6 August 2010

Mr. Gregory T. Austin
AECOM
400 British American Blvd.
Latham, NY 12110

Re: NSF
SUNY Oneonta Upper Research Site Lab
Town of Otsego, Otsego County
10PR04654

Dear Mr. Austin:

The State Historic Preservation Office (SHPO) has reviewed the information submitted for this project (*Phase I Report of Archaeological Investigations of the State University of New York at Oneonta Upland Field Station Renovation Project, Cooperstown, Otsego County, New York*, revised August 2010, prepared by Renee B. Walker, SUNY Oneonta). Our review has been in accordance with Section 106 of the National Historic Preservation Act and relevant implementing regulations.

The above-referenced investigation has resulted in the identification of a previously unrecorded archaeological site, the Moe Pond Historic Site, which has been given the Unique Site Number (USN A07741.000841).

Based on the information provided, SHPO recommends that the identified site is not eligible for listing on the National Register of Historic Places. Therefore, SHPO further recommends that the planned project will have **No Effect** on historic properties listed or eligible for listing on the National Register of Historic Places. This recommendation pertains only to the Area of Potential Effects (APE) examined during the above-referenced investigation. It is not applicable to any other portion of the project property. Should the project design be changed, SHPO recommends further consultation with this office.

These comments are those of the Field Services Bureau and relate only to Historic/Cultural resources. They do not include potential environmental impacts to New York State Parkland that may be involved in or near your project. Such impacts must be considered as part of the environmental review of the project pursuant to the State Environmental Quality Review Act (New York Environmental Conservation Law Article 8) and its implementing regulations (6 NYCRR Part 617).

If you have any questions please don't hesitate to contact me.

Sincerely,

Philip A. Perazio

Philip A. Perazio, OPRHP
Phone: 518-237-8643 x3276; FAX: 518-233-9049
Email: Philip.Perazio@oprhp.state.ny.us

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Appendix E – Project 6

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LUMMI INDIAN BUSINESS COUNCIL
2616 KWINA DRIVE • BELLINGHAM, WASHINGTON 98226 • (360) 384-1489
DEPARTMENT________________________ EXT.________

April 19, 2004

Dave Oreiro,
Vice-President
Northwest Indian College
2522 Kwina Rd.
Bellingham, WA 98226

RE: Mitigation Measures for Hist#1, Northwest Indian College (NWIC) Expansion Project-Phase 1

Dear Mr. Oreiro:

Thank you for meeting with the Lummi Nation Tribal Historic Preservation Office (LNTHPO) on Thursday, April 15 regarding mitigation measures for archaeological resources (Hist#1) identified in the proposed NWIC Expansion Project-Phase 1 project area.

The LNTHPO has reviewed the report entitled *Northwest Indian College Kwina Estate Project: Report on Archaeological Survey and Assessment Activities* prepared by the Lummi Cultural Contract Services Department (Anderson, et al. April 2, 2004).

Based upon our understanding of the report - in particular the description of Hist#1 (Section 5.2) and the discussion of suggested mitigative measures for reducing construction impacts (Section 6.0) - the LNTHPO would like to concur with your proposal to reduce the suggested buffer from 10m to 5m during construction activities, should they be funded, in order to accommodate truck passage. Following construction, the buffer will be extended to 10m as originally proposed. We look forward to receiving an updated map of the project area with the locations of the building corners, the truck access, and the buffered archaeological site clearly indicated.

While the archaeological survey and assessment was conducted in order to identify both archaeological resources in the project area and potential impacts to them, inadvertent discoveries of resources during construction are still possible. We recommend that the Lummi Cultural Resource Management Program's standard inadvertent discovery language be followed throughout the construction process. This language may be found in the Conclusions section of the archaeological report (Section 7.0, pages 19-20).

Thank you very much for consulting with our office on this project. We believe the information provided in both the archaeological report and this letter will contribute to a more comprehensive Environmental Assessment of the proposed project. We look forward to establishing a productive relationship with the NWIC, the Lummi Planning Department, and other tribal partners on this and future projects. Should you have further questions or comments, please do not hesitate to call me at (360) 384-2280.

Sincerely,

Mary Rossi

Mary Rossi,
Tribal Historic Preservation Officer
[redacted] Tribal Historic Preservation Office

cc: Darrell Hillaire, Chairman, Lummi Indian Business Council
James Hillaire, Facilitator, Lummi Cultural Resources Preservation Commission
Al Scott Johnnie, Director, Lummi *Sche'lang'en* Department
Sarah Campbell, Principal Investigator, Western Washington University
Shelby Anderson, Lead Archaeological Technician, Lummi Cultural Contract Services Dept.

Appendix F – Project 7

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OFFICE OF HISTORIC PRESERVATION
DEPARTMENT OF PARKS AND RECREATION
P.O. BOX 942896
SACRAMENTO, CA 94296-0001
(916) 653-6624 Fax: (916) 653-9824
calshpo@ohp.parks.ca.gov
www.ohp.parks.ca.gov

14 July 2010

Reply To: NSF100701A

Steve Meacham
Senior Staff Associate
Office of Integrative Activities
National Science Foundation
4201 Wilson Boulevard, Room 1270
Arlington, VA 22230

Re: Section 106 Consultation for the Cyber-infrastructure improvements at the University of California Natural Reserve System

Dear Mr. Meacham:

Thank for initiating consultation for the National Science Foundation (NSF) regarding the above referenced undertaking in order to comply with Section 106 of the National Historic Preservation Act of 1966 and its implementing regulation at 36 CFR Part 800. You are requesting at this time that concur with the determination of No Historic Properties.

As I presently understand it, the NSF is funding through the Academic Research Infrastructure Recovery and Reinvestment Program, the upgrade of the cyber-infrastructure (wireless internet access and data transmission equipment) at 17 of the University of California Natural Reserves (UCNRS). The UCNRS is a network of 36 reserves that encompasses approximately 135,000 acres of natural land across California. The proposed cyber-infrastructure improvements are needed for the reserves to manage modern methods of data collection and data sharing, improve their capacity to stream live data, and achieve reliable and precise control and coordination of the multiple sensors and instruments that support their research programs.

The proposed improvements would consist of upgrading existing equipment as well as installation of new equipment. Where new equipment would be installed, it would be mainly be of two types: solar-powered, low-profile repeater stations and solar-powered mesh network radios. The typical designs for the new equipment are shown in Figures 2 and 3. Minimal excavation is required for the supports holding up the towers as described in your letter and no known archaeological sites are located in the areas to be excavated. Additionally new equipment placed on buildings will be placed on buildings that are not 50 years old.

At this time, NSF has determined the proposed undertaking will not affect historic properties. I concur with this determination.

Thank your for considering historic properties in your planning process and I look forward to continuing consultation on this project. If you have any questions, please contact Amanda Blosser of my staff at (916) 445-7048 or e-mail at ablosser@parks.ca.gov.

Sincerely,

Milford Wayne Donaldson, FAIA
State Historic Preservation Officer

MWD:ab

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
81440-2010-SL-0323

August 11, 2010

Elizabeth Copley, Program Manager
AECOM Environment
2101 Webster, Suite 1900
Oakland, California 94612

Subject: Species List Request for National Science Foundation Academic Research Infrastructure-Recovery and Reinvestment Program Grant for the University of California Natural Reserve System, Santa Barbara and Monterey Counties, California

Dear Ms. Copley:

This letter responds to your request, dated May 27, 2010, received in our office on June 1, 2010, for a list of federally endangered, threatened, and other special status species that may occur in the vicinity of five reserve sites throughout Santa Barbara and Monterey Counties, California. The National Science Foundation (NSF) is considering funding the subject project through the Academic Research Infrastructure-Recovery and Reinvestment Program (ARI-R2), which is a program under the American Recovery and Reinvestment Act (ARRA) of 2009. The proposed project consists of cyber-infrastructure improvements at 17 of the University of California (UC) Reserves within California, 5 of which are within the Ventura Fish and Wildlife Office's jurisdiction including: Coal Oil Point Natural Reserve (near Isla Vista), Sedgewick Reserve (north of Santa Ynez), Santa Cruz Island Reserve (Northern Channel Islands), Landels-Hills Big Creek Reserve (Big Sur), and Hasting's Reserve (southeast of Carmel Valley). The proposed cyber-infrastructure improvements would include installation of new radio transmitters, low profile solar powered repeater stations, and other wireless equipment on existing or new support structures. New support structures would typically consist of 8 to 10-foot tall metal poles placed in small holes in the ground or small concrete footings. The new cyber-infrastructure equipment would utilize either existing power sources or small solar panels.

The enclosed list of species fulfills the requirements of the U.S. Fish and Wildlife Service under section 7(c) of the Endangered Species Act of 1973, as amended (Act). The NSF, as the lead Federal agency for the project, has the responsibility to review its proposed activities and determine whether any listed species may be affected. If the project is a construction project which may require an environmental impact statement[1], the NSF has the responsibility to prepare

[1] "Construction project" means any major Federal action which significantly affects the quality of the human environment designed primarily to result in the building of structures such as dams, buildings, roads, pipelines, and channels. This includes Federal actions such as permits, grants, licenses, or other forms of Federal authorizations or approval which may result in construction.

a biological assessment to make a determination of the effects of the action on listed species or critical habitat. If the NSF determines that a listed species or critical habitat is likely to be adversely affected, it should request, in writing through our office, formal consultation pursuant to section 7 of the Act. Informal consultation may be used to exchange information and resolve conflicts with respect to threatened or endangered species or their critical habitat prior to a written request for formal consultation. During this review process, the NSF may engage in planning efforts but may not make any irreversible commitment of resources. Such a commitment could constitute a violation of section 7(d) of the Act.

Only federally listed species receive protection under the Act; however, species listed by the State of California or otherwise considered to be sensitive should be considered in the planning process in the event they become listed or proposed for listing prior to project completion. We recommend that you review information in the California Natural Diversity Data Base and contact the California Department of Fish and Game at (916) 324-3812 for information regarding other sensitive species that may occur in this area. If you have any questions regarding this matter, please contact Heather Abbey or Jenny Marek at (805) 644-1766, extension 290 and 325 respectively.

Sincerely,

Douglass M. Cooper
Deputy Assistant Field Supervisor

ENDANGERED AND THREATENED, SPECIES THAT MAY OCCUR WITHIN THE VICINITY OF LANDELS-HILLS BIG CREEK UC RESERVE, BIG SUR, MONTEREY COUNTY, CALIFORNIA

<u>Birds</u>		
Least Bell's vireo	*Vireo bellii pusillus*	E
California condor	*Gymnogyps californianus*	E
<u>Amphibians</u>		
California red-legged frog	*Rana draytonii*	T
<u>Fish</u>		
Steelhead trout	*Oncorhynchus mykiss*	*
<u>Invertebrates</u>		
Smith's blue butterfly	*Euphilotes enoptes smithi*	E
Vernal pool fairy shrimp	*Branchinecta lynchi*	T
<u>Plants</u>		
Monterey spineflower	*Chorizanthe pungens* var. *pungens*	T
Contra Costa goldfields	*Lasthenia conjugens*	E
Yadon's piperia	*Piperia yadonii*	E

Key:
E - Endangered T - Threatened

* The National Marine Fisheries Service is the responsible agency for the steelhead. Please contact that agency for information on this species in your area.

ENDANGERED AND THREATENED SPECIES THAT MAY OCCUR WITHIN THE VICINITY OF SANTA CRUZ ISLAND UC RESERVE, SANTA CRUZ ISLAND, SANTA BARBARA COUNTY, CALIFORNIA

Mammals		
Santa Cruz Island fox	*Urocyon littoralis santacruzae*	E
Birds		
California least tern	*Sterna antillarum browni*	E
Western snowy plover	*Charadrius alexandrinus nivosus*	T
Xantus's murrelet	*Synthliboramphus hypoleucus*	C
Plants		
Hoffmann's rock-cress	*Arabis hoffmannii*	E
Island barberry	*Berberis pinnata* ssp. *insularis*	E
Santa Cruz Island dudleya	*Dudleya nesiotica*	T
Island bedstraw	*Galium buxifolium*	E
Island rush-rose	*Helianthemum greenei*	T
Santa Cruz Island bushmallow	*Malacothamnus fasciculatus* ssp. *nesioticus*	E
Santa Cruz Island malacothrix	*Malacothrix indecora*	E
Island malacothrix	*Malacothrix squalida*	E
Santa Cruz Island fringepod	*Thysanocarpus conchuliferus*	E

Key:

E – Endangered T – Threatened C – Candidate

ENDANGERED AND THREATENED SPECIES THAT MAY OCCUR WITHIN THE VICINITY OF COAL OIL POINT UC RESERVE, SANTA BARBARA COUNTY, CALIFORNIA

Mammals		
Southern sea otter	*Enhydra lutris nereis*	T
Birds		
California least tern	*Sterna antillarum browni*	E
Light-footed clapper rail	*Rallus longirostris levipes*	E
Western snowy plover	*Charadrius alexandrinus nivosus*	T, CH
Amphibians		
California red-legged frog	*Rana draytonii*	T
Fish		
Tidewater goby	*Eucyclogobius newberryi*	E
Plants		
Ventura marsh milk-vetch	*Astragalus pycnostachyus* var. *lanosissimus*	E

Key:
E – Endangered   T - Threatened   CH - Critical habitat

ENDANGERED AND THREATENED SPECIES THAT MAY OCCUR WITHIN THE VICINITY OF SEDGWICK UC RESERVE, SANTA BARBARA COUNTY, CALIFORNIA

Birds		
Least Bell's vireo	*Vireo bellii pusillus*	E, CH
Southwestern willow flycatcher	*Empidonax traillii extimus*	E
Amphibians		
California red-legged frog	*Rana draytonii*	T
Invertebrates		
Vernal pool fairy shrimp	*Branchinecta lynchi*	T

Key:
E – Endangered   T - Threatened   CH - Critical habitat

Appendix G – Project 8

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Coconino National Forest (CNF Project 2010-07-Z)
Documentation that an Undertaking
"does not have the potential to cause effects on historic Properties"
as per 36 CFR 800.3(a)and (a)(1)

Project Name/Name of Applicant: Lowell Observatory Antenna Sites **District No. :_Mormon Lake, Mogollon Rim___**
Project Function Code: ____
Brief Description of Activities Related to Application: To replace an existing communications tower at Anderson Mesa/Lowell Observatory site by removing the existing 30-foot antenna, a 4-square-foot (2'x2') concrete pad, and existing guy wires to ground level, ¾" crushed gravel would be added to level the ground surface and a new surface-only cell block foundation would be installed for the monopole. The foundation would consist of 4 pieces that would each be 7-foot square and 1 foot thick in the same area as the current tower. A new 30-40-foot monopole tower would be installed on this base. Located at (T20N, R8E, Sections 22 and 27).; Also adding a new microwave dish to an existing building at the Discovery Channel Lowell Site near Happy Jack with no ground activities. Located at (T16N, R9E,Section 29.) Previous surveys of these permit sites have been completed. **Approximate Acres** 1 acre

IS THIS PERMIT FOR:
(Check all that apply, but ***mark the most appropriate choice with "X"*** *.)* **Yes No**

1. Activities that do not authorize surface disturbance? (PA Appendix II.a) /_ / /X/

2. Activities that involve less than 1 sq. m. of cumulative ground surface? (FSM R-3, 2361.24.c.(1)). (PA Appendix II.m.) /_/ /_X/

3. Activities in areas where previous natural or human disturbance has modified the landscape so extensively that the likelihood of finding cultural resources is negligible, for example, vertical expansion of existing borrow pits? (FSM R-3, 2361.24.c.(2) **/X_/** /_/

4. Activities within stream channels? (FSM R-3, 2361.24.c.(3)). (PA Appendix II.l.) / _/ / _x/

5. Maintenance, reconstruction, or replacement of existing facilities, for example, cattleguards, gates, fences, culverts, stock tanks, and which do not involve new ground disturbance? (FSM R-3, 2361.24.c.(4)). (PA Appendix II.f.) /_/ /X_/

6. Tenant-type maintenance of an administrative site? (FSM R-3, 2361.24.c.(5)) /_/ /X_/

7. Alteration of structures less than 40 years old? (PA Appendix II.t) /_/ /X_/

8. Resource maintenance activities that do not involve surface disturbance, or surface disturbance that only barely exposes mineral soil? For example, TSI, precommercial thinning by hand, hand fire line construction? (FSM R-3, 2361.24.c.(6)). (PA Appendix II.s). /_/ /_X/

9. Installation of sign posts and survey monuments, but not in known archaeological sites? (FSM R-3, 2361.24.c.(7)). (PA Appendix II.n). /_/ /X_/

10. Routine foot trail maintenance that does not involve new ground disturbance or disturb known sites? (FSM R-3, 2361.24.c.(8). (PA Appendix II.o.) /_/ /X_/

11. Personal use, hand-excavated, wilding permits that cover a large area, such as District-wide Christmas tree permits? (FSM R-3, 2361.24.c.(9). (PA Appendix II.p). /_/ /_X/

12. Personal use fuelwood permits, where activity is dispersed over:

large areas? For example, District-wide, LMP area wide, or 10-K blocks, /_/ /X_/

or

large areas that are within a previously archaeologically surveyed timber sale above the ponderosa pine/pinyon-juniper Transition Line, /_/ /_X/

or

large areas or other surveyed areas above the ponderosa pine/pinyon-juniper Transition Line? FSM R-3, 2361.24.c.(10). (PA Appendix II.q) /_/ /X_/

13. Seismic testing activities on surfaced or regularly maintained roads, within the existing road prism, AND does not affect known archaeological sites? (PA Appendix II.g). /_/ /X_/

14. The San Francisco Peaks are recognized by the Coconino National Forest as a Traditional Cultural Property to a number of Arizona and New Mexico Indian Tribes. The Forest is currently conducting a formal evaluation of the San Francisco Peaks for their eligibility to the National Register of Historic Places. Consequently, a number of permittees that are currently under authorization to conduct activities in the vicinity of San Francisco Peaks may be affected in the future by the outcome of this process. All new and re-issued authorizations for activities within the San Francisco Peaks area will be evaluated during the proposal phase of permit issuance to determine if they are consistent with any new guidelines that may take effect as a result of the formal determination of eligibility for the National Register of Historic Places. Those uses that are not consistent with the new guidelines may be denied or required to relocate the activity. /_/ /_X/

.

IF SO: Congratulations! You have an undertaking that "... *does not have the potential to cause effects on historic properties, and the Agency Official has no further obligations under section 106* ...". It requires no further Cultural Resource Clearance documentation other than this form. Simply sign this form, send one copy to the Zone Archaeologist, one to the Forest Archaeologist, and file the original in your permit file.

I have evaluated the above-mentioned permit and have determined it is an undertaking that ".... does not have the potential to cause effects on historic properties.... " as defined in 36 CFR 800.3(a) and (a)(1); FSM R-3 2361.24.1.c; and the *Programmatic Agreement Regarding Cultural Property Protection and Responsibilities Among The New Mexico Historic Preservation Division, and Arizona State Historic Preservation Office, and Texas State Historic Preservation Office, and Oklahoma State Historic Preservation Office, and The Advisory Council on Historic Preservation, and the United States Department of Agriculture, Forest Service, Region 3*, dated April 2, 1990.

Name: Judith Adams Date: 07/23/2010

Title: Lands Team Leader District: Red Rock RD

I concur:

Name: /s/Jeremy Haines Date: 7/26/10

Title: Zone/Forest Archaeologist

United States Department of the Interior

U.S. Fish and Wildlife Service
Arizona Ecological Services Office
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 Fax: (602) 242-2513

In Reply Refer to:
AESO/SE
22410-2010-I-0411

June 22, 2010

Ms. Kristin J. Gade
Senior Biologist/Environmental Planner
AECOM
2777 East Camelback Road, Suite 200
Phoenix, Arizona 85016

RE: Lowell Observatory Installation of Microwave Relay Antennas

Dear Ms. Gade:

Thank you for your May 17, 2010, request for informal consultation with the U.S. Fish and Wildlife Service pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). As an agent of the National Science Foundation (NSF), you are requesting our review of a proposed microwave relay antenna installation project at three existing telescope locations in Coconino County, Arizona. The purpose of the project is to improve the information technology infrastructure at Lowell Observatory and its two associated telescope data collection sites on the Coconino National Forest. The project is one of ten projects across the United States that NSF is considering for funding through the Academic Research Infrastructure-Recovery and Reinvestment Program, a program funded under the American Recovery and Reinvestment Act of 2009. You requested our concurrence that the proposed action will not affect any federally-listed or proposed species, or designated critical habitat. We concur with your determination and provide our rationale below.

PROPOSED ACTION

A complete description of the proposed action is found in your May 17, 2010, letter. The project consists of replacing the existing data transmission systems with a high-capacity microwave relay system. The three locations where antennas are proposed are existing telescope locations associated with the Lowell Observatory. They are the Lowell Observatory on Mars Hill in Flagstaff, Arizona (Township 21 North, Range 7 East, Sections 16 and 17); the Discovery Channel Telescope located near Happy Jack on the Coconino National Forest (Township 16 North, Range 9 East, Section 29); and, the Naval Prototype Optical Inferometer site at Anderson Mesa, Coconino National Forest (Township 20 North, Range 8 East, Sections 22 and 27). Project activities would take place on both private (Mars Hill location) and Forest Service managed lands. At the Mars Hill and Happy Jack sites, the proposed microwave relay antennas would be installed on existing structures. At the Anderson Mesa site, a new monopole and antenna would replace an existing antenna at the same location.

The only site that has habitat for a listed species at the location is the Happy Jack site. Adjacent to the observatory there is Mexican spotted owl (*Strix occidentalis lucida*) habitat and critical habitat; however, these key habitat components and/or primary constituent elements do not occur within the footprint of the facility, which is where the antenna would be installed.

DETERMINATION OF EFFECTS

We concur with your determination that the proposed action will not affect any federally-listed species or their habitats. We base our determination on the following:

- The proposed microwave relay antenna sites are located within and immediately adjacent to developed areas. The antenna location sites do not support habitat that may be occupied by endangered, threatened, or proposed species or designated critical habitat, either within the footprint of the construction or adjacent to the site.

Thank you for your continued coordination. No further section 7 consultation is required for this project at this time. Should project plans change, or if information on the distribution or abundance of listed species or critical habitat becomes available, this determination may need to be reconsidered. We also encourage you to coordinate the review of this project with the AGFD. In all future correspondence on this project, please refer to consultation number 22410-2010-I-0411.

Should you require further assistance or if you have any questions, please contact Shaula Hedwall (x103) or Brenda Smith (x101) of our Flagstaff Suboffice at (928) 226-0614.

Sincerely,

Brenda N Smith

for Steven L. Spangle
Field Supervisor

cc (electronic):
Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
Regional Supervisor, Arizona Game and Fish Department, Flagstaff, AZ
District Ranger, Peaks & Mormon Lake Ranger Districts, Flagstaff, AZ
District Ranger, Mogollon Rim Ranger District, Happy Jack, AZ

W:\Shaula Hedwall\Lowell Observatory Installation of Microwave Relay Antennas.docx: jkey

SHPO-2010-0738(86576

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD, Room 1270
ARLINGTON, VIRGINIA 22230
Tel. 703-292-8040 ~ Fax. 703-292-9040

OFFICE OF
INTEGRATIVE
ACTIVITIES

RECEIVED
DJ
AUG 06 2010
8/9/10
ARIZONA STATE PARKS/S.H.P.O

August 5, 2010

State Historic Preservation Office
Attn: Ms. Carol Griffith
Arizona State Parks
1300 West Washington Street
Phoenix, Arizona 85007

RE: SHPO-2010-0738(85033)
National Science Foundation
Installation of Microwave Relay Antennas
Lowell Observatory, Flagstaff, Anderson Mesa, and Happy Jack, Coconino County, Arizona
Section 106 Consultation – Request for concurrence with determination of "no effect"

Dear Ms. Griffith:

As you are aware from previous informal communications from our consultant for this project AECOM, Inc., the National Science Foundation (NSF) is preparing an environmental assessment (EA) to evaluate the impacts of several projects that we are considering for funding under the Academic Research Infrastructure-Recovery and Reinvestment Program (ARI-R2), a program funded under the American Recovery and Reinvestment Act of 2009 (ARRA). One of these projects is proposed by Lowell Observatory in Flagstaff, Arizona. The Observatory is proposing to install microwave relay antennas at three locations in Coconino County, Arizona (see enclosed Figure 1) as described below. We also are reviewing the effects of the project pursuant to Section 106 of the National Historic Preservation Act and are providing the following information to your office for review and comments. As explained in this letter, NSF has, after a review of the proposed projects potential effects on significant historic properties, made a determination of "no effect." NSF respectfully seeks the Arizona State Historic Preservation Office's concurrence with this determination.

The three locations where antennas would be installed are existing telescope sites: the main Lowell Observatory site on Mars Hill in Flagstaff, Arizona (T21N, R7E, Sections 16 and 17; see Figure 2); the Discovery Channel Telescope (DCT) site, located near Happy Jack, in the Coconino National Forest (T16N, R9E, Section 29; see Figure 3); and the Anderson Mesa-Naval Prototype Optical Interferometer (NPOI) site, also in the Coconino National Forest (T20N, R8E, Sections 22 and 27; see Figure 4). Lowell Observatory owns the Mars Hill site and operates the Anderson Mesa/NPOI and DCT/Happy Jack sites under special use permits from the US Forest Service.

The purpose and need of the proposed action is to allow Lowell Observatory to handle the ever-growing amount of electronic data collected at, and transmitted between, its three sites. At the Mars Hill site, the project involves attaching a 2- to 4-foot microwave relay antenna to an existing water tank built in 1994. Electrical and data transmission wiring will be through existing lines. No ground-disturbing or other activities other than mounting the antenna on the tank are involved.

At the DCT/Happy Jack site, the proposed action consists of placing a 4-foot microwave relay antenna on the southwest corner of the existing Auxiliary Building. The antenna would be mounted on a support pole that would also be attached to the building. This would require hand-excavation of a less than 1-foot diameter hole near the building foundation, a previously disturbed area.

At the Anderson Mesa/NPOI site, the project involves the removal of an existing 30-foot antenna, 4-square-foot concrete pad, and existing guy wires, followed by the installation at the same location of a 40-foot monopole on above-ground concrete cell block foundation, with a 4-foot antenna at the top of the pole. No guy wires would be required. Wiring would be through existing conduits.

The US Forest Service has reviewed the activities proposed at the Anderson Mesa/NPOI and DCT/Happy Jack sites under the *Programmatic Agreement Regarding Cultural Property Protection and Responsibilities Among The New Mexico Historic Preservation Division, and Arizona State Historic Preservation Office, and Texas State Historic Preservation Office, and Oklahoma State Historic Preservation Office, and The Advisory Council on Historic Preservation, and the United States Department of Agriculture, Forest Service, Region 3*, dated April 2, 1990 and determined that they do not "have the potential to cause effects on historic properties....as defined in 36 CFR 800.3(a) and (a)(1); FSM R-3 2361.24.1.c." A copy of this finding is enclosed.

The Mars Hill site consists of approximately one square mile of land on Mars Hill, a mesa just west of Flagstaff. Founded in 1894 by Percival Lowell, Lowell Observatory at Mars Hill was designated a National Historic Landmark (NHL) in 1965 under Theme XX, Arts and Science in the "Science and Invention" subcategory (now Theme XIII – Science, Subcategory A-1: Physical Sciences-Astronomy). Based on information contained in the 1978 National Register of Historic Places Nomination Form (copy enclosed), the site encompasses two discontiguous parcels and includes the following contributing resources: the 1896 Clark telescope; the Lowell Library (c. 1894); Mausoleum (c. 1916); Administration (Slipher) Building (1914); Stone Water Tower; 1912 Residence; and Iron Gate. There are several other structures within the boundary of the site, including the 1929 Pluto Discovery Telescope (not listed in the Nomination Form but presumed contributing); the Hendricks Center for Planetary Studies (built in the 1960s), and the Steele Visitor Center (opened in 1994).

The area of potential effect (APE) for the Mars Hill project component includes the water tank on which the proposed antenna would be mounted and the viewshed of the tank. The APE is shown in Figure 2. The water tank (Photo 1) was installed in 1994 and is not a contributing element to the historic district. It currently has a ladder and power source available at the location where the antenna would be installed; no ground-disturbing activities would be required to connect the antenna. Installing the proposed antenna would have no effect on, nor compromise the integrity of, any of the historic resources at Mars Hill.

To evaluate potential indirect visual effects of the proposed antenna at the Mars Hill site, photographs were taken looking from the Slipher Administration Building (Photos 2 and 3) and the Pluto Telescope (Photo 4) toward the planned location of the antenna. The photos show that the antenna would not be visible from these buildings because of the surrounding vegetation and terrain. Other historic buildings and structures are farther away, with no potential to be visually affected by the addition of a 2- to 4-foot antenna to the water tank.

Therefore, the proposed action would not alter, directly or indirectly, any of the characteristics of the site that qualify it for listing in the National Register, nor would it result in cumulative effects that would alter the historic integrity of the site. The installation of equipment designed to facilitate continued scientific research at Lowell Observatory is fully compatible with the historic significance of the property as a scientific campus dedicated to astronomical research.

Pursuant to 36 CFR 800.8(c)(1)(i), the following Consulting Parties were identified and consulted: The National Park Service (for the Mars Hill site, which contains a National Historic Landmark [NHL]); the US Forest Service (for the Anderson Mesa/NPOI and DCT/Happy Jack sites); the Federal Communications Commission; the City of Flagstaff Historic Preservation Commission; the Fort Mojave Indian Tribe; the Havasupai Tribe; the Hopi Tribe; the Hualapai Tribe; the Navajo Nation; the Yavapai-Apache Nation; the Yavapai-Prescott Indian Tribe; and the Pueblo of Zuni.

To date, the following responses have been received:

- The US forest Service, as indicated above, has conducted its own review of the project under the 1990 Programmatic Agreement with respect to the Anderson Mesa/NPOI and DCT/Happy Jack sites and found that the proposed action has no potential to affect historic properties.

- The Federal Communications Commission has declined to participate in the review process.

- The Yavapai-Prescott Indian Tribe and Hopi Tribe have expressed no concerns with respect to the proposed action.

The other parties have not responded to the original letters or to follow-up calls placed after 30 days from the initial date of contact.

<u>Finding</u>

Based on the finding of the US Forest Service for the Anderson Mesa/NPOI and DCT/Happy Jack sites, and the effect analysis presented above for the Mars Hill site, NSF finds that the proposed action under the American Recovery and Reinvestment Act would have "no effect" on historic properties as defined in 36 CFR 800.16(i).

Thank you for reviewing the information contained in this letter. Because of the requirement that NSF's ARRA actions be completed before the end of the fiscal year, I would be grateful if you would provide me with your comments by email, at smeacham@nsf.gov, within 30 days of receiving this letter. Please, do not hesitate to call me if you have any questions or require further information.

Steve Meacham
Senior Staff Associate
Office of Integrative Activities
National Science Foundation
Ph: 703-292-8040

CONCUR

13 AUG 10

Arizona State Historic Preservation Office

THE NAVAJO NATION

JOE SHIRLEY, JR.
PRESIDENT

BEN SHELLY
VICE-PRESIDENT

July 8, 2010

Stephen Meacham, Senior Staff Associate
National Science Foundation
4201 Wilson Boulevard, Room 1270
Arlington, Virginia 22230

Dear Mr. Meacham:

Our apology for an oversight and missing the deadline date of our response to your request, and that the Navajo Nation Historic Preservation Department – Traditional Culture Program (NNHPD-TCP) is in receipt of the proposed project regarding the installation of Microwave Relay Antennas at the Lowell Observatory in Flagstaff, Anderson Mesa, and Happy Jack, Coconino County, Arizona.

After reviewing your consultation documents, HPD-TCP has concluded the proposed undertaking/project area **will not impact** Navajo traditional cultural properties. The Navajo Nation is aware of no new ground disturbances and that all Microwave Relay Antennas will be mounted on to existing water tanks and former tower sites. The NNHPD-TCP, on behalf of the Navajo Nation has no concerns at this time.

However, the determination made by the HPD-TCP does not necessarily mean that the Navajo Nation has no interest or concerns with the proposed project. The Navajo Nation considers the Anderson Mesa a TCP due to the fact that there are many Navajo archaeological sites atop of the mesa and so, should the proposed project inadvertently discovers habitation sites, plant gathering areas, human remains and objects of cultural patrimony the HPD-TCP request that we be notified respectively in accordance with the Native American Graves Protection and Repatriation Act (NAGPRA).

The HPD-TCP appreciates the National Science Foundation's consultation efforts, pursuant to 36 CFR Pt. 800.1 (c)(2)(iii). Should you have any additional concerns and/or questions, do not hesitate to contact me electronically at tonyjoe@navajo.org or telephone at 928-871-7750. Mr. Kelly Francis will be taking over all Section 106 Consultations soon within the near future.

Sincerely,

Tony H. Joe, Jr., Supervisory Anthropologist *(Section 106 Consultations)*
Historic Preservation Department – Traditional Culture Program

TCP 10-543
CC: Office File/Chrono

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Appendix H – Project 9

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
81440-2010-I-0297

June 18, 2010

Carl Rykaczewski, Senior Environmental Professional
AECOM
1461 East Cooley Drive, Suite 100
Colton, California 92324

Subject: University of California Santa Barbara Greenhouse Replacement, Santa Barbara County, California

Dear Mr. Rykaczewski:

We are responding to your request, dated May 7, 2010, and received in our office on May 14, 2010, for our concurrence with the National Science Foundation's determination that the proposed greenhouse replacement project, which is being considered for funding through the American Research Infrastructure – Recovery and Reinvestment Program, would have no effect on any federally listed or candidate species. The proposed project would involve the demolition of two existing bio-science annex facilities at the University of California Santa Barbara, in Santa Barbara County, California, and the construction of a new 2,700 square-foot commercial grade greenhouse and 700 square-foot alpine greenhouse. Your request and our response are made pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act).

Because there is no suitable habitat for federally listed or candidate species in or adjacent to the project area we concur with your determination that the proposed project will not affect any federally listed or candidate species.

If you have any questions regarding this matter, please contact Jenny Marek of our staff at (805) 644-1766, extension 325.

Sincerely,

Chris Dellith
Senior Biologist

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STATE OF CALIFORNIA – THE RESOURCES AGENCY

ARNOLD SCHWARZENEGGER, *Governor*

OFFICE OF HISTORIC PRESERVATION
DEPARTMENT OF PARKS AND RECREATION
P.O. BOX 942896
SACRAMENTO, CA 94296-0001
(916) 653-6624 Fax: (916) 653-9824
calshpo@ohp.parks.ca.gov
www.ohp.parks.ca.gov

27 July 2010

Reply To: NSF100517A

Steve Meacham
Senior Staff Associate
Office of Integrative Activities
National Science Foundation
4201 Wilson Boulevard, Room 1270
Arlington, VA 22230

Re: Section 106 Consultation for the University of California Santa Barbara Greenhouse Replacement, Determination of No Historic Properties Affected, Santa Barbara, Santa Barbara County, CA

Dear Mr. Meacham:

Thank for continuing consultation for the National Science Foundation (NSF) regarding the above referenced undertaking, pursuant to the National Historic Preservation Act of 1966 as amended and the implementing regulations in 36 CFR 800. Specifically, you are seeking my concurrence with the NSF's determination finding that the above mentioned undertaking will result in No Effect on Historic Properties.

As I presently understand it, the NSF is receiving funding through the Academic Research Infrastructure Recovery and Reinvestment Program, for the replacement of two greenhouse structures on the campus of University of California (UC) Santa Barbara. The proposed location for the new greenhouses is occupied by Building 539. Constructed in 1961, Building 539 will be 50 years old upon implementation of the project.

NSF determined the APE for the undertaking is the footprint of the project. I find this sufficient pursuant to 36 CFR 800.4(a)(1).

NSF evaluated Building 539 and determined the building is not eligible for inclusion in the National Register of Historic Places (NRHP). Therefore, there are no historic properties within the APE of the project and a determination of No Historic Properties Affected is appropriate for the undertaking. I concur with these determinations.

Thank your for considering historic properties in your planning process and I look forward to continuing consultation on this project. If you have any questions, please contact Amanda Blosser of my staff at (916) 654-7372 or e-mail at ablosser@parks.ca.gov.

Sincerely,

Susan K Stratton for

Milford Wayne Donaldson, FAIA
State Historic Preservation Officer

MWD:ab

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Appendix I – Project 10

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Minnesota
Historical Society

STATE HISTORIC PRESERVATION OFFICE

RECEIVED JUL - 6 2010

July 2, 2010

Amy Ollendorf
AECOM
161 Cheshire Lane North, Suite 500
Minneapolis, MN 55441

RE: Rehabilitation of the St. Anthony Falls Lab
Minneapolis, Hennepin County
SHPO Number: 2009-3413

Dear Ms. Ollendorf:

Thank you for the opportunity to review and comment on the above project. We received the original review packet materials on May 28, and the supplemental information we requested arrived on June 16. These materials have been reviewed pursuant to the responsibilities given the State Historic Preservation Officer by the National Historic Preservation Act of 1966 and the Procedures of the Advisory Council on Historic Preservation (36CFR800), and to the responsibilities given the Minnesota Historical Society by the Minnesota Historic Sites Act.

The St. Anthony Falls Lab is a contributing element in the in the St. Anthony Falls Historic District, which is listed in the National Register of Historic Places. Accordingly, any rehabilitation work on the building must be in conformance with the Secretary of the Interior's Standards for Rehabilitation.

For your information, when we review smaller rehabilitation projects, we ask developers to fill out a "Scope of Work Form for Historic Preservation Projects" (enclosed). If the project meets the Standards, we are able to make a finding of "no adverse effect" pursuant to 36 CFR 800. For larger, more complex projects like yours, we typically do our reviews directly from the architectural plans and specifications. In terms of review time, we often ask to see the plans at 30, 60 and 90 percent complete; as well as receiving a set of the 100 percent complete plans for final review. The timing of these check-points is not set in stone, and can be adjusted to the needs of your project.

As discussed at the June 15 meeting on this project, you may need to complete your NEPA /106 documentation in order to receive funding approval, before final design work can be done. In these circumstances, we are willing to negotiate a Programmatic Agreement (PA), that will specify further consultation and review steps, as the design is more fully developed. Agreed upon plan review points, as described above, can be part of the PA.

I have examined the Lab's grant application, which provided a good understanding of the proposed project as a whole. Based on that reading, I can identify a number of project components that we will want to review for conformance to the Secretary of Interior Standards. These include:

1. Gate house restoration, including installation of the new overhead crane
2. All door and window replacements
3. Any substantial re-channeling of the internal or external waterways, that change the historic functioning of the building hydraulics
4. Structural repairs, especially those involving the cutting and patching of existing walls
5. Concrete restoration, both interior and exterior
6. Floor plan re-configurations for remodeled offices, labs and restrooms
7. New elevator and stair well configurations
8. Interior and exterior trims and finishes, for period compatibility and possible salvage or re-use of existing period items
9. Site repairs and modifications
10. Outdoor stream lab modifications and equipment placement

In all our review work, our guiding principles will be to honor the WPA-era construction and style of the St. Anthony Falls Lab building, while maintaining compatibility with the historic industrial setting of the St. Anthony Falls Historic District.

It seems from the description that most of your work will be inside the building. However, preliminary plans do indicate some site work. Further, wall and channel repairs may result in more work than now anticipated. As we all know, the St. Anthony Falls area is very sensitive from an archaeological standpoint. If your project will require any new ground disturbance, we will want the area to be affected examined by a qualified archaeologist prior to commencement of work.

We realize that part of your project will be paid for by the National Science Foundation grant, and these items are the federal portion of the project. The balance of the work will be paid for by University funds, and this represents the State portion of the project. However, we intend to review the whole project using Federal Sec. 106 processes and standards. We do so with the knowledge that both NEPA and the National Historic Preservation Act have rules that prohibit "segmentation" of projects. By "federalizing" our entire historical review, we actually want to make it simpler for all of us.

We look forward to working with you as project plans progress. If you have any questions regarding our preliminary review of this project, please contact our Compliance Section (651) 259-3456.

Sincerely,

Mary Ann Heidemann

Mary Ann Heidemann, Manager
Government Programs and Compliance

Enclosure: *Scope of Work Form for Historic Preservation Projects*

cc: Caroline Middleton, Univ. of MN General Counsel's Office
Fotis Sotiropoulos, St. Anthony Falls Lab

MINNESOTA HISTORICAL SOCIETY • STATE HISTORIC PRESERVATION OFFICE

REQUIRED DOCUMENTATION FOR REVIEW AND COMPLIANCE REHABILITATION PROJECTS:

WINDOWS AND DOORS:
Close-up/detail photographs of existing windows/doors
Drawings/catalog cuts of proposed windows/doors:
- Must include section and elevation, and muntins
- Material (e.g. wood, aluminum)
- Screens/Storms
- Finish (e.g. painted)
- Glass type (e.g. single pane, low-e, thermo-pane)

STOREFRONTS:
Photographs/description of existing
Architect's drawing(s) of proposed new storefront
Glass type
Finish
Molding profiles

SIDING:
Photograph of existing siding, with description of type and condition
Documentation of original siding, if available
Description of proposed replacement:
- Material
- Exposure/lap
- Trim details
- Catalog references

MASONRY:
Photographs and documentation of existing and condition
Repointing:
- Existing mortar composition/analysis
- Proposed mortar composition/joint profile/color

Cleaning:
Technical specs for product and method

PAINTING:
Photographs/description of existing condition and material to be painted
Specifications for primer and finish coat

ACCESSIBILITY/ADA:
Photographs of proposed location for ramp/lift
Site plan or interior plan, if applicable
Manufacturer's specifications/catalog reference

ROOFS:
Photographs and documentation of existing roofing
Proposed roofing:
- Material
- Exposure
- Catalog references

INTERIOR ALTERATIONS:
Photographs of existing conditions
Floor plan of existing spaces
Proposed plan

NEW ADDITIONS:
Photographs of proposed location for addition
Architect's plans and specifications for new construction

REPLACEMENT OF EXISTING ELEMENTS:
Documentation of original detail (**e.g. historic photograph**)
Drawing/catalog reference for proposed replacement

INSTRUCTIONS FOR COMPLETING THE *SCOPE OF WORK FORM*:

DETAILED DESCRIPTION OF REHABILITATION WORK. In the numbered blocks, provide a description of project work. *Describe the entire project, not simply those portions for which the federal funds will be used.* A separate block should be used to describe each work item. In the left block, identify the architectural feature requiring work and indicate whether the feature described is original to the building, was added at a later date, or is new construction. Give the approximate date of the feature. In the appropriate space, describe its physical condition. Indicate the photograph or drawing numbers that show the feature described. In the right block, explain in detail the rehabilitation work to be undertaken. List drawings, marked photographs, or catalog specification page numbers that show the rehabilitation work. ***Please include historic photos***.

EXAMPLES:

NUMBER Architectural feature *facade brick* Approximate date of feature: *ca. 1880* Describe existing feature and its condition: *Hard pressed red brick with butter joints in good condition. Mortar mostly sound, but deteriorated and missing around downspout at east end of facade. Some graffiti at first floor.* Photo no. *3, 6* Drawing No. ____	Photo no. *9, 10* Drawing No. A-12 Describe work and impact on existing feature: *Will selectively hand clean deteriorated joints and repoint with mortar and joint width to match existing (see spec. p. 33-35); chemically clean graffiti from 1st floor piers (see spec. p. 30-31.)*
NUMBER Architectural feature *main staircase* Approx. date of feature: *ca. 1880/unknown* Describe existing feature and its condition: *Original stair exists between 1st and 3rd floors. Some balusters missing and treads worn. Later stair from 3rd to 8th floors.*	Describe work and impact on existing feature: *Replace missing balusters with matching pieces. Sand painted banisters and balusters and varnish. Replace treads as needed. Sand and paint stairs. Retain later stair as is.*

Property Name
Property Address

Scope of Work Form
for
Historic Preservation Projects

Please include historic photos

Date: ____________

R&C Number:

Detailed Description Of Rehabilitation / Preservation Work – Includes site work, new construction, alterations, etc. Complete blocks below.

Number Architectural feature ____________ Approximate date of feature____________ Describe existing feature and its condition: Photo no. ____________ Drawing no. ____________	Describe work and impact on existing feature:
Number Architectural feature____________ Approximate date of feature____________ Describe existing feature and its condition: Photo no. ____________ Drawing no. ____________	Describe work and impact on existing feature:
Number Architectural feature ____________ Approximate date of feature ____________ Describe existing feature and its condition: Photo no. ____________ Drawing no. ____________	Describe work and impact on existing feature:
Number Architectural feature ____________ Approximate date of feature ____________ Describe existing feature and its condition: Photo no. ____________ Drawing no. ____________	Describe work and impact on existing feature:

PROGRAMMATIC AGREEMENT AMONG
REGENTS OF THE UNIVERSITY OF MINNESOTA,
THE NATIONAL SCIENCE FOUNDATION,
THE NATIONAL PARK SERVICE, AND
THE MINNESOTA STATE HISTORIC PRESERVATION OFFICE

WHEREAS, Regents of the University of Minnesota (the “University”) are proposing to renovate the Saint Anthony Falls Laboratory (the “Project”), comprised of the main laboratory building itself and the Outdoor Stream Laboratory located in the adjacent wasteway;

WHEREAS, the University submitted a grant application to the National Science Foundation (“NSF”) for ARI-R2 funds to design and construct a portion of the Project, which assistance would render the Project a federal undertaking pursuant to Section 106 of the National Historic Preservation Act (“Section 106”), 16 U.S.C. Section 4700(f), as amended;

WHEREAS, the Saint Anthony Falls Laboratory is located within the Mississippi River National River and Recreation Area (“MNRRA”) as authorized by the U.S. Congress;

WHEREAS, the Saint Anthony Falls Laboratory is, along with a number of other historic components, a contributing element of the Saint Anthony Falls Historic District (the “Historic District”) which is listed on the National Register of Historic Places and locally designated by the City of Minneapolis;

WHEREAS, the NSF, the University, the Minnesota State Historic Preservation Office (“SHPO”), and the National Park Service (“NPS”) have been engaged in consultations as consulting parties in accordance with Section 106 and 36 CFR 800.2(c);

WHEREAS, the University and NSF began public participation in the proposed Project on June 10, 2010, through a meeting attended by public representatives including the Minneapolis Riverfront Corporation, the City of Minneapolis-Heritage Preservation Commission, and the SHPO;

WHEREAS, the Minneapolis Riverfront Corporation and the City of Minneapolis-Heritage Preservation Commission were invited to and have elected to participate as consulting parties;

WHEREAS, Xcel Energy has been invited to participate as a consulting party;

WHEREAS, the Advisory Council on Historic Preservation (“Council”) was invited to participate in the development of this Agreement, in accordance with 36 CFR 800.2(b), and declined to participate;

WHEREAS, in accordance with 36 CFR 800.2(c)(2)(ii), the NSF sent consultation letters to the Minnesota Indian Affairs Council and potentially interested Indian tribes (Upper Sioux Community of Minnesota, the Lower Sioux Indian Community Council, the Flandreau Santee Sioux, the Prairie Island Indian Community, the Sisseton-Wahpeton Oyate of the Lake Traverse Reservation, the Santee Sioux Nation, and the Spirit Lake Tribe Council) describing the proposed Project and inviting them to provide comments and to notify NSF of any concerns they might have;

WHEREAS, the full range of effects on the Historic District will not be known prior to the NSF's decision regarding whether to grant funds made available under the American Reinvestment and Recovery Act for the proposed Project, and, therefore, this Agreement provides for ongoing consultation to assess effects and resolve any adverse effects in fulfillment of the requirements of Section 106 in accordance with 36 CFR 800.14(b)(1)(ii) once those effects are known;

WHEREAS, Xcel Energy maintains a "Manual for Managing Historic Resources," reviewed by the Minnesota State Historic Preservation Office and the National Park Service, that pertains to projects on property owned by Xcel;

WHEREAS, the purpose of this Agreement is to identify the process for consultation to assess effects on historic properties and to identify measures to avoid, minimize, or mitigate any adverse effects;

WHEREAS, the NSF will be responsible for ensuring that all aspects of the Project implementation for which it is responsible meet the terms of this Agreement; and

WHEREAS, if NSF makes a decision to award funds for the proposed Project, the University will implement the proposed Project and will complete the stipulations of this Agreement.

NOW THEREFORE, the NSF, NPS, and the Minnesota SHPO agree that the University, if awarded the grant, may implement the Project pursuant to the following stipulations:

STIPULATIONS

A. The design of the proposed Project will, if awarded, effectively meet the Project's purpose and need while avoiding, minimizing, and/or mitigating adverse impacts to historic properties.

B. As part of the design and development process, the University and NSF shall continue to consult with the SHPO, the NPS, and the other consulting parties (all consulting parties shall herein be referred to as the "consultation group") regarding adverse effects on historic properties that may potentially be caused by implementation of the Project. Insofar as possible, the proposed Project shall be implemented in a manner consistent with the *U.S. Secretary of the Interior's Standards for Archaeology and*

Historic Preservation, taking into account the *U.S. Secretary of the Interior's Standards for the Rehabilitation of Historic Properties* ("SOI Rehabilitation Standards").

C. (i) The University will submit plans to the consultation group for review and comment at the 30 percent completion phase to assure that historic values are respected, integrated, incorporated and implemented into the Project. The consultation group will provide comments to the University and NSF within 60 days after receipt of the plans or the University and NSF may assume that they have no comments. Where NSF and the University are unable to integrate the consultation group's comments into the design, NSF, through the University, shall provide a written explanation to the consultation group within 30 days after the University's receipt of written comments.
(ii) The University will submit plans to the consultation group for review and comment at the 60 percent completion phase to assure that historic values are respected, integrated, incorporated and implemented into the Project. The consultation group will provide comments to the University and NSF within 30 days after receipt of the plans or the University and NSF may assume that they have no comments. Where NSF and the University are unable to integrate the consultation group's comments into the design, NSF, through the University, shall provide a written explanation to the consultation group within 30 days after the University's receipt of written comments.
(iii) The University will submit plans to the consultation group for review and comment at the 90 percent completion phase to assure that historic values are respected, integrated, incorporated and implemented into the Project. The consultation group will provide comments to the University and NSF within 30 days after receipt of the plans or the University and NSF may assume that they have no comments.

D. The University will deploy a publicly-accessible web-site that describes the Project and the opportunities for input by interested parties. This web-site will provide the public with information about the Project, including the evolution of its design, its effects on historic properties, and its potential for promoting discovery in science and engineering. The web-site will be maintained for, at least, the duration of the consultation process. The University and NSF will, when the design is developed to a stage where effects on historic properties can be reasonably known, seek further public participation with respect to the Project and its effects on historic properties by holding a Section 106 meeting. Advance notice of the meeting will be given through one or more local newspapers.

E. If there are any Project elements for which it is not feasible to reach a design that meets the SOI Rehabilitation Standards, the Project elements at issue will be considered to have an adverse effect and a mitigation plan will be developed, as set forth below.

F. In any instance where a Project element does not meet the SOI Rehabilitation Standards, NSF and the University will consult with the consultation group and, if appropriate, hold a Section 106 meeting, to develop a mitigation plan appropriate to the Historic District, and type and degree of the effect.

G. NSF and the University shall notify the consultation group when a mitigation plan will be prepared pursuant to this Agreement. The NSF and the University will develop the mitigation plan within 60 calendar days of such notification. If more time is required to develop a proposed mitigation plan, NSF and the University will notify the consulting parties regarding the reason for the delay and the anticipated timeframe for mitigation plan distribution. The NSF and the University will provide a copy of the draft mitigation plan to the consulting parties for a 30 day comment period during which the consulting parties may provide written comments to NSF and the University.

H. NSF agrees to consider any timely comments of the consultation group in the development of final mitigation plans.

I. In the event of a dispute regarding this Agreement, the NSF shall request Council comment pursuant to 36 CFR Part 800.

J. As part of the regular progress reporting required as part of the ARI-R2 grant, the University, if awarded the grant by NSF, agrees to provide written updates regarding implementation of any mitigation plan that is developed pursuant to this Agreement to the NSF.

K. Any signatory to this Agreement may request that this Agreement be amended. If such a request is made, the other signatories will consider such amendment. Any amendments shall be in writing and signed by all signatories to be effective.

L. Any signatory to this Agreement may withdraw from this Agreement, however, such withdrawal shall not become effective unless the signatory seeking withdrawal first provides 30 days written notice to the other signatories and engages in consultations with the signatories regarding the reason for the requested withdrawal. Likewise, any signatory to this Agreement make seek termination of this Agreement, provided that the same process required for seeking withdrawal from the Agreement is followed. In the event of termination or withdrawal, the NSF will comply with 36 CFR Part 800 with regard to the proposed undertaking covered by this Agreement.

Execution and implementation of this Agreement evidences that the NSF has satisfied its Section 106 responsibilities for all aspects of this undertaking.

SIGNATORY PARTY

National Science Foundation

By: ______________________________ Date: 27 Aug 2010

SIGNATORY PARTY

National Park Service

By: Paul Labovitz Date: 8-27-10

SIGNATORY PARTY

Minnesota State Historic Preservation Office

By: Britta L. Bloomberg Date: 8/27/10

Britta L. Bloomberg
Deputy State Historic Preservation Officer

SIGNATORY PARTY

Regents of the University of Minnesota

By: Kathleen O'Brien Date: 8/27/10

Vice President

CONSULTING PARTY

Minneapolis Riverfront Corporation

Cordelia Pierson

By: ________________________________ Date: _August 27, 2010_

CONSULTING PARTY

City of Minneapolis-Heritage Preservation Commission

By: Jack Byers Date: August 27, 2010

Appendix J – Comments on the Draft EA and Responses

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EA for Academic research Infrastructure Recovery & Reinvestment Program

Comments Received on the Draft EA with Responses

September 16, 2010

Comment #	Comment	Response
Comments from Jeremy R. Freimund, P.H., Water Resource ManagerLummi Natural Resources Department		
1	Section 3.2.6.1, Section 3.2.6.4, and Section 3.7.6.1: All the "Chief" in front of Kwina Road need to be removed. Google Maps has Kwina Road mislabeled as Chief Kwina Road.	The EA (text and graphics) was modified as requested.
2	Section 3.8.4.1 Last Paragraph – Original is in Bold which is inaccurate, the paragraph with red is a suggested revision. **"All construction activities in Washington State are subject to National Pollutant Discharge Elimination System General Construction permitting and erosion and sediment control BMPs, as prescribed in the Storm water Management Manual for Western Washington (Washington State Department of Ecology, 2005)."** All construction activities on the Lummi Indian Reservation are subject to National Pollutant Discharge Elimination System (NPDES) General Construction Permit and Lummi Code of Laws (LCL) Title 17 Water Resources Protection Code. The NPDES Permit requires the owner/operator to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) that meets the criteria set forth by the Lummi Natural Resources Department. All SWPPPs must included erosion and sediment control BMPs. If the area of ground disturbance is less than one acre, NPDES General Construction Permit is not required.	The EA was modified as requested.
Comment from Carole L. Sanner, Asst. Planning and Zoning Officer, Anne Arundel County Office of Planning and Zoning		
3	[...] This office has no objections to the improvements as described in the EA. We again appreciate the opportunity to review the document, and would ask that you contact this office at (410) 222-7450 if we can be of any further assistance in this matter.	Comment noted. No further action required or taken.

Comment #	Comment	Response
Comment by Beth Callahan, Project Manager, Maine Dept. of Environmental Protection Division of Land Resource Regulation		
4	[…] Of the ten projects listed, I am very familiar with Project 1 – Bigelow Laboratory for Ocean Sciences in E. Boothbay, Maine. This facility was reviewed and approved by the Maine Department of Environmental Protection (MDEP) under the Site Location of Development Act and the Natural Resources Protection Act in Department Order #L-24979-26-A-N/L-24979-4E-B-N, dated June 4, 2010. During MDEP's licensing review process, Bigelow Labs took all appropriate measures to avoid and minimize natural resource and impacts and other potential impacts to the greatest extent practicable. The facility went above and beyond to meet all of the state's environmental regulations that relate to coastal and freshwater wetland protection, noise, wildlife, stormwater management, historic and scenic resource preservation, scenic character and visual quality, and other standards. After review of Bigelow Labs proposal to construct its Center for Ocean Biogeochemistry and Climate Change, MDEP is confident that Project 1 will not result in significant adverse impacts to the human environment.	Comment noted. No further action required or taken.
Comments from Brian Schaffer, Senior City Planner, AICP City of Minneapolis- CPED-Planning, Preservation & Design		
5	At this time the City of Minneapolis cannot support the evaluation impact findings regarding impacts to Historic Resources and Visual Quality in the Draft EA. The findings are based on assumed outcomes from yet to be completed regulatory review processes and not on an evaluation of the proposed actions on the impact on the St. Anthony Falls Historic District or its individual resources. More data and information is needed before the City of Minneapolis can provide additional substantive comments.	As discussed and agreed on by the Section 106 Consulting Parties, there is not sufficient information at this time for a complete evaluation of the effects (physical and visual) of the project on the historic SAFL facility and surrounding historic district. The bulk of the project involves interior renovation. As noted in the EA, two aspects of the renovation will be apparent from outside the laboratory building. One is the addition of an elevator shaft. Representatives of the NPS and SHPO have offered examples of similar projects where the design was achieved in a way that resulted in only minor impact on Historic Resources and Visual Quality. The second is the addition of an instrument gantry to an

Comment #	Comment	Response
		existing outdoor stream laboratory. A Programmatic Agreement has been executed among NSF, the University of Minnesota, the MN SHPO, and NPS, with the Minneapolis HPC and Minneapolis Riverfront Corporation as consulting parties, to establish a consultation and review process with public participation that will provide input to and feedback during the design phase that would be part of the project, if funded. The same reason that necessitated the preparation of the PA prevents the EA from providing the kind of specific and detailed analysis requested by the commenter prior to grant award. The City of Minneapolis, through its Historic Preservation Commission, is a party to the Programmatic Agreement, ensuring that it will receive the requested information as the design evolves, have an opportunity to evaluate this information, and provide feedback to potentially modify the design, as appropriate.

Comment #	Comment	Response
6	In section 3.3.10.2 Impacts of the Proposed Action Alternative the Draft EA states that the "proposed action has no more than minor direct long-term impacts on the SAFL and the St. Anthony Falls Historic District." In section 3.3.10.4 Cumulative Impacts of the Proposed Action the Draft EA states that the "proposed action is expected to result in minor direct long-term negative cumulative impacts to the historic SAFL building." The section goes on to evaluate the impacts on the St. Anthony Falls Historic District and states that there would "be minor direct long-term negative cumulative impacts to the St. Anthony Falls Historic District." The conclusions in sections 3.3.10.2, 3.3.10.4, and 3.4.10.2 are based on the review [of] the proposed work as a Certificate of Appropriateness application by the Minneapolis Heritage Preservation Commission (HPC) in a public hearing. And that a Programmatic Agreement has been prepared among the NSF, the University of Minnesota, the Minnesota State Historic Preservation Office and the National Park Service, the Minneapolis HPC and the Minneapolis Riverfront Corporation. The Draft EA states that these reviews "would ensure that the proposed action has no more than minor direct long-term negative impacts." […] However, neither of these regulatory review processes guarantees that the proposed project will have minor negative direct or cumulative impacts and mitigation plans for the impact are proposed work are potential results of the processes.	For the reason stated in the response to Comment #5 above, a detailed evaluation of the impacts of the project on historic properties is not possible at this time. However, because the objective of the review process defined in the PA is to avoid, minimize, and, if appropriate, mitigate any adverse effects of the proposed project, it is a reasonable assumption that the impacts of the project on historic resources will be minor and non-significant. The text of the EA sections referenced in the comments has been modified, as appropriate, to clarify that while the outcome of the processes mentioned are not fully known, as noted in the comment, they nonetheless provide a reasonable basis for a conclusion of no significant impact.
7	The City of Minneapolis is appreciative that the Draft EA recognizes the regulatory review authority of the Minneapolis HPC on this matter. The City of Minneapolis looks forward to working with the parties involved in the Programmatic Agreement to develop a design for the proposed scope of work that meets the Secretary of the Interior's Standards for Rehabilitation.	The City of Minneapolis' enthusiasm for participating in the PA process is noted. The EA reflects the participation of the Minneapolis HPC in the Programmatic Agreement process. The EA text has been modified to clarify that the text in the EA is not intended to constrain or endorse the internal processes that the Minneapolis HPC may choose to use to evaluate the design of the project and to formulate its feedback.

Comment #	Comment	Response
8	The Draft EA discusses previous alterations to the SAFL and the Wasteway #2 (site of the OSL) as the basis for the findings of minor direct negative cumulative impacts, but does not provide any further information describing how the proposed projects in this action will impact the SAFL, Waterway #2, or the St. Anthony Falls Historic District. The cumulative impacts, especially on the Wasteway #2 - where permanent buildings and above ground structures have never historically been located -and the historic district have not been effectively evaluated in the Draft EA. The Draft EA should provide a complete analysis of the visibility of the proposed areas of work to better understand the cumulative and direct impacts the St. Anthony Falls Historic District and its individual resources such as the wasteways.	See responses to Comments #5 and 6.
	Comments from State of California Clearinghouse and Planning Unit	
9	The State Clearinghouse submitted the Above Named environmental assessment to selected state agencies for review. The review period closed on September 7, 2010, and no state agencies submitted comments by that date. This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act.	Comment noted.

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Cartayrade, Laurent

Subject: NWIC - NSF Environmental Assessment Review

From: Jean M. Snyder
Sent: Friday, August 20, 2010 8:40 AM
To: Jeremy Freimund
Subject: NWIC - NSF Environmental Assessment Review

Jeremy,

Per your request, I reviewed the Environmental Assessment for the Academic Research Infrastructure Recovery and Reinvestment Program through the NSF. NWIC Science laboratory is included in the EA. After reviewing the document I found the following sections that require modification:

Section 3.2.6.1, Section 3.2.6.4, and Section 3.7.6.1
All the "Chief" in front of Kwina Road need to be removed. Google Maps has Kwina Road mislabeled as Chief Kwina Road.

Section 3.8.4.1 Last Paragraph – Original is in Bold which is inaccurate, the paragraph with red is suggested revisions.

"All construction activities in Washington State are subject to National Pollutant Discharge Elimination System General Construction permitting and erosion and sediment control BMPs, as prescribed in the Storm water Management Manual for Western Washington (Washington State Department of Ecology, 2005)."

All construction activities on the Lummi Indian Reservation are subject to National Pollutant Discharge Elimination System (NPDES) General Construction Permit and Lummi Code of Laws (LCL) Title 17 Water Resources Protection Code. The NPDES Permit requires the owner/operator to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) that meets the criteria set forth by the Lummi Natural Resources Department. All SWPPPs must included erosion and sediment control BMPs. If the area of ground disturbance is less than one acre, NPDES General Construction Permit is not required.

If you have any questions, please feel free to contact me.

Thanks

Jean Snyder
Water Resources Specialist II
Lummi Natural Resources Department
2616 Kwina Rd
Bellingham WA 98226

TEL: 360-384-2358
FAX: 360-384-4737
jeans@lummi-nsn.gov

ANNE
ARUNDEL
COUNTY
M A R Y L A N D
County Executive John R. Leopold

2664 RIVA ROAD, P.O. BOX 6675
ANNAPOLIS, MARYLAND 21401
OFFICE OF PLANNING AND ZONING

September 2, 2010

National Science Foundation
4201 Wilson Boulevard, Room 1270
Arlington, VA. 22230
Attn: Steve Meacham
Senior Staff Associate
Office of Integrative Activities

Re: EA for Smithsonian Environmental Research Center Improvements
Anne Arundel County, Maryland

Dear Mr. Meacham:

Thank you for the opportunity to review the Draft Environmental Assessment document which includes proposed improvements to the Smithsonian Research Center located in our jurisdiction. The improvements include repair of equipment such as weirs, flumes and dams; renovation of an existing laboratory building; construction of an instrument storage shed; and installation of seven radio communication towers that will address the need for improved data transmission capabilities. The towers will be 120 feet tall, and are not expected to have aviation airspace impacts and are predicted to have minimal visual impacts.

This document has been reviewed by our Long Range Planning, Cultural Resources, and Watershed and Ecosystem Services divisions, and no objection is offered to the proposed improvements. I would note that the our Cultural Resources division has had several conversations with a representative of the National Science Foundation over the past several months regarding the proposed project, and any concerns have been addressed as part of the draft EA. NSF will be monitoring the tower foundation sites for archaeological resources [with a Smithsonian archaeologist(s)], the areas to be impacted are minimal, and they are located in lower probability areas of the property. This stipulation has been supported by the State's Historic Preservation Office.

In summary, this office has no objections to the improvements as described in the EA. We again appreciate the opportunity to review the document, and would ask that you contact this office at (410) 222-7450 if we can be of any further assistance in this matter.

Sincerely,

Carole L. Sanner

Carole L. Sanner
Asst. Planning and Zoning Officer
Anne Arundel County
Office of Planning and Zoning

Cc: Larry R. Tom, Planning and Zoning Officer
Ronald Bowen, Director – Dept. of Public Works
Ginger Ellis – Watershed and Ecosystem Services, DPW
Lynn Miller, Planning and Zoning
C. Jane Cox, Planning and Zoning
File

Cartayrade, Laurent

From: Callahan, Beth [Beth.Callahan@maine.gov]
Sent: Thursday, August 12, 2010 8:58 AM
To: oia_ea_comments
Cc: gshimmield@bigelow.org
Subject: ARI-R2 - Project 1 comments

Good morning Mr. Meacham,

I received your letter dated August 6, 2010 regarding a request for comments on projects currently under consideration for funding through the ARI-R2 program. Of the ten projects listed, I am very familiar with Project 1 – Bigelow Laboratory for Ocean Sciences in E. Boothbay, Maine. This facility was reviewed and approved by the Maine Department of Environmental Protection (MDEP) under the Site Location of Development Act and the Natural Resources Protection Act in Department Order #L-24979-26-A-N/L-24979-4E-B-N, dated June 4, 2010.

During MDEP's licensing review process, Bigelow Labs took all appropriate measures to avoid and minimize natural resource and impacts and other potential impacts to the greatest extent practicable. The facility went above and beyond to meet all of the state's environmental regulations that relate to coastal and freshwater wetland protection, noise, wildlife, stormwater management, historic and scenic resource preservation, scenic character and visual quality, and other standards. After review of Bigelow Labs proposal to construct its Center for Ocean Biogeochemistry and Climate Change, MDEP is confident that Project 1 will not result in significant adverse impacts to the human environment.

Please feel free to contact me again if you have any additional questions, would like a copy of the Department's Order for Project 1, or if I can be of any other further assistance regarding this project.

Sincerely,

BETH CALLAHAN
Project Manager
ME Dept. of Environmental Protection
Division of Land Resource Regulation
17 State House Station
Augusta, Maine 04333
(207) 446-1586

Minneapolis
City of Lakes

Community Planning & Economic Development
Planning Division
250 South 4th Street – Room 110
Minneapolis MN 55415

Office 612 673-2597
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September 7, 2010

Steve Meacham
National Science Foundation
Suite 1270
4201 Wilson Boulevard
Arlington, Virginia 22230

RE: Comments regarding comments regarding the Draft EA for the Academic Research Infrastructure Recovery & Reinvestment Program

Dear Mr. Meacham,

The City of Minneapolis appreciates the opportunity to comment on the Draft EA for the Academic Research Infrastructure Recovery & Reinvestment Program. The following comments on directed toward the proposed actions at the St. Anthony Falls Laboratory.

The St. Anthony Falls Laboratory (SAFL) and the adjacent Wasteways #1 and #2 are contributing resources to the St. Anthony Falls Historic District. The historic district is locally designated district and listed on the National Register of Historic Places.

At this time the City of Minneapolis cannot support the evaluation impact findings regarding impacts to Historic Resources and Visual Quality in the Draft EA. The findings are based on assumed outcomes from yet to be completed regulatory review processes and not on an evaluation of the proposed actions on the impact on the St. Anthony Falls Historic District or its individual resources. More data and information is needed before the City of Minneapolis can provide additional substantive comments.

In section 3.3.10.2 Impacts of the Proposed Action Alternative the Draft EA states that the "proposed action has no more than minor direct long-term impacts on the SAFL and the St. Anthony Falls Historic District." In section 3.3.10.4 Cumulative Impacts of the Proposed Action the Draft EA states that the "proposed action is expected to result in minor direct long-term negative cumulative impacts to the historic SAFL building." The section goes on to evaluate the impacts on the St. Anthony Falls Historic District and states that there would "be minor direct long-term negative cumulative impacts to the St. Anthony Falls Historic District."

The conclusions in sections 3.3.10.2, 3.3.10.4, and 3.4.10.2 are based on the review the proposed work as a Certificate of Appropriateness application by the Minneapolis Heritage Preservation Commission (HPC) in a public hearing.

And that a Programmatic Agreement has been prepared among the NSF, the University of Minnesota, the Minnesota State Historic Preservation Office and the National Park Service, the Minneapolis HPC and the Minneapolis Riverfront Corporation. The Draft EA states that these reviews "would ensure that the proposed action has no more than minor direct long-term negative impacts."

The City of Minneapolis is appreciative that the Draft EA recognizes the regulatory review authority of the Minneapolis HPC on this matter. The City of Minneapolis looks forward to working with the parties involved in the Programmatic Agreement to develop a design for the proposed scope of work that meets the Secretary of the Interior's Standards for Rehabilitation. However, neither of these regulatory review processes guarantees that the proposed project will have minor negative direct or cumulative impacts and mitigation plans for the impact are proposed work are potential results of the processes.

The Draft EA discusses previous alterations to the SAFL and the Wasteway #2 (site of the OSL) as the basis for the findings of minor direct negative cumulative impacts, but does not provide any further information describing how the proposed projects in this action will impact the SAFL, Waterway #2, or the St. Anthony Falls Historic District. The cumulative impacts, especially on the Wasteway #2 – where permanent buildings and above ground structures have never historically been located -and the historic district have not been effectively evaluated in the Draft EA. The Draft EA should provide a complete analysis of the visibility of the proposed areas of work to better understand the cumulative and direct impacts the St. Anthony Falls Historic District and its individual resources such as the wasteways.

Thank you for the opportunity to comment. Should you have any questions about the information and concerns expressed in this letter, please contact Brian Schaffer, Senior City Planner.

Sincerely,

Brian Schaffer
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City of Minneapolis- CPED-Planning, Preservation & Design
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STATE OF CALIFORNIA
Governor's Office of Planning and Research
State Clearinghouse and Planning Unit

Arnold Schwarzenegger
Governor

Cathleen Cox
Acting Director

September 9, 2010

Steve Meacham
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Subject: Academic Research Infrastructure Recovery and Reinvestment Program
SCH#: 2010084004

Dear Steve Meacham:

The State Clearinghouse submitted the above named Environmental Assessment to selected state agencies for review. The review period closed on September 7, 2010, and no state agencies submitted comments by that date. This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act.

Please call the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process. If you have a question about the above-named project, please refer to the ten-digit State Clearinghouse number when contacting this office.

Sincerely,

Scott Morgan
Director, State Clearinghouse

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State Clearinghouse Data Base

SCH# 2010084004
Project Title Academic Research Infrastructure Recovery and Reinvestment Program
Lead Agency National Science Foundation

Type EA Environmental Assessment

Description NOTE: Review per lead

Project 5 (proposed by UC-Merced): Interior and exterior renovations to an existing building operated by UC-Merced at Wawona, Yosemite National park, under a special use permit from the National Park Service. Site is currently occupied by the building to be renovated. There will be no change in footprint.

Project 7 (proposed by the UC Natural Reserve System): Upgrade, replacement, or placement of data transmission (radios, repeater stations) equipment at 17 reserves of the UC Natural Reserve System. Most new equipment will be placed either on existing buildings or structures, or an 8-foot poles with solar panels and battery within the reserves to established adequate internet connectivity. Ground disturbing, when required, will consist of digging small holes using a hand auger.
Project 9 (proposed by UC Santa Barbara): Construction at UC-Santa Barbara's Main Campus of two research greenhouses (2,700 square feet and 700 square feet, repectively) on an already developed site. An existing building will be demolished to build the larger greenhouse; the smaller greenhouse will be constructed on an adjacent, paved lot currently used for outdoor vehicle storage.

Lead Agency Contact

Name Steve Meacham
Agency National Science Foundation
Phone (703) 292-8970 ***Fax***
email
Address 4201 Wilson Boulevard
City Arlington ***State*** VA ***Zip*** 22230

Project Location

County Mendocino, Mono, Monterey, Nevada, Placer, Riverside, ...
City
Region
Lat / Long
Cross Streets
Parcel No.
Township ***Range*** ***Section*** ***Base***

Proximity to:

Highways Hwy 1, Hwy 74
Airports Santa Barbara
Railways
Waterways
Schools
Land Use

Project Issues Aesthetic/Visual; Air Quality; Archaeologic-Historic; Noise; Soil Erosion/Compaction/Grading; Vegetation; Water Quality; Wildlife; Landuse; Cumulative Effects

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Reviewing Agencies Resources Agency; California Coastal Commission; Department of Conservation; Department of Fish and Game, Headquarters; Office of Emergency Management Agency, California; Office of Historic Preservation; Department of Parks and Recreation; Department of Water Resources; Caltrans, Division of Transportation Planning; State Water Resources Control Board, Division of Water Quality; Native American Heritage Commission; Public Utilities Commission; State Lands Commission

Note: Blanks in data fields result from insufficient information provided by lead agency.

State Clearinghouse Data Base

Date Received 08/10/2010 ***Start of Review*** 08/10/2010 ***End of Review*** 09/07/2010

Note: Blanks in data fields result from insufficient information provided by lead agency.

Draft EA Distribution List

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Draft EA Distribution List

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Draft EA Distribution List

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