National Science Foundation

FINDING OF NO SIGNIFICANT IMPACT/ DECISION DOCUMENT AND FINAL ENVIRONMENTAL ASSESSMENT

for the **Proposed Laser Interferometer Gravitational-Wave Observatory (LIGO) STEM Exploration Center at Hanford**
near Richland, Washington

Final
September 10, 2020

FES041520094ZTPA

Finding of No Significant Impact and Decision Document Regarding the Proposed Laser Interferometer Gravitational-Wave Observatory STEM Exploration Center at Hanford near Richland, Washington

The National Science Foundation (NSF) prepared an environmental assessment (EA) pursuant to the Council on Environmental Quality Regulations (*Code of Federal Regulations* [CFR], Title 40, Parts 1500 through 1508) for implementing the National Environmental Policy Act (NEPA) (42 *United States Code* [USC] Section 4321 *et seq*.) and NSF's NEPA implementing regulations at 45 CFR Part 640 to evaluate the anticipated environmental impacts associated with the construction and operation of the proposed Laser Interferometer Gravitational-Wave Observatory (LIGO) Science, Technology, Engineering, and Math (STEM) Exploration Center (LExC) facility located at the Hanford Site Property (LIGO Hanford). NSF is the lead agency for the EA, in coordination with the U.S. Department of Energy (DOE).

LIGO Hanford is a national facility for gravitational-wave research also and is funded by the NSF and operated by the California Institute of Technology (Caltech) and the Massachusetts Institute of Technology. LIGO Hanford is located on land owned by the United States and administered by DOE. Per its 1993 Memorandum of Understanding with DOE, as amended in 2018, NSF has a permit to use the site for LIGO.

Purpose and Need

Southeastern and central Washington is a region with few hands-on science-education facilities. Since LIGO announced its first detection of gravitational waves in February 2016, the number of school teachers and students visiting the site on field trips has increased, more than doubling the number of annual visitors. It is not currently possible for the LIGO Hanford facility to accommodate all educational requests. A dedicated education center is needed to enable LIGO Hanford to address the growing interest in LIGO's discoveries and provide visitors, including those who are underrepresented in STEM career fields, with science and engineering learning experiences.

The purpose of the Proposed Action is to improve STEM educational capabilities at LIGO Hanford and support the demand for in-person educational opportunities at the Observatory by creating a facility capable of accommodating approximately 10,000 visitors per year.

Proposed Action

The Proposed Action is for NSF to authorize the construction and operation of a LExC facility at LIGO Hanford within its permitted area (subject to DOE's final approval). The proposed LExC facility would be constructed east of the existing parking lot and Lab Support Building, along the current access road to LIGO Hanford. The facility would include the construction of a new approximately 13,000-square-foot building and associated infrastructure, including water and sewer utilities, electrical service, and telecommunications connection. All utilities would be extended from existing services at LIGO Hanford.

LExC construction activities would require excavation to support utility installation and grading, as needed, for the construction of a parking lot.

The LExC facility would include a visitor center with exhibit hall; static exhibits showcasing the engineering of LIGO and highlighting LIGO staff; classrooms; and a makerspace. Positioning the LExC close to the Lab Support Building would allow for the outreach programs to use the existing auditorium while maintaining distance from the interferometer, which is important to minimize the impact on the data collected at the Observatory. The LExC facility would be on the same side of the road as the auditorium to reduce visitor and vehicle conflicts while visitors are onsite.

The Proposed Action would add two additional Education and Public Outreach staff members at LIGO Hanford.

No Action

Under the No Action Alternative, NSF would not authorize the construction of a LExC facility at LIGO Hanford. The capacity of the educational and visitor sites to accommodate the increasing number of visitors would continue to be exceeded, resulting in fewer opportunities for LIGO Hanford to educate local school students and the general public about its work and to support STEM education in the region.

Factors Considered in Determining That An Environmental Impact Statement Is Not Required

The EA examined the potential effects of the Proposed Action on Biological Resources; Historic, Architectural, and Archaeological Resources; Geology, Soils, and Seismicity; Hazardous Materials and Solid Waste; Human Health and Safety; Transportation; Water Resources; and Utilities. Cumulative impacts were also evaluated. The following summarizes the resource areas where impacts resulting from implementation of the Proposed Action would be expected.

Biological Resources

Implementing the Proposed Action would result in minor, negative, short-term impacts to biological resources from the construction of the LExC facility (refer to Section 3.1, *Biological Resources*, in the EA). Direct impacts during construction would include the removal of up to 4.7 acres of vegetation, which could include state-protected plant species. Ground disturbance during construction could alter native plant communities by increasing the potential for the introduction and spread of invasive or noxious weed species at LIGO.

Construction activities would generate intermittent noise and present a physical risk to local wildlife, particularly to less mobile species; however, many potentially affected species would likely relocate elsewhere on the Hanford Site. Migratory birds that use the project site for nesting, migration stopover, or wintering purposes could also be affected by construction activities; however, there is a low probability of

such an occurrence because of other, more desirable, nesting, stopover, and foraging opportunities in the vicinity.

Geology, Soils, and Seismicity

The construction of the Proposed Action would include site grading, soil compaction, depth of excavation, and construction staging areas that would disturb up to 4.7 acres at the Hanford Site. Land and subsurface disturbance and erosion would result in minor, negative, short-term impacts to soil during construction of the LExC facility (refer to Section 3.3, *Geology, Soils, and Seismicity*, in the EA).

Hazardous Materials and Solid Waste

The Proposed Action is expected to increase the number of people onsite by 2 full-time employees daily and approximately 5,000 additional visitors per year. The additional personnel and visitors would increase the amount of solid waste generated onsite; however, this amount is relatively small compared to the remaining capacity of the existing onsite and offsite disposal facilities. The resulting impact would be minor, negative, and long-term (refer to Section 3.4, *Hazardous Materials and Solid Waste*, in the EA).

Transportation

The new LExC facility would accommodate an increase in visitation for the once-a-month Saturday tours to a maximum of 400 visitors during peak visitation months (March through November), as discussed in Section 3.6, *Transportation*, of the EA. Increased Saturday visitation would be expected to contribute approximately 50 to 100 extra vehicles per day on Hanford Site Route (HSR) 10, in addition to the current weekend average daily traffic of 400 vehicles per day. This minor change to traffic would not exceed roadway capacity or cause delays on the roadway network because it is much lower than the normal workday average daily traffic on HSR 10. The relatively small changes to traffic during operation of the Proposed Action would result in a minor, negative, long-term impact to transportation resources.

Cumulative Impacts

The Proposed Action is in a remote location and no reasonably foreseeable future actions in LIGO's vicinity were identified. While the site has had a history of wildfires and human occupation, no significant archaeological remnants were found during the field surveys and no past cumulative activities were identified. Mitigation of impacts to biological resources could affect areas of the proposed site; however, this mitigation would result in a net benefit to biological resources. Because there are no planned future activities beyond LExC construction and operation at the site and because offsite biological restoration would result in a benefit, no potential negative cumulative impacts associated with this project have been identified.

Mitigation

Environmental protection measures and best management practices (BMPs) would be implemented to avoid, minimize, and reduce potential impacts resulting from the Proposed Action to less than significant

levels. The LIGO operator (currently Caltech) would be responsible for the implementation of the following mitigations unless otherwise noted:

- BMPs such as dust control measures, use of unleaded gasoline and ultra-low sulfur diesel fuel, and proper maintenance of equipment would be implemented to protect air quality during construction.
- The LIGO Hanford operator would develop and implement a revegetation management plan to address the removal of vegetation during construction. The plan would be developed in coordination with DOE and would outline specific mitigation measures, revegetation locations and acreage, and BMPs to avoid and minimize the impacts of the Proposed Action on vegetation at LIGO Hanford.
- Resource priority Level 2 through 5 resources would be revegetated with native plant species as directed by the Hanford Site Biological Resources Management Plan (BRMP). Additionally, in accordance with the BRMP, mitigation areas would be monitored for a minimum of 5 years after planting to confirm the vegetation is developing.
- Impacts from invasive weeds during construction would be minimized with the implementation of DOE-approved weed mitigation BMPs, and a noxious weeds management plan would be implemented to manage noxious weeds and vegetation during operation and maintenance activities.
- Pre-construction surveys and nesting bird BMPs would be implemented if construction commences during the mid-March to mid-July nesting period.
- NSF would direct Caltech to develop an unanticipated discovery plan to address buried historic, cultural, or archaeological resources before initiating project activities to address any resources that might be discovered during construction.
- Erosion control BMPs would be used to minimize impacts to soil from erosion and final design plans would evaluate seismicity prior to any construction activities.
- Construction BMPs and applicable pollution prevention and spill mitigation plans would be implemented to address the use or generation of hazardous materials and solid waste, and the LIGO facility would abide by the Hanford Site Pollution Prevention Program following construction.
- Increased sewer utility infrastructure would be built to accommodate increased wastewater generation. Solid waste would be disposed of at existing solid waste facilities with adequate capacity.
- Construction would be conducted in accordance with Occupational Safety and Health Administration regulations and DOE and NSF-specific safety regulations and the existing

protective measures, emergency action plans, and access restrictions would remain in place to protect staff and visitors to LIGO Hanford.

- A traffic management plan would be developed prior to construction to identify BMPs to minimize construction traffic impacts and construction vehicle traffic would be timed to avoid peak-hour traffic periods at the Hanford Site to the extent possible.
- A Construction Stormwater General Permit would be obtained and a site-specific stormwater pollution prevention plan that includes stormwater BMPs, as well as sediment and erosion control measures, would be developed. Stormwater runoff would be managed through infiltration swales designed in accordance with the Stormwater Management Manual for Eastern Washington.

Public Comment

Pursuant to NEPA requirements to allow for public participation, NSF distributed the Draft EA for a 30-day public review period beginning on June 23, 2020. A Notice of Availability of the Draft EA was published on June 23, 2020 and June 28, 2020 in the *Tri-City Herald* and the *Yakima Herald-Republic*. The public comment period ended on July 23, 2020, and the EA was revised based on the comments received.

NSF coordinated closely with DOE, the State Historic Preservation Officer, and consulting parties to identify potential environmental, archaeological, historic, and cultural impacts resulting from the Proposed Action. Native American tribes were given project updates and provided with the opportunity to comment on project planning through the regularly scheduled Hanford cultural resources meetings and formal review of the Cultural Survey Report, which included site forms, eligibility, and effects recommendations.

While the Yakama Nation did not submit written comments on the Draft EA during the public comment period, the Nation did indicate during a call with NSF that they have an interest in education and outreach opportunities specific to Yakama Nation students. NSF passed on this information to the LIGO Outreach Coordinator (September 9, 2020) so that she could follow up directly with the Yakama Nation about this interest.

Conclusion

As stated previously, implementation of the Proposed Action is to authorize the construction and operation of the LExC facility at LIGO Hanford. Based on the Final EA, which is hereby incorporated by reference, it has been determined that the implementation of the Proposed Action will have no significant impacts on the quality of the natural or human environment at LIGO Hanford. Because no significant environmental impacts will result from implementing the Proposed Action, an environmental impact statement is not required and will not be prepared.

Decision

After consideration of the Final EA, including all public comments received during the public comment period, the Finding of No Significant Impact, and the outcome of the Section 106 consultation process under the National Historic Preservation Act (which concluded that there are no historic properties affected), NSF hereby authorizes the construction and operation of a LExC facility at LIGO Hanford within its permitted area (the Proposed Action). NSF's authorization, however, is contingent upon approval of the LExC plans by DOE.

C. Denise Caldwell

Date: 10 September 2020

Denise C. Caldwell
Physics Division Director
National Science Foundation

Final

Environmental Assessment for the Proposed Laser Interferometer Gravitational-Wave Observatory (LIGO) STEM Exploration Center at Hanford near Richland, Washington

National Science Foundation

September 4, 2020

Table of Contents

Appendixes

Tables

Figures

SECTION 1

Introduction

The Laser Interferometer Gravitational-Wave Observatory (LIGO) is a national facility for gravitational-wave research in Livingston, Louisiana and Hanford, Washington. LIGO is funded by the National Science Foundation (NSF) and operated by the California Institute of Technology (Caltech) and the Massachusetts Institute of Technology (MIT). The interferometer in Hanford (LIGO Hanford) is located on land owned by the United States (U.S.) and administered by the U.S. Department of Energy (DOE). Per its 1993 Memorandum of Understanding (MOU) with DOE, NSF has a permit to use the site for LIGO. In 2019, Caltech received a grant from the State of Washington to construct a LIGO Science, Technology, Engineering, and Math (STEM) Exploration Center (LExC) near Richland, Washington, adjacent to the interferometer. LExC would complement and enhance the existing education and public outreach conducted at LIGO Hanford.

This environmental assessment (EA) evaluates the anticipated environmental impacts associated with the construction and operation of the proposed LExC facility at LIGO Hanford. NSF is the lead agency for the purpose of compliance with the National Environmental Policy Act of 1969 (NEPA) and has coordinated with DOE in the preparation of this EA. This section describes the purpose of and need for the Proposed Action, summarizes the scope of the EA, and explains the applicable regulatory requirements.

1.1 Background and Project Location

The LIGO Hanford facility is located in the state of Washington on the DOE's Hanford Site, approximately 13 miles northwest of the city of Richland in Benton County (Figure 1-1). The Observatory is adjacent to Hanford Site Route (HSR) 10, which connects to State Route (SR) 240 approximately 5 miles to the south.

LIGO's mission is to open the field of gravitational-wave astrophysics through the direct detection of gravitational waves. LIGO detectors use laser interferometry to measure the distortions in space-time occurring between stationary, hanging masses (mirrors) caused by passing gravitational waves. LIGO is a national facility for gravitational-wave research, providing opportunities for the broader scientific community to participate in detector development, observations, and data analysis. LIGO comprises four facilities across the U.S.: two gravitational wave detectors (the interferometers) and two university research centers. The interferometers are located in fairly isolated areas of Washington (LIGO Hanford) and Louisiana (LIGO Livingston) and are separated by 1,865 miles. The two primary research centers are located at Caltech in Pasadena, California and MIT in Cambridge, Massachusetts. The detector sites in Hanford and Livingston are home to the interferometers that make LIGO an "observatory."

Site construction at LIGO Hanford began in 1994 and the installation and commissioning of the initial interferometers occurred from 1999 to 2002. Approximately 40 people work at each site, including engineers, technicians, and scientists, who keep the instruments operating and monitor vacuum and computer systems. Administrative and business staff are also present, as well as education and public outreach professionals who conduct public tours, facilitate field trips for local students, and arrange periodic public events.

1.2 Purpose and Need

1.2.1 Need for Action

Southeastern and central Washington is a region with few hands-on science-education facilities. Since LIGO announced its first detection of gravitational waves in February 2016, the number of schools wanting to visit the site for field trips has more than doubled from an average of 3,900 annual visitors to nearly 8,600. It is not currently possible for the LIGO Hanford facility to accommodate all educational requests, and as of 2018, visitation was limited to around 4,800 visitors annually. A dedicated education center is needed to enable LIGO Hanford to accommodate the growing interest in LIGO's discoveries and provide visitors of all ages, including those who are underrepresented in STEM career fields, with science and engineering learning experiences.

1.2.2 Project Purpose

The purpose of the Proposed Action is to improve STEM educational capabilities at LIGO Hanford and support the demand for in-person educational opportunities at the Observatory by creating a facility capable of accommodating approximately 10,000 visitors per year.

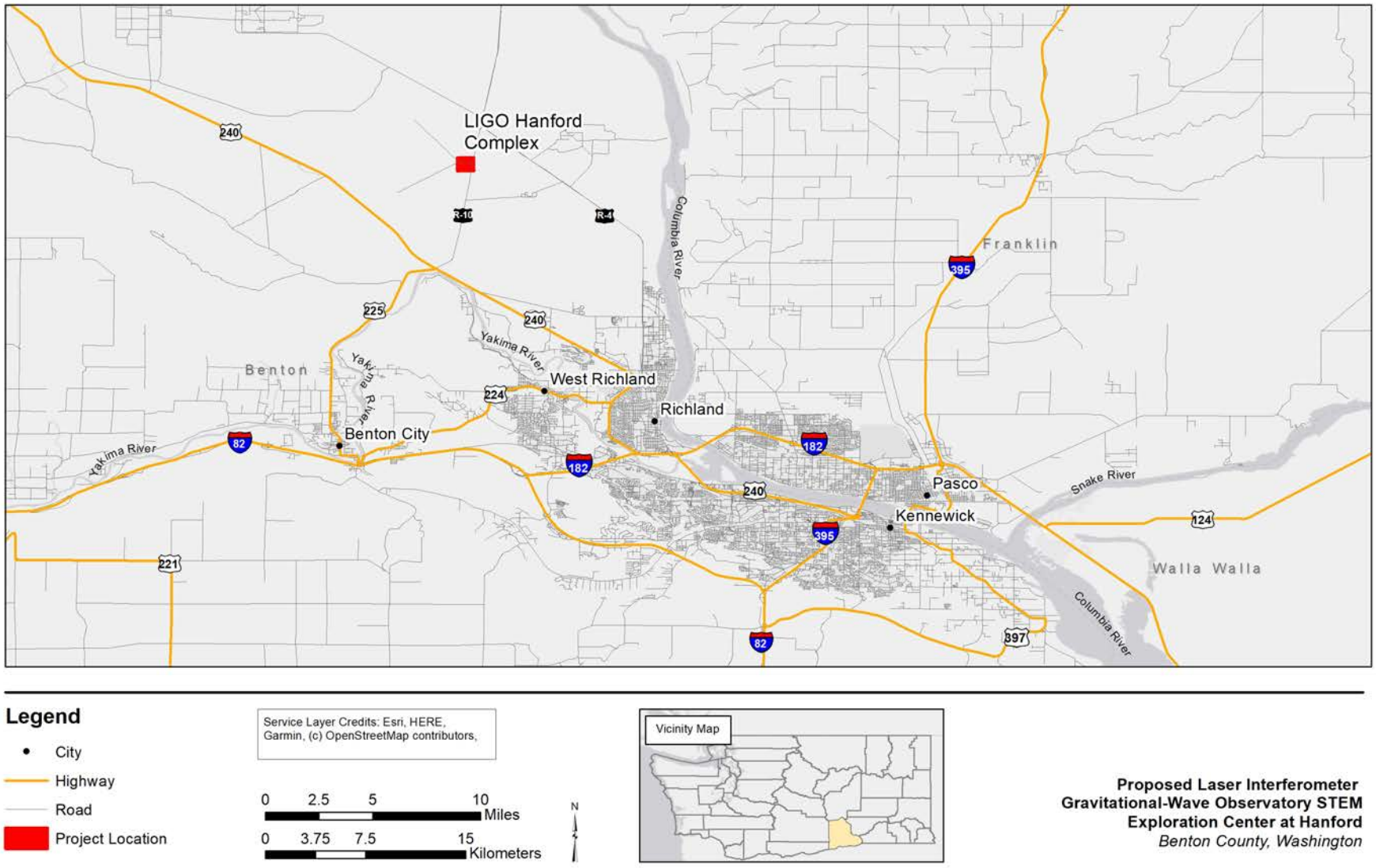
1.3 Regulatory Setting

In addition to NEPA, other federal, state, and local regulations must be considered in the planning process. The regulations most relevant to the analysis presented herein are summarized in this section. The agencies responsible for administering these regulations are noted, where applicable. NSF is carrying out its compliance with these regulations in parallel with the NEPA process.

1.3.1 National Environmental Policy Act

As a federal agency, NSF is subject to the requirements of NEPA and its implementing regulations (*Code of Federal Regulations* [CFR], Title 40, Parts 1500 through 1508), which require federal agencies to assess the environmental effects of their proposed actions before making decisions. NSF is also subject to its agency-specific regulations implementing NEPA at 45 CFR Part 640. The purpose of NEPA is to inform decision-makers and the public of the likely environmental effects of a proposed action and its alternatives; identify appropriate mitigation measures to avoid, minimize, rectify, reduce, eliminate, or compensate for impacts of the proposed action and reasonable alternatives; and allow for public comment. Approval of the proposed project by NSF constitutes a federal action under NEPA.

FIGURE 1-1
Project Location



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1.3.1.1 National Historic Preservation Act

The National Historic Preservation Act of 1966 (NHPA), as amended (54 *United States Code* [U.S.C.] Section [§] 300101, et seq.) recognizes the nation's historic heritage and establishes a national policy for the preservation of historic properties and the National Register of Historic Places (NRHP) (54 U.S.C. §302101). Section 106 of the NHPA (54 U.S.C. §306108) requires federal agencies to consider the effects of their projects on significant historic properties.

The implementing regulations for the NHPA are found in the Protection of Historic Properties (36 CFR Part 800), which defines historic properties as any prehistoric or historic district, site, building, structure, or object that is included in, or eligible for inclusion in, the NRHP (54 U.S.C. §302101). In the case of this proposed project, NSF's approval of construction within the boundaries of its permit for LIGO Hanford and its location on federal land establishes the need for Section 106 compliance. The purpose of the Section 106 consultation process is to evaluate the potential for effects on existing historic properties, if any, from the proposed project.

1.3.1.2 Endangered Species Act and the Migratory Bird Treaty Act

The Endangered Species Act of 1973 (ESA) (16 U.S.C. §1531 through 1544) and subsequent amendments provide for the protection and conservation of threatened and endangered species (listed species) of animals and plants and the ecosystems on which the listed species depend. The ESA prohibits federal agencies from funding, authorizing, or carrying out actions likely to jeopardize the existence of listed species through direct or incidental taking or through the destruction or adverse modification of critical habitat designated for these species under the ESA. Section 7 of the ESA requires consultation with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service, if applicable, when any listed species under its jurisdiction could be affected by a proposed action.

The Migratory Bird Treaty Act of 1918 (MBTA) establishes federal responsibilities to protect migratory birds. Under the MBTA, nearly all species of birds occurring in the United States are protected. The MBTA makes it illegal to take (hunt, pursue, wound, kill, possess, or transport by any means) listed bird species or their eggs, feathers, or nests unless otherwise authorized.

1.4 Agency Coordination and Public Involvement

Stakeholder engagement has been conducted to comprehensively address NSF policies, as well as to comply with specific regulatory requirements relating to public involvement and agency consultation. NSF has coordinated closely with DOE in the preparation of this EA. NSF has also engaged with stakeholders, including tribes and other agencies, as a part of the NEPA and NHPA Section 106 reviews. Native American tribes were engaged early in the process and invited to observe or participate in the pedestrian surveys. The Draft EA was made available for a 30-day public review and comment period on June 23, 2020. A detailed explanation of the public engagement process and a summary of the comments received on the Draft EA during the public comment period are provided in Section 4.0, *Notification,*

Public Involvement, and Consulted Parties, and copies of the comments received are included in Appendix C.

1.5 Document Organization

This EA is arranged as follows:

- Section 1, Introduction
- Section 2, Description of Proposed Action and Alternatives
- Section 3, Affected Environment and Environmental Consequences
- Section 4, Notification, Public Involvement, and Consulted Parties
- Section 5, References
- Section 6, List of Preparers
- Section 7, Acronyms and Abbreviations
- Section 8, List of EA Recipients

1.5.1 Resources Areas Analyzed

This analysis considers the following resource areas, as these resources would have the potential for environmental impacts under one or more of the considered alternatives.

- **Biological Resources**: Potential impacts to vegetation, wildlife, wetlands, threatened and endangered species, and migratory birds.
- **Historic Architectural, Archaeological, and Cultural Resources**: Potential effects of project alternatives on historic architectural, archaeological, and cultural resources.
- **Geology, Soils, and Seismicity**: Potential impacts to soil and sensitive geologic features, including seismicity.
- **Hazardous Materials and Solid Waste**: Potential impacts to existing hazardous material contamination and the generation of hazardous materials from construction and operation, including the potential for existing radiological contamination.
- **Human Health and Safety**: Potential impacts to public health, occupational health, and the protection of children.
- **Transportation**: Potential impacts of construction and operations on traffic.
- **Water Resources**: Potential impacts to surface and groundwater.
- **Utilities**: Potential impacts from construction and operation of new utilities and infrastructure.

1.5.2 Resource Areas Eliminated from Further Analysis

The following resource areas are not considered in detail, because there is no potential for noticeable or measurable impacts to these resources:

- **Air Quality**: The Proposed Action would involve short-term emissions associated with construction; however, the Proposed Action is in an area that is in full attainment for all National Ambient Air Quality Standards (NAAQS) criteria pollutants (EPA, 2020a). Therefore, the Clean Air Act (CAA) conformity analysis is not required and there is limited likelihood for the Proposed Action to cause a violation in CAA NAAQS. Any air quality impacts would be negligible on a regional basis. Impacts from construction on air quality, while considered negligible, would be minimized further through implementation of best management practices (BMPs) such as the use of unleaded gasoline, ultra-low sulfur diesel fuel (15-parts per million [ppm] maximum), and through proper maintenance of equipment with air emission control devices. Fugitive dust would be minimized through the use of dust control measures and revegetation following construction.
- **Climate Change**: Potential greenhouse gas (GHG) emissions under the Proposed Action are expected to be similar to current conditions. Based on the location of the facility, impacts from climate change would not affect future activities at LIGO Hanford or the surrounding area.
- **Environmental Justice**: Executive Order (E.O.) 12898, Federal Actions to Address Environmental Justice in Minority and Low-income Populations, requires federal agencies to consider disproportionate risk to minority and low-income communities. Within a 10-mile buffer area surrounding the proposed site, the percentage of minority and low-income populations is lower than the state average (EPA, 2020b). LIGO Hanford is located on DOE's Hanford Site, where residential uses are not permitted; therefore, it is unlikely that the Proposed Action would cause a disproportionate and adverse impact to these populations. Additionally, the increased opportunity for in-person educational opportunities could result in a benefit to the surrounding communities, where low-income and minority populations could be present.
- **Land Use**: The land use will not change with the implementation of the Proposed Action and is consistent with the land use map, designations, policies, and procedures that the Hanford Comprehensive Land Use Plan (DOE, 1999) established at the project site.
- **Noise**: The Proposed Action would not alter the current noise environment. Short-term impacts to noise could occur during construction; however, construction would be carried out in accordance with BMPs. Construction activities will be timed to avoid observation periods at LIGO Hanford.

- **Socioeconomics**: The Proposed Action would have a beneficial effect during the construction of the facility and any additional personnel hired as part of the Proposed Action would be minimal compared to the population of the region.
- **Visual Resources**: There are no sensitive viewsheds in the vicinity of the Proposed Action. The changes in the visual environment at LIGO would be minimal because the project would be constructed adjacent to the existing LIGO facility and in a manner that is consistent with existing development at the site. BMPs would be used to minimize the potential for dust during construction activities, which could indirectly impact views, and revegetation at the site would minimize the potential for dust after the construction period.

SECTION 2

Description of Proposed Action and Alternatives

This section presents information on the Proposed Action and the alternatives that were considered. The Proposed Action is described in Section 2.1. The No Action Alternative is presented in Section 2.2. Additional action alternatives were not considered because NSF's role as the permit holder for the land at LIGO is to approve or disapprove the construction and operation of the LExC; NSF's role does not include proposing changes to the LExC.

2.1 Proposed Action

The Proposed Action is for NSF to authorize the construction and operation of a LExC facility at LIGO Hanford near Richland, Washington, within its permitted area (subject to DOE's final approval). The proposed LExC would be constructed east of the existing parking lot, along the current access road to LIGO Hanford, as shown on Figure 2-1. The LExC facility would include the construction of a new approximately 13,000-square-foot building (Figure 2-2) and associated infrastructure, including water and sewer utilities, electrical service, and telecommunications connection. All utilities would be extended from existing services at LIGO Hanford. LExC construction activities would require excavation to support utility installation and grading, as needed, for the construction of a parking lot. Construction activities for the LExC would be contained within the disturbed area, as indicated on Figure 2-2.

The following components are expected to be included in the LExC:

- Visitor center including exhibit hall (approximately 5,000 square feet) with capacity for 50 hands-on exhibits
- Static hardware exhibits that showcase the engineering of LIGO
- Static exhibits highlighting the diversity of the people, careers, and educational backgrounds of LIGO staff
- Classroom and makerspace (a collaborative work space for making, learning, exploring, and sharing that uses high tech to no tech tools) that will host teacher workshops and student activities

Visitors to LIGO Hanford would follow a tour route similar to the one used currently. In addition to use of the new LExC visitor center, tours would walk the site roadways between the buildings, spending time at exhibits, the control room, and viewpoints (e.g., the x-arm overpass). Land immediately surrounding the laboratory roads and buildings at LIGO Hanford would continue to be restricted to access by visitors and most staff.

The LExC facility would be sited to the east of the existing Lab Support Building, as shown on Figure 2-2. Positioning the LExC close to the Lab Support Building would allow for the outreach programs to

use the existing auditorium while maintaining distance from the interferometer to minimize the impact on it and data collected at the Observatory. The LExC facility would be located on the same side of the road as the auditorium to reduce visitor and vehicle conflicts while visitors are onsite.

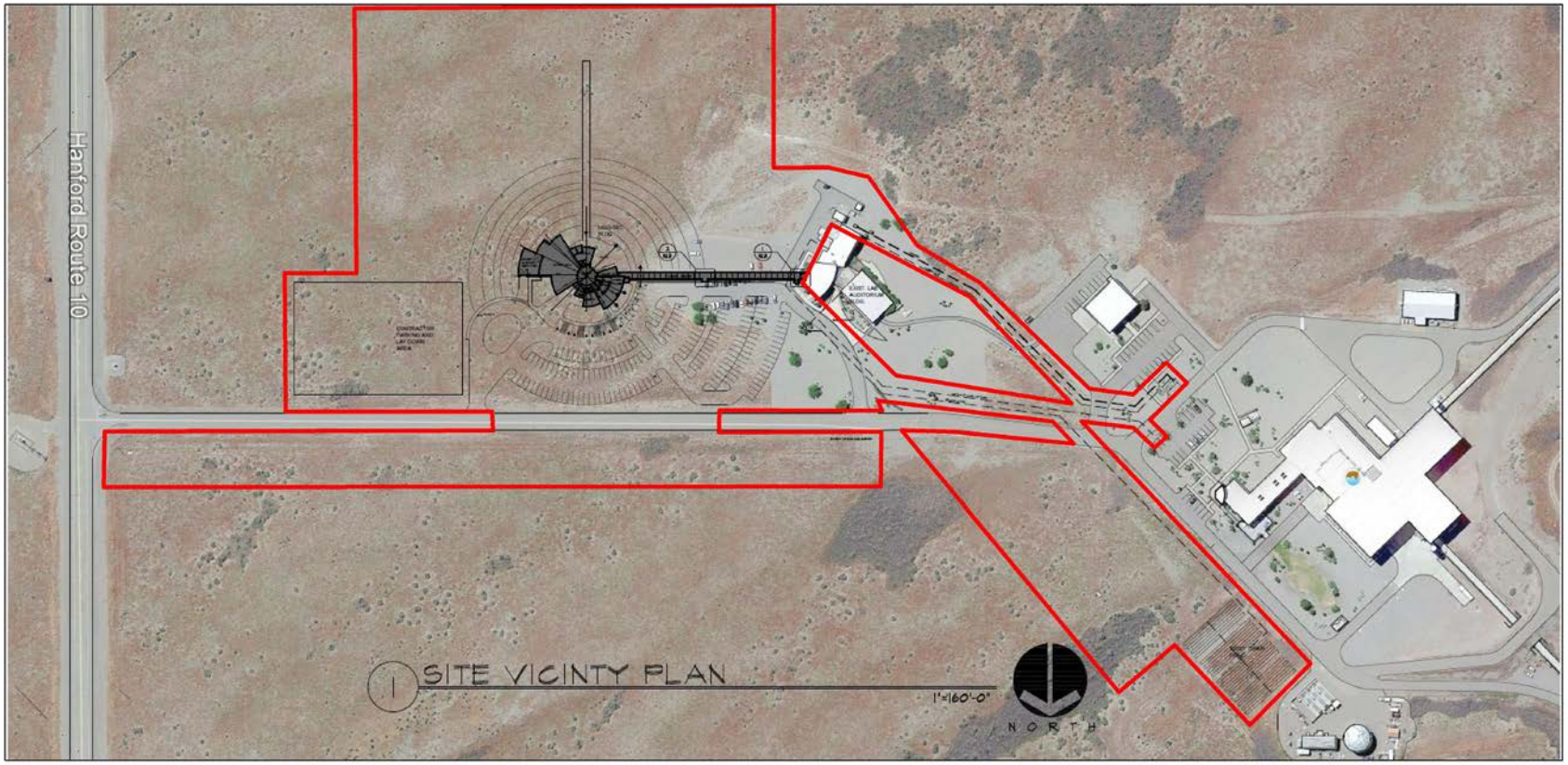
The Proposed Action would add two additional Education and Public Outreach staff members at LIGO Hanford and is anticipated to support approximately 10,000 visitors annually. The conceptual design of the LExC is illustrated on Figure 2-3. Should NSF provide authorization to Caltech to construct and operate the LExC, Caltech anticipates starting construction in October 2020.

2.2 No Action Alternative

A No Action Alternative is evaluated in this EA to serve as a benchmark for evaluating the potential effects of the Proposed Action. The No Action Alternative would not satisfy the need for action.

Under the No Action Alternative, NSF would not authorize the construction of a LExC facility at LIGO Hanford. The capacity of the educational and visitor sites to accommodate the increasing number of visitors would continue to be exceeded, resulting in fewer opportunities for LIGO Hanford to educate local schools and the general public about its work and support STEM education in the region.

FIGURE 2-1
Conceptual Layout of the Proposed Action within the Project Study Area



Legend

Study Area

Terence L Thornhill Architect, Site Plan, Ligo-Sec Exploration Center, Richland WA

N

0 125 250 500 Feet

0 50 100 200 Meters

Proposed Laser Interferometer Gravitational-Wave Observatory STEM Exploration Center at Hanford
Benton County, Washington

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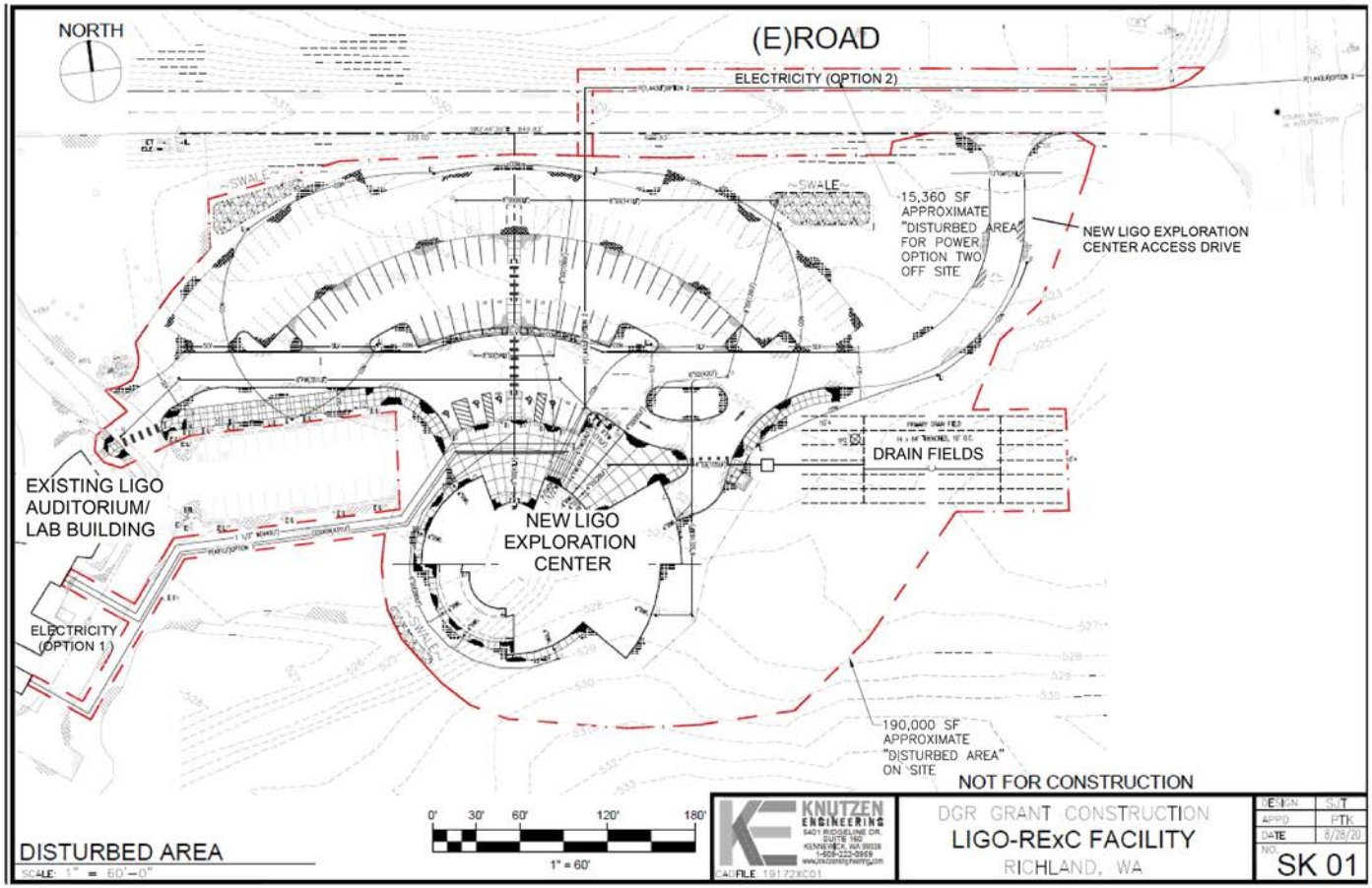
FIGURE 2-2

Conceptual Project Design and Area of Disturbance for the Proposed Action[1]



Terence L Thornhill Architect, Site Plan, Ligo-Sec Exploration Center, Richland WA

Proposed Laser Interferometer Gravitational-Wave Observatory STEM Exploration Center at Hanford
Benton County, Washington

1 This figure shows the footprint within the greater project area (refer to Figure 2-1) where ground disturbance is anticipated during construction of the proposed LExC. Construction support trailers and laydown areas would occur within the future parking areas.

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FIGURE 2-3
Architect's Conceptual Design of the Proposed Action

Note that the design continues to be refined, and that the latest changes (not pictured) include: removal of the cement walkway extending into the desert and shifting of the building 120 feet closer to the existing structure.

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SECTION 3

Affected Environment and Environmental Consequences

Pursuant to NEPA and its implementing regulations (40 CFR Parts 1500 through 1508), federal agencies are required to undertake an assessment of the environmental effects of their proposed actions before making decisions. The purpose of NEPA is to inform decision-makers and the public of the likely environmental consequences of the proposed action and its alternatives.

Consistent with these regulations, this section provides an overview of the existing environmental conditions at the proposed project site and identifies the anticipated effects of the Proposed Action on each resource. The analysis of resource impacts focuses on environmental issues in proportion to the degree of impact within the region of influence (ROI) or the area in which project-related impacts could occur for each resource. For most resources, the ROI is generally limited to the project area, as shown on Figure 2-1. However, for some resources, the potential impacts of the proposed project must be considered within the context of the surrounding vicinity. For example, the evaluation of biological resources and geology, soils, seismicity, transportation, traffic, and water resources also include the surrounding areas. The anticipated area where ground disturbance is expected is shown on Figure 2-2.

Analysis of impacts in terms of their duration, intensity, and scale is provided where possible. Mitigation measures or BMPs that would be implemented to avoid or minimize potential impacts are identified, where relevant. The LIGO operator (currently Caltech) would be responsible for the implementation of identified mitigations unless otherwise noted. The environmental effects of the No Action Alternative were also evaluated, based on a comparison to the baseline conditions presented in this section.

3.1 Biological Resources

Biological resources include plants and animals and the habitats in which they occur. A natural resources habitat survey was conducted to determine the presence or absence of sensitive species at the LIGO Hanford Site. The survey was conducted in accordance with the Hanford Site Biological Resources Management Plan (BRMP) (DOE, 2017), which covers the entire Hanford Site managed by DOE and on which NSF holds a permit for LIGO. The complete survey report is provided in Appendix A. The ROI for biological resources is the project area shown on Figure 2-1; however, a broader area was considered where needed to assess the stability of a species' population over the greater region.

3.1.1 Affected Environment

3.1.1.1 Plants

The project area lies within the central portion of the Hanford Site, with vegetation consisting primarily of shrub-steppe (shrubs and steppe grasses) plant communities. Approximately 9 percent of the project area

(2.3 acres) is disturbed/non-vegetated, specifically the drain field area, the extensive stands of invasive species Russian thistle (*Salsola tragus*), the area adjacent to the entrance road to LIGO Hanford, and the areas subjected to extensive off-road vehicle traffic with noticeably reduced vegetation cover. Disturbed areas identified in the project area are adjacent to developed areas, which cover approximately 4.1 acres (16 percent) of the project area. In the absence of disturbance and non-native species, the entire project area would likely consist of Big Sagebrush-Sandberg bluegrass habitat.

Eighteen plant species were recorded during the biological survey (Appendix A). Native species identified in the project area include western yarrow (*Achillea millefolium*), Indian ricegrass (*Achnatherum hymenoides*), tapertip onion (*Allium acuminatum*), big sagebrush (*Artemisia tridentata*), Carey's balsamroot (*Balsamorhiza careyana*), crossflower (*Chorispora tenella*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), rubber rabbitbrush (*Ericameria nauseosa*), smoothstem blazingstar (*Mentzelia laevicaulis*), slender phlox (*Microsteris gracilis* var. *humilior*), Sandberg bluegrass (*Poa secunda*), and Bitterbrush (*Purshia tridentata*). Non-native species include crested wheatgrass (*Agropyron cristatum/desortorium*), cheatgrass (*Bromus tectorum*), spring draba (*Draba verna*), jagged chickweed (*Holosteum umbellatum*), Russian thistle (*Salsola tragus*), and tall tumblemustard (*Sisymbrium altissimum*).

Appendix A contains additional information on the vegetation documented to occur within the proposed project area. The field survey was conducted too early in the season to observe pre-emergent vegetation; therefore, additional plant species could potentially occur within the project area.

3.1.1.2 Wildlife

Typical wildlife likely to be found on the shrub-steppe habitat in the project site include coyote (*Canis latrans*), mule deer (*Odocoileus hemionus*), Rocky Mountain elk (*Cervus elaphus nelsoni*), American badger (*Taxidea taxus*), deer mouse (*Peromyscus maniculatis*), Great Basin pocket mouse (*P. parvus*), white-tailed jackrabbits (*Lepus californicus* and *L. townsendii*), and unidentified burrowing rodents (DOE, 2017). During the field survey, coyotes (*Canis latrans*) and a burrow possibly belonging to an American badger (*Taxidea taxus*) were observed.

Over 200 bird species have been documented at the Hanford Site (DOE, 2017). Western meadowlark (*Sturnella neglecta*) and common raven (*Corvus corax*) were observed during the biological survey of the Proposed Action area. Western meadowlark is protected under the MBTA.

Well over 1,000 species of insects and invertebrates have been documented at the Hanford Site (DOE, 2017). Wolf spiders (family Gnaphosidae) and darkling beetles (family Tenebrionidae) were observed during the biological survey of the Proposed Action area.

3.1.1.3 Special Status Species

No federal threatened or endangered and no state endangered animal species were identified in the project area during the field surveys. The state candidate species and federal species of concern sagebrush lizard (*Sceloporus graciosus*) has been documented in the northern portion of the LIGO Hanford Site, but not near the project area, and this species would not be expected to occur in the project area. While the habitat is suitable for black-tailed jackrabbit (*Lepus californicus*), this species has not been observed within 2 miles of the project area.

No federally or state endangered, threatened, sensitive, or candidate avian species were observed during the field survey. The state-threatened ferruginous hawk (*Buteo regalis*) and three state candidate species (loggerhead shrike [*Lanius ludovicianus*], sagebrush sparrow [*Artemisiospiza nevadensis*], and sage thrasher [*Oreoscoptes montanus*]) have been observed within 1 mile of the project area during breeding bird surveys. Raptors likely would not nest in the project area, but foraging is likely. Other avian species may forage or nest in the project area. There was no evidence of burrowing owl (*Athene cunicularia*) use at any of the small mammal burrows observed during the field survey and the species has not been observed in the project vicinity during historical surveys of breeding birds. This species is not expected to occur in the project area.

The field survey was too early in the season to observe plants in vegetative growth and several state sensitive and threatened plant species have the potential to occur within the project area. These species are described in Table 3-1. See Appendix A for additional information regarding the special status plant species within the proposed project area.

TABLE 3-1
Special Status Plant Species with Potential to Occur in the Project Area

Species	Type	Status	Presence in Project Area
Coyote tobacco (*Nicotiana attenuate*)	Plant	State sensitive species	While unlikely due to the lack of regular fire through the area, occurrence of this species cannot be ruled out.
Desert dodder (*Cuscuta denticulata*)	Plant	State threatened species	Not expected to occur in the project area.
Greyer's milkvetch (Astragalus geyeri var. geyeri)	Plant	State threatened species	Not expected to occur in the project area.
Hairy bugseed (*Corispermum villosum*)	Plant	State sensitive species	Overwintering stalks were not observed but recent disturbance could have eliminated remnant stalks. While unlikely, occurrence of this species cannot be ruled out.
Rosy pussypaws (*Cistanthe rosea*)	Plant	State threatened species	Species was not observed during the field survey. While unlikely, occurrence of this species in the project area cannot be ruled out.
Snake River cryptantha (*Cryptantha spiculifera*)	Plant	State sensitive species	Not expected to occur in the project area.
Snowball cactus (*Pediocactus nigrispinus*)	Plant	State sensitive species	This species does not occur in the project area.

Source: WADNR, 2020

3.1.1.4 Non-native and Invasive Species

The State of Washington has identified certain plants as noxious weeds, several of which are of high priority for control on the Hanford Site, including yellow starthistle (*Centaurea solstitialis*), rush skeletonweed (*Chondrilla juncea*), medusahead (*Taeniatherum caput-medusae*), baby's breath (*Gypsophila paniculata*), Dalmatian toadflax (*Linaria dalmatica*), spotted knapweed (*Centaurea stoebe*), diffuse knapweed (*Centaurea diffusa*), Russian knapweed (*Acroptilon repens*), saltcedars (*Tamarix* spp.), and purple loosestrife (*Lythrum salicaria*) (DOE, 2017). None of these high priority noxious weeds were identified during the field survey.

However, during the field survey, numerous other non-native, invasive plant and animal species were documented in the project area. The project area is moderately disturbed, which has allowed invasive plant species to colonize. Certain areas contain Russian thistle (*Salsola tragus*) to the exclusion of all other vegetation except for the occasional big sagebrush. These areas were clearly evident on aerial photography and were mostly outside the project area. To address the accumulation of wind-transported tumbleweeds, the LIGO operator employs tumbleweed abatement activities (such as baling and chipping), as well as landscaping services for removal of tumbleweeds around the LIGO corner station; the Hanford Fire Department visited LIGO in 2020 to conduct controlled burn tests of tumbleweeds, primarily along the laser interferometer X-arm (the northern arm).

3.1.2 Environmental Consequences

This section identifies the potential direct and indirect impacts to biological resources that could result from implementation of the Proposed Action or No Action Alternative. Impacts to biological resources were assessed based on an evaluation of the potential for each alternative to:

(1) Cause the loss of habitat, diminished health, or reduction in diversity of native species
(2) Adversely affect any protected species or habitat (particularly species listed or proposed for listing under the ESA
(3) Introduce or contribute to the spread of invasive or noxious weed species

The impact thresholds related to biological resources are presented in Table 3-2.

TABLE 3-2
Impact Thresholds for Biological Resources

Impact	Description
Negligible	The proposed alternative would either not affect biological resources, or the impacts to biological resources would be below or at the lower levels of detection.
Minor	The proposed alternative would result in a detectable change to biological resources or habitat; however, the change would be small, localized, and of little consequence. Any disruption to wildlife would be short-term and species would be expected to return to normal activities after disturbance. No measurable reduction in species population stability would occur. Threatened or endangered species (or those proposed for listing) or migratory birds may occur in the project area but the species would not be adversely affected. There may be some increase in the presence of invasive or noxious weed species over a small area, but the increase would be easily controllable.

Impact	Description
Moderate	The proposed alternative would result in a readily apparent change to biological resources or habitat over a relatively wide area; however, the change would not constitute substantial degradation in the character of the biological resource or habitat. A permanent loss of vegetative cover or other habitat may occur; however, no measurable reduction in species population stability would occur. Any effects to threatened and endangered species (or those proposed for listing) or migratory birds would be temporary and would not result in mortality or impacts to population size. There would be a noticeable increase in the presence of invasive or noxious weed species and would require long-term or extensive control efforts.
Major	The proposed alternative would result in a substantial change to the character of the biological resource or habitat. A permanent loss in vegetative cover or other habitat would occur, resulting in a measurable reduction in species population stability. Effects to threatened and endangered species or migratory birds would result in mortality or impacts to population size. There would be a large and uncontrollable increase in the presence of invasive or noxious weed species.
Quality:	Beneficial – would have a positive effect Negative – would have an adverse effect
Duration:	Short-term – occurs only during the construction period Long-term – continues after the construction period

In the BRMP, biological resources are assigned resource priority levels that range from Level 0 through 5 (lowest to highest quality of resource) for mitigation purposes. Descriptions of the levels and mitigation requirements are as follows (DOE, 2017):

- Level 0 resources consist of non-native plants and animals (unless otherwise listed at a higher level), non-vegetated areas, and industrial areas. Management goals and actions are limited to those needed for regulatory compliance, such as the MBTA. There are no compensation requirements for impacts to Level 0 resources.
- Level 1 resources include individual common native plant and wildlife species, upland stands of non-native plants, and abandoned agricultural fields. Impacts should be avoided or minimized if possible, but there are no compensation requirements for impacts to Level 1 resources.
- Level 2 resources include migratory birds; state watch list plants and monitor list animals; recreationally and commercially important species; and lower quality steppe and shrub-steppe. The management goal is conservation, with a low level of status monitoring. Impacts should be avoided if possible, and compensation may be at a ratio of 1:1. However, Level 2 habitat areas may often be good areas to perform actions to mitigate for impacts to higher-level habitat resources.
- Level 3 resources include Washington State sensitive, candidate, and review species; Washington Department of Fish and Wildlife priority species; and lower-quality mature shrub-steppe, such as

shrub stands that are less mature, have lower shrub density or canopy cover, and/or a greater proportion of cheatgrass in the understory than stands that qualify for Level 4. Level 3 also includes high-quality grasslands, conservation corridors, snake hibernacula, bat roosts, rookeries, burrowing owl buffer areas, and areas with significant quantities of culturally important species. The management goal for Level 3 is conservation, with a moderate level of status monitoring. Impacts should be avoided or minimized if practical and, if needed, compensatory mitigation would be made at a ratio of 3:1.

- Level 4 resources include federal candidate species; Washington State threatened or endangered species; habitat or exclusion buffers for federal candidates and Washington State threatened or endangered species; high-quality mature shrub-steppe; wetlands, swales, and riparian areas; and buffer areas for bald eagles and ferruginous hawks. The management goal for Level 4 is preservation, with a high level of status monitoring. Avoidance and minimization of impacts is expected, but if required, habitat compensation would be made at an area ratio of 5:1.
- Level 5 resources include species that are listed or proposed to be listed under the ESA and their critical habitat, as well as rare and irreplaceable habitats. The management goal for this level is preservation, and a high level of status monitoring is appropriate. Impacts to Level 5 resources should be avoided, and compensatory mitigation would be determined on a case-by-case basis.

Projects are expected to avoid or minimize adverse impacts to Level 2 through 5 resources. For Level 2, 3, and 4 resources, onsite revegetation is required for impact areas greater than 1.25 acres. Levels 2 through 5 require mitigation at varying ratios for permanent impacts. Level 5 resources are considered irreplaceable and mitigation is determined on a case-by-case basis. Although the BRMP does not provide management on LIGO-permitted areas, the proposed mitigation measures and BMPs are consistent with DOE requirements for the Hanford Site.

3.1.2.1 Proposed Action

Construction Phase

The construction of the Proposed Action would directly affect up to 4.7 acres of vegetation within the project area of disturbance (Figure 2-2). The design of the Proposed Action is in process, so opportunities to minimize the project footprint and associated impacts to vegetation will continue to be refined through the final design of the LExC.

There are no federally protected plant species known to occur within the project area; however, there is the potential for state-protected plant species to occur. Post-construction native species revegetation would be conducted in areas surrounding the built environment. Approximately 0.8 acre of BRMP Level 0 or Level 1 resources would be disturbed during construction and would not require revegetation mitigation. Approximately 1.3 acres of Level 2 resources would be disturbed during construction and

would require revegetation of native plant species at a 1:1 ratio as a mitigation measure. Additionally, in accordance with the BRMP, mitigation areas would be monitored for a minimum of 5 years after planting to ensure the vegetation is developing. Approximately 2.6 acres of Level 3 resources would be impacted by construction of the Proposed Action; however, impacts would be avoided to the extent possible by adjusting the design of the LExC in areas where these resources are present. Where avoidance is not possible, Level 3 resources would be mitigated with revegetation at 3:1 ratio. The LIGO operator, Caltech, would develop and implement a revegetation management plan. The plan would be developed in coordination with DOE and would outline specific mitigation measures, revegetation locations and acreage, and BMPs to avoid and minimize the impacts of the Proposed Action on vegetation at LIGO. By following the revegetation management plan, once approved by DOE, and implementing the agreed upon minimization and mitigation measures, impacts to vegetation during construction would be **minor, negative, and short-term**.

Ground disturbance during construction could alter native plant communities by increasing the potential for the introduction and spread of invasive or noxious weed species at LIGO. Invasive or noxious weed species could be introduced to the project site via vehicles, construction equipment, materials, or personnel. Invasive species currently at LIGO could also take advantage of construction-related habitat disturbance and spread across a larger area. Caltech would ensure that BMPs are implemented to prevent and control the spread of invasive and noxious weed species. BMPs will be agreed upon by DOE prior to implementation; these BMPs would include cleaning vehicles and equipment prior to entering the project site; using certified weed-free mulch on revegetation sites; manually, chemically, or mechanically controlling noxious weeds prior to construction, if needed; and reseeding disturbed areas with native species after construction activities are complete. With the implementation of BMPs, the spread of invasive and noxious weed species as a result of the Proposed Action would be **minor, negative, and short-term**.

Construction activities under the Proposed Action would generate noise and present a physical risk to local wildlife, particularly to less mobile species. However, noise generated during construction would be intermittent, and many potentially affected species would likely relocate elsewhere on the Hanford Site. A **minor, negative, short-term** impact to wildlife would result due to land disturbance activities.

Undeveloped habitat within and near the project area could provide suitable nesting and foraging habitat for bird species. The construction phase of the Proposed Action would potentially affect migratory birds that use the project site for nesting, migration stop-over, or wintering purposes. However, there is a low probability of such an occurrence due to other, more desirable, nesting, stopover, and foraging opportunities elsewhere in the vicinity. The planned fall onset of construction would further minimize the potential for such an occurrence. Pre-construction surveys and nesting bird BMPs would be implemented

if construction commences during the mid-March to mid-July nesting period. The construction of the Proposed Action would result in **minor, negative, short-term** impacts to wildlife.

Operation Phase

During the operational phase of the Proposed Action, noxious weed management would be implemented in a manner consistent with DOE's sitewide Integrated Biological Control Plan (MSA, 2014). Additionally, the revegetation management plan that would be developed will identify ongoing management actions to control the spread of noxious and invasive weed species after construction. The impacts to vegetation associated with the operation and maintenance phase of the Proposed Action are expected to be **negligible**.

Average annual visitation levels would increase from 4,800 (based on 2018 visits) to approximately 10,000; however, wildlife species in this area are currently adapted to a human presence and the impacts to wildlife during operation would be **negligible**.

3.1.2.2 No Action Alternative

Under the No Action Alternative, the construction of the LExC and its associated infrastructure would not occur. There would be no change to the nature and frequency of visitation in the project area. Natural resources management and monitoring efforts would also continue. There would be no impacts to biological resources under the No Action Alternative.

3.2 Historic Architectural, Archaeological, and Cultural Resources

Resources discussed under this section include prehistoric and historic archaeological sites; historic architectural properties, including buildings, structures, and objects; historic districts; designed landscapes; and cultural resources. These resources are protected under the NHPA through the Section 106 process.

The NHPA Section 106 review process encompasses a good faith effort to ascertain the existence and location of historic architectural, archaeological, and cultural resources (collectively referred to in the NHPA as "historic properties" if they are listed, or eligible for listing, on the NRHP) near and within the proposed project site; establishing an area of potential effects (APE) for the proposed project; identifying whether the proposed project could adversely affect historic properties; and, if so, developing ways to avoid, minimize, or mitigate those adverse effects. The resolution of any adverse effects is typically memorialized in a memorandum of agreement (MOA) created through consultation with the State Historic Preservation Officer (SHPO), Advisory Council on Historic Preservation (ACHP) (if it chooses to participate), and any consulting government agencies and Native American tribes. Additional detail regarding the NHPA Section 106 consultation process is provided in Section 4.2. NSF used the Section 106 process to identify historic architectural, archaeological, and cultural resources and to analyze any

effects to those resources under the Proposed Action. The outcomes of the Section 106 process has informed NSF's analysis of impacts on these resources under its NEPA process for this Proposed Action.

3.2.1 Affected Environment

The APE is defined as the geographic area within which a project could directly or indirectly affect historic properties. For the Proposed Action, the APE is defined to include the LExC facility footprint, areas for construction laydown, parking areas, and utility corridors. The APE mirrors the project area shown on Figure 2-1 and is approximately 25.5 acres in size. The Washington Department of Archaeology and Historic Preservation (DAHP) SHPO concurred with the preliminary APE in a letter dated February 10, 2020 (refer to Appendix B, NHPA Section 106 Correspondence). Native American tribes were also provided a copy of the preliminary APE and comments received from the Nez Perce led to the revision of the preliminary APE to better capture the project footprint, including utility corridors. The APE was updated again on the day of the field surveys to include additional minor areas for utility corridors. Tribes were offered the opportunity to participate in project survey activities, although no tribal representatives participated. The SHPO concurred with the revised APE on June 1, 2020 (Appendix B).

3.2.1.1 Background

The Hanford Site has been inhabited by humans for more than 10,000 years. The arid climate provides favorable environmental conditions for the preservation of materials that may otherwise decay more quickly. While there has been continual development in the region, largely undisturbed places remain, especially at Hanford where public access and commercial development have been largely curtailed. Within these undisturbed portions of the landscape, there is potential for evidence of past human behavior to be present in the archaeological record.

The history of the Mid-Columbia Basin includes three distinct periods of human occupation: the Pre-Contact period, the Euro-American period, and the Manhattan Project/Cold War period. The Pre-Contact period dates from approximately 11,000 years before present (BP) until approximately 250 BP. The archaeological record shows a change in subsistence and habitation strategies over this time period. The earliest archaeological sites in the region date to the Windust Phase (approximately 11,000 BP to 8,000 BP). These sites are found typically near rock shelters or caves or at open habitation sites with no evidence of constructed dwellings or storage features. Faunal assemblages found at sites dating to this timeframe show a reliance on large mammals, supplemented by smaller mammals and fish. The toolsets were often versatile or expediently crafted, indicating high mobility and a lack of sedentism during this period.

The Cascade/Vantage Phase (8,000 to 4,500 BP) saw a continuation of the habitation strategies, but lithic tool and faunal assemblages became more diverse. The Frenchman Springs Period (4,500 to 2,500 BP) shows a transition to a more sedentary lifestyle with the construction of semi-permanent dwellings, including semi-subterranean structures. Groundstone implements appear in the artifact assemblage for the

first time during this period and archaeological evidence suggests an increased reliance on upland resources, seeds, and roots. Travel for resource procurement became more evident during this period. Archaeological evidence suggests that native peoples participated in a "seasonal round" subsistence strategy, where semi-sedentary groups would "map on" to food resources to harvest at peak times and break into organized task groups to maximize resource acquisition. The tool assemblage continues to diversify during this period and a wider variety of toolstone material is used. The Cayuse Phase (2,500 to 250 BP) contains three subphases. Cayuse Phase I (2,500 to 1,200 BP) and Cayuse Phase II (1,200 to 900 BP) habitation sites begin to appear along major rivers, confluences, and tributaries. The structures consist of pithouses with (Cayuse Phase I) and without (Cayuse Phase II) wall benches. A wide variety of food resources are evident at these sites and suggest a continued reliance on a "seasonal round" subsistence strategy. During Cayuse Phase III (900 to 250 BP), the horse was introduced, increasing mobility and range of hunting. Large villages begin to appear in the archaeological record and an increase in trade goods also appears during this time.

Many of the settlement and subsistence patterns that appear in the archaeological record of the Southern Plateau continued after contact into the Ethnographic Period, with larger villages occupied during the winter months and smaller groups foraging over large areas throughout most of the year.

Although the groups moved and changed between seasons, most of the camps were seen as permanent because they came back to these locations each year. The winter villages consisted of 5 to 15 multi-family lodges that accommodated related adults and their spouses, as well as their children. A few smaller, funnel-shaped lodges were used by a single-family unit. There also would have been a few sweat lodges (Schuster 1998). Before the arrival of horses, people wintered in dwellings that were circular semi-subterranean house pits that varied between 12 to 30 feet in diameter. The later rectangular lodges (40 to 60 feet long) were built using an A-frame construction of poles covered in multiple layers of stitched tule mats (Schuster 1998).

With the arrival of Euro-Americans, conflict ensued. When the treaties of 1855 were signed, many of the native peoples were moved to reservations, while some, like the Wanapum, remained in the area of the Columbia River. Descendants of the groups that used these areas are now represented by the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Nez Perce Tribe, and the Colville Tribe.

The Euro-American period began when the earliest non-native peoples, explorers, and fur traders entered the region. In 1805, American explorers Lewis and Clark stopped at the confluence of the Snake and Columbia Rivers on their way to the Pacific Ocean. Six years later, the Columbia River became the major thoroughfare used by fur traders to move people, supplies, correspondence, and furs between upriver inland posts and Fort Astoria/Fort George, and later Fort Vancouver near the mouth of the Columbia River (Mackie 1997; Parker 1986; Ross 1849).

Starting in the mid-1850s, gold miners traveled through the region on their way north to gold fields on the Kootenai River near Fort Colville. This influx of miners created a demand for beef, and cattle ranching expanded into the region after the local bunch grass was found to provide excellent fodder for cattle. Additionally, this area was an ideal spot to winter cattle with its mild winter and early spring (Mendenhall 2006). However, overgrazing and several severe winters decimated cattle populations in the 1880s. Some cattlemen went out of business, while the more fortunate ones left the region or became local ranchers, growing rye and alfalfa to feed their stock. In place of cattle, sheep, which were better able to survive on the overgrazed bunchgrass, were brought into the area by English, Scottish, and later Basque drovers (Parker 1986).

These ranchers were soon joined by homesteaders, who came to the area after land in the Yakima and Kittitas Valleys began to fill up. Early homesteaders were concentrated along the edge of the Columbia River, dependent on the river to provide the necessary water to grow crops. Homesteaders built water wheels to catch water from the river and cisterns to store water. Early farmsteads were often limited in size and practiced subsistence farming. To make money, many of these early homesteaders worked other jobs. Commercial farming did not develop in the area until the 1890s, when river transportation necessary to ship produce became more reliable. Even then, few farmers possessed irrigation systems big enough to support such farming (Mendenhall 2006; Parker 1986).

In the 1890s and 1900s, land speculators bought cheap, unirrigated land, started towns (including Hanford), and developed large-scale irrigation systems that would supply water to thousands of acres in the White Bluffs, Hanford, Fruitvale, Vernita, and Richland areas (Mendenhall 2006; Parker 1986; Sharpe 1999; Stapp et al. 2005).

The farmers who came to the region to start irrigated farms faced a number of challenges, including engineering difficulties when it came to the canals and irrigation systems; the high cost of power needed to irrigate the land; the lack of railroad for shipping produce; and climate extremes, which could damage crops. Additionally, an economic downturn after World War I that continued through the 1930s depressed crop prices, putting some famers in debt (Mendenhall 2006; Sharpe 1999). Despite these problems, many farmers remained in the area. In 1943, the federal government took over the area under the War Powers Act and residents were forced to abandon their property (Marceau et al. 2003).

The Manhattan Project/Cold War Era began in 1942. The area around Hanford, Washington was selected by the federal government as one of the three principal Manhattan Project sites. Occupying portions of Grant, Franklin, and Benton counties, the Hanford Site was created to support the U.S.'s plutonium-production effort during World War II. Plutonium production, chemical separation, and research and development focusing on process improvement were the primary activities during the Manhattan Project, as well as the subsequent Cold War Era. The industrial components of the Manhattan Project and Cold War Era are located in discrete areas throughout the Hanford Site (Marceau et al. 2003).

Reactors in the 100 Areas were used to irradiate uranium fuel to produce plutonium. The 200 Areas were the locations of the chemical separation facilities that extracted plutonium from the irradiated fuel. The 300 Area was where the uranium fuel was manufactured prior to being delivered to the reactors in the 100 Areas, and the location for process improvement studies. The 400 Area, a Cold War expansion, was the location of advanced nuclear power plant research and development. The 600 Area was a broad expanse between the production areas that contained the infrastructure such as roads and rail systems that served the entire site. The 700 Area was the administration area in Richland (Marceau et al. 2003).

3.2.1.2 Historic Architectural Resources

Architectural resources are buildings, other structures or groups of structures, and designed landscapes that are of historic, aesthetic, or scientific significance. Generally, architectural resources must be more than 50 years old to be considered for listing on the NRHP; however, more recent resources might be significant if they are of exceptional importance or if they have the potential to gain significance in the future. The structures within the APE are all associated with LIGO. Site construction for LIGO Hanford began in the mid-1990s, and at this time, it has not been deemed eligible for listing on the NRHP. None of the structures known to exist within the vicinity of the APE are more than 40 years old and they are not considered eligible or potentially eligible for listing on the NRHP. Because the Proposed Action has no potential to affect historic architectural resources, they are not further analyzed in this EA.

3.2.1.3 Archaeological Resources

Archaeological resources comprise areas where human activity has measurably altered the earth or deposits of physical remains are found, such as projectile points and bottles, and where past peoples left physical evidence of their occupation. Archaeological resources may include structural ruins or deposits of prehistoric occupation debris such as artifacts and food remains, including seed, shells, and bones. The literature review indicated that no archaeological sites have been previously identified within the APE. A field survey was conducted for the proposed project in March 2020 to identify archaeological resources within the APE. A single historic site consisting of six fragments of cement irrigation pipe was identified during the survey and recorded as a historic archaeological site (45BN2067). While the site is likely to be associated with pre-Hanford-era agriculture, background research indicates the site is not associated with any known agricultural activity in the area, and lacks integrity for inclusion on the NRHP. NSF sent a letter to DAHP requesting concurrence with this eligibility determination on June 1, 2020.

3.2.1.4 Cultural Resources

Cultural resources include evidence of cultural uses of the natural or built environment. They also include social institutions. The NHPA also considers effects to traditional cultural properties (TCPs), which includes sites, areas, and materials associated with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community. No documented cultural resources and no TCPs under the NHPA have been located in the

vicinity of the APE. However, the Yakama Nation is working on an ongoing sitewide TCP study at the Hanford Site. If cultural resources or TCPs under the NHPA within the APE are identified in the future, further consultation between NSF, the SHPO, and the consulting parties (including DOE) would occur.

3.2.2 Environmental Consequences

This subsection describes the potential effects to historic architectural, archaeological, and cultural resources within the APE that could result from implementation of the Proposed Action and No Action Alternative and presents the assessment of effects under the NHPA and impact findings under NEPA.

The ACHP's regulations implementing Section 106 of the NHPA create a process by which federally assisted projects are reviewed for their effects on historic properties. After the historic property is identified and evaluated, the Criteria of Adverse Effect (36 CFR Section 800.1(1)) are applied. These criteria are used to determine whether the undertaking could change the characteristics that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Section 106 of the NHPA allows the following three findings for effects on historic properties:

- No Historic Properties Affected
- No Adverse Effect
- Adverse Effect

An effect is adverse under Section 106 if it diminishes the integrity of the property's historically significant characteristics. The federal agency makes the determination of effects for each historic property. Based on these determinations, an overall finding of effect for the undertaking is reached in consultation with the SHPO and other consulting parties.

When an undertaking is found to have an adverse effect, Section 106 requires notification to the ACHP and consultation with the SHPO and other interested parties regarding appropriate avoidance, minimization, or mitigation measures. For a finding of adverse effect, the product of consultation is usually an MOA (per 36 CFR Section 800.6(c)) containing stipulations with measures that would be implemented to avoid, minimize, or mitigate the adverse effects.

Table 3-3 identifies impact thresholds for the NEPA analysis relevant to historic architectural, archaeological, and cultural resources. It also lists the correlation between effects under NHPA Section 106 and NEPA.

TABLE 3-3
Impact Thresholds for Historic Architectural, Archaeological, and Cultural Resources

Impact	Description
No Impact/ Negligible	Impacts on historic architectural, archaeological, and cultural resources would not be detectable and would not alter resource characteristics. *The NHPA Section 106 determination would be no historic properties affected or no adverse effect on historic properties.*
Minor	Impacts on historic architectural, archaeological, and cultural resources would result in little, if any, loss of integrity and would be slight but noticeable. Impacts would not appreciably alter resource characteristics. *The NHPA Section 106 determination would be no adverse effect on historic properties.*
Moderate	Impacts on historic architectural, archaeological, and cultural resources would result in some loss of integrity and would be noticeable. Impacts could appreciably alter resource characteristics. Measures to mitigate impacts would be relatively easy to implement (e.g., through consultation, changes in project design, or via an MOA), and would be sufficient to reduce the intensity of impacts to a level less than major under NEPA. *The NHPA Section 106 determination would likely be no adverse effect, but only after implementing minimization or mitigation measures sufficient to reduce the adverse effects on historic properties.*
Major	Impacts on historic architectural, archaeological, and cultural resources would result in disturbance to an important site, substantial loss of integrity, or severe alteration of property conditions, the result of which would significantly affect the human environment. Mitigation would not be sufficient to reduce the intensity of impacts to a level less than major under NEPA. *The NHPA Section 106 determination would be adverse effect to historic properties. Measures to mitigate, avoid, or minimize adverse effects under Section 106 would be decided through consultation and stipulated in an MOA.*
Quality:	Beneficial – would have a positive effect Negative – would have an adverse effect
Duration:	Short-term – occurs only during the construction period Long-term – continues after the construction period

Note: Text shown in italics is the corresponding NHPA Section 106 Finding of Effect.

3.2.2.1 Proposed Action

As described in Section 3.2.1, no known historic properties or TCPs that are eligible for, or listed in, the NRHP are located within the APE. A single archaeological site was identified within the APE; however, it was recommended as not eligible for listing on the NRHP, resulting in a "no historic properties affected" determination recommendation. NSF submitted these recommendations to the SHPO and consulting parties in a letter dated June 1, 2020 (refer to Appendix B) and SHPO concurred with the findings on the same day. The Confederated Tribes of the Umatilla Indian Reservation responded on June 4, 2020, stating that they reviewed the survey and have no comments at this time. The Nez Perce Tribe did not provide comments on the survey report or assessment of effects; however, they provided comments on the Draft EA (Appendix C) on July 22, 2020, which were focused on biological resources. No further comments on the survey report and assessment of effects were received from any of the other consulting parties.

As with any ground-disturbing project, the potential for discovery of buried resources exists. NSF would direct Caltech to develop an unanticipated discovery plan before initiating project activities to address any resources that might be discovered. If previously unidentified resources were discovered during project activities, ground-disturbing activities would be halted in the vicinity of the find and Caltech would notify DOE (the landowner) and NSF who would then consult with the SHPO and other consulting parties, as appropriate, regarding eligibility for listing on the NRHP, project effects, necessary mitigation, or other treatment measures.

With implementation of these BMPs, and based on the determination of **no historic properties affected** under Section 106 of the NHPA, the Proposed Action is expected to result in **no impact** to historic architectural, archaeological resources, or cultural resources under NEPA.

3.2.2.2 No Action Alternative

Under the No Action Alternative there would be no change from the existing conditions. The No Action Alternative would result in a finding of no historic properties affected under NHPA Section 106 and no impact to historic architectural, archaeological, and cultural resources under NEPA.

3.3 Geology, Soils, and Seismicity

This section describes the geology, soils, and seismic conditions at LIGO Hanford. The ROI for geology, soils, and seismicity is the Pasco Basin.

3.3.1 Affected Environment

3.3.1.1 Geology

LIGO Hanford is located in the south-central area of Washington and is a part of the Columbia Basin, which occupies a large area ranging from the eastern slopes of the Cascade Range to the western slopes of the Blue Mountains. The Columbia Basin is characterized by steep river canyons, extensive plateaus, and long ridges. The area contains limited topographic relief comprised predominately of undulating or rolling hills. Steep slopes are present only in areas where the major regional rivers have eroded basalt deposits, creating canyons and buttes (Franklin and Dyrness, 1973). Within the Columbia Basin lies the Pasco Basin, which is bound to the north by the Saddle Mountains, to the west by the Hog Ranch Naneum Ridge and Umtanum and Yakima Ridges, to the south by Rattlesnake Mountain and the Rattlesnake Hills, and to the east by the toe of the Palouse Slope. The Pasco Basin ranges from 390 feet (120 meters) above mean sea level at the Columbia River to 750 feet (230 meter) in the 200 East Area of Hanford Site (DOE, 2004; WADNR, 2020b). LIGO Hanford is located in the southern portion of the Pasco Basin.

The geology underlying LIGO Hanford has resulted from wind and deposits from cataclysmic glacial floods and lava flows over millions of years (Washington State, 2020). Generally, sediments deposited over 2.6 million years ago were reworked through flood events that have created relict channels and terraces across portions of the western Pasco Basin (Fecht et al., 2004; Fecht and Marceau, 2006). During

the last 15,000 years, eolian processes further shaped the landscape through wind deposition of sand-dominated sediments. Volcanic activity from Cascade volcanoes during this timeframe also resulted in volcanic ash mixing with local sediments in the Pasco Basin. In the last 8,000 years to present day, eolian deposition has been responsible for deep deposits of sand and silt (Gaylord et al., 1991).

3.3.1.2 Soils

Geomorphological processes have resulted in soil types varying from sand to silty and sandy loam. Rupert (Quincy) sand, a coarse sand, is the most widespread soil type at LIGO (Hajek, 1966). This soil type consists of very deep, excessively drained soils formed in sands on dunes and terraces (NCSS, 2019a). Burbank loamy sand, a coarse-textured soil underlain by gravel, also exists throughout the LIGO Hanford area. This soil type consists of very deep, excessively drained soils formed in basaltic glacial outwash or alluvium on terraces and terrace escarpments (NCSS, 2019b). Due to the eroded and sandy nature of these soils, these soils have limited uses; therefore, no soils are classified as prime or unique farmland soil.

3.3.1.3 Seismicity

Compared to the region as a whole, seismic activity is relatively uncommon in the Columbia Basin. The regional seismicity is dominated by small-magnitude earthquakes. Rates of moderate-to-large earthquakes are relatively low. Faults in the vicinity of LIGO correlate with geologic features of the area (DOE, 2014). The Saddle Mountains to the north are reverse or thrust faults; the Rattlesnake Mountains bound the southern side of the project area and are classified as thrust faults. The Central Gable Mountain Fault section of the Umtanum Ridge, along with the folds and other faults of the Umtanum-Ridge Gable Mountain uplift, lie to the west. Other faults include the Cold Creek Fault on the west end of the Cold Creek syncline and the May Junction Fault, which is located nearly 3 miles (4.8 kilometers) east of the 200-East Area of the Hanford Site (USGS, 2018). Within the region, the largest observed earthquakes were the 1936 Milton-Freewater earthquake at magnitude 6.0 and the 1872 Lake Chelan earthquake at magnitude 6.7–7.0 (DOE, 2014).

The Cascade Mountains lie to the west of LIGO Hanford and are considered an active volcanic range. Active volcanic peaks include Mount St. Helens, Mount Baker, Mount Hood, and Mount Adams. The U.S. Geological Survey (USGS) categorizes these peaks as very high threat, with the exception of Mount Adams, which is classified as high threat (USGS, 2018).

3.3.2 Environmental Consequences

This section identifies the potential direct and indirect impacts to geology, soils, and seismicity that could result from implementation of the Proposed Action and No Action Alternative. The impact evaluation considered the extent of soil disturbance, impacts to geologic features, and seismic-related hazards. The impact thresholds related to geology, soils, and seismicity are presented in Table 3-4.

TABLE 3-4
Impact Thresholds for Geology, Soils, and Seismicity

Impact	Description
Negligible	The alternative would either not result in a change to geologic or soil resources, or the change 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 geologic or soil resources; however, the impact would be small, localized, and of little consequence.
Moderate	The alternative would result in a measurable and consequential change to geologic or soil resources. Mitigation would be needed to offset adverse impacts would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change to the character or usability of geologic or soil resources. Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.
Quality:	Beneficial – would have a positive effect Negative – would have an adverse effect
Duration:	Short-term – occurs only during the construction period Long-term – continues after the construction period

3.3.2.1 Proposed Action

The construction of the Proposed Action could disturb up to 4.7 acres at the Hanford Site. Construction activities include site grading, soil compaction, depth of excavation, and construction staging areas. Land disturbance would include impacts to soil from erosion during these construction activities. Construction BMPs would be implemented to reduce soil erosion. Subsurface disturbance would also occur from trenching and excavation construction work for the installation of new utilities. The design of the new LExC facility would include excavation of up to 36 feet (approximately 11 meters) during construction efforts; the utility excavations and placements would be to a similar excavation depth. The uppermost layer of the Hanford formation is approximately 213 feet (65 meters) deep and will not be impacted by the construction of the Proposed Action.

Earthquakes are historically shown to occur in the region and there is potential for associated ground motion to impact the structural integrity of the proposed facility. However, all structures, including the facility and associated infrastructure would be designed to standards that mitigate impacts from earth-moving activities or events and the site is not located within range of potential hazard zones for volcanic eruptions (WADNR, 2020c). Geotechnical surveys were completed to provide detailed information on subsurface conditions, and final design plans will evaluate seismicity prior to any construction activities.

The implementation of the Proposed Action would not substantially alter the condition or function of the underlying geology or soil strata within the Pasco Basin. Soil erosion would be managed by implementing construction BMPs. Collectively, these measures would help prevent soil movement or loss and minimize the potential for soil to be transported in surface runoff or wind erosion. Additionally, the Proposed Action would not increase susceptibility to, or risks associated with, an earthquake or volcanic

event within the Pasco Basin. Therefore, impacts to soil, geology, and seismicity from the implementation of the Proposed Action would be **minor, negative,** and **short-term**.

3.3.2.2 No Action Alternative

Under the No Action Alternative, the construction of the LExC facility would not occur. LIGO would continue to operate without the new LExC facility. There would be no change to soils, geology, or seismicity.

3.4 Hazardous Materials and Solid Waste

This section discusses the hazardous materials and solid waste generation at the Hanford Site. The ROI for this analysis includes the LIGO Site boundary and disposal facilities.

3.4.1 Affected Environment

A hazardous material is defined as a material that exhibits ignitability, corrosivity, reactivity, or toxicity characteristics. Solid waste includes a broad range of materials such as garbage, sludge, demolition and construction waste, nonhazardous industrial waste, universal waste, and municipal waste. Solid waste management includes the treatment, storage, and disposal of solid waste produced as a result of site operations. Hazardous material is regulated under federal and state regulations, including the Resource Conservation and Recovery Act (RCRA). The State of Washington is authorized under RCRA and the U.S. Environmental Protection Agency's (EPA's) implementing regulations to regulate solid waste; therefore, solid waste at Hanford is managed by DOE in accordance with Washington Administrative Code 173-350 "Solid Waste Handling Standards" (DOE, 2018).

The LIGO facility does not produce a substantial amount of hazardous materials and is categorized as a small quantity generator. The most commonly used hazardous materials are solvents, such as acetone, isopropanol, and methanol. Although DOE operations at the Hanford Site include the disposal of radioactive materials, these activities do not occur within the property permitted for LIGO Hanford. Overall, hazardous materials used at LIGO Hanford are either treated at onsite facilities or shipped offsite for treatment and/or disposal. Waste that does not contain hazardous substances are disposed of offsite at the Roosevelt Regional Landfill.

3.4.2 Environmental Consequences

This section identifies potential impacts related to hazardous material and solid waste that could result from the implementation of the Proposed Action and No Action Alternative. The impact thresholds related to hazardous materials and solid waste are defined in the Table 3-5.

TABLE 3-5
Impact Thresholds for Hazardous Materials and Solid Waste

Impact	Description
Negligible	The alternative would either not result in a change to hazardous material and/or solid waste, or the change 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 hazardous material and/or solid waste; however, the impact would be small, localized, and of little consequence.
Moderate	The alternative would result in a measurable and consequential change to hazardous material and/or solid waste. Mitigation would be needed to offset adverse impacts. It would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change to hazardous material and/or solid waste. Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.
Quality:	Beneficial – would have a positive effect Negative – would have an adverse effect
Duration:	Short-term – occurs only during the construction period Long-term – continues after the construction period

3.4.2.1 Proposed Action

The Proposed Action would result in an increase of solid waste from the construction and operation of the LExC facility. Minimal hazardous waste would be generated from the construction or operation of the LExC facility.

The amount of construction debris requiring disposal is expected to be small. The Roosevelt Regional Landfill is at 61.5 percent of the total statewide capacity for disposal of municipal solid waste (DOE, 2019b). All solid waste generated during construction would be disposed of appropriately in a landfill and there are no current limitations on the receiving landfill. All hazardous material used during construction would be handled in accordance with applicable state and federal law and a spill mitigation plan would be developed prior to construction. Only **negligible** impacts associated with solid and hazardous wastes would be expected during construction.

Operation-related waste generation is typically based on the number of personnel and visitors at a facility. The number of people onsite is expected to increase by 2 full-time employees daily and approximately 5,000 additional visitors per year. During a typical tour day, the maximum number of daily visitors would be approximately 120 people and field trips would be offered 1 to 2 additional days per week. On public tour days held once per month, the maximum number of daily visitors would increase from 200 people to up to 400 people. The amount of waste generated from the additional personnel and visitors would facilitate the need for additional sewer utilities, as discussed in Section 3.8, *Utilities*. The additional personnel and visitors would increase the amount of solid waste generated onsite; however, the additional

generation is relatively small compared to the remaining capacity of the existing onsite and offsite disposal facilities.

The LIGO facility will abide by the Hanford Site Pollution Prevention Program, which aims to prevent pollution and minimize waste inside the site to achieve sitewide sustainability goals. This includes reducing construction and demolition debris, and recycling non-hazardous solid waste (DOE, 2018). With the implementation of construction BMPs and applicable pollution prevention plans, there would be **minor, negative, long-term** impacts from solid waste and **negligible** impacts from hazardous materials during operations.

3.4.2.2 No Action Alternative

Under the No Action Alternative, the construction of the LExC facility would not occur. There would be no increase in daily visitation; therefore, there would be no impacts to hazardous materials or solid waste.

3.5 Human Health and Safety

This section describes the affected environment, including public safety, occupational health, and the protection of children. The ROI for health and safety includes the LIGO Hanford boundary.

3.5.1 Affected Environment

Public safety is defined as the welfare and protection of the general public and includes individuals at LIGO Hanford. The existing Observatory is considered a valuable community resource that serves the general population, with an average of 4,800 visitors served in 2018, many of whom were children. E.O. 13045, Protection of Children from Environmental Health Risks and Safety Risks, requires an assessment of any potential disproportionate impacts to children. Since the surrounding area is on the DOE's Hanford Site, no other child-centric resource locations occur in the vicinity of the area.

Occupational health is defined as risk arising from physical, chemical, and other workplace hazards that interfere with establishing and maintaining a safe and healthy work environment. Existing hazards that could affect construction personnel or NSF onsite workers include chemical agents; physical agents, such as loud noise or vibration; physical hazards, such as slip, trip, and fall hazards; natural hazards, such as flooding, botanical hazards, or wildfires; and potential radiological sources from the DOE's Hanford Site remediation activities.

The DOE's operations at the Hanford Site include environmental restoration activities, including the remediation of radionuclides and non-radioactive hazardous constituents from past DOE activities. These remediation activities are managed under a Tri-Party Agreement between the DOE, EPA, and the State of Washington Department of Ecology (Ecology) in compliance with RCRA, the Comprehensive Environmental Response, Compensation, and Liability Act, and applicable state hazardous waste regulations. The Tri-Party Agreement regulates non-DOE entities using the Hanford Site, including the NSF, which is permitted for LIGO at the Hanford Site (DOE, 2018). DOE is required to evaluate potential

radiation doses to non-DOE employees who work at facilities within the Hanford Site, in accordance with 40 CFR Part 61. A radiological survey of LIGO Hanford revealed no surface radiation levels above typical background levels. Results of previous soil surveys are not atypical of natural background constituents in soil in the area (NSF, 1966).

3.5.2 Environmental Consequences

This section identifies potential impacts related to human health and safety that could result from the implementation of the Proposed Action and No Action Alternative. This assessment of impacts considers occupational health, public safety, and the protection of children. The impact thresholds related to human health and safety are defined in the Table 3-6.

TABLE 3-6
Impact Thresholds for Human Health and Safety

Impact	Description
Negligible	The alternative would either not result in a change to health and safety, or the change 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 public safety, occupational health, and protection of children; however, the impact would be small, localized, and of little consequence.
Moderate	The alternative would result in a measurable and consequential change to public safety, occupational health, and protection of children. Mitigation would be needed to offset adverse impacts. It would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change to public safety, occupational health, and protection of children. Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.
Quality:	Beneficial – would have a positive effect Negative – would have an adverse effect
Duration:	Short-term – occurs only during the construction period Long-term – continues after the construction period

3.5.2.1 Proposed Action

Under the Proposed Action, construction would include a new building and the associated infrastructure. Construction activities would also require excavation to support utilities installation and grading, as needed for the construction of the new parking lot. Any occupational health impacts to construction workers during the construction of the new facility and associated infrastructure would be **negligible** and conducted in accordance with applicable Occupational Safety and Health Administration (OSHA) regulations and DOE-specific safety regulations and procedures, including radiation surveys of soil and equipment during excavation if DOE subject matter experts determine this measure is needed. No children or members of the public would be permitted within the construction footprint during the construction of the facility.

Although the operation of the Proposed Action would result in additional employees and visitors onsite, including school-age children, the increase in people on site would not change the existing conditions relating to health and safety.

Despite the proximity to the DOE Hanford site, individuals visiting the LIGO site would not be exposed to radiation levels above natural background levels (NSF, 1993) and LIGO Hanford has an emergency action plan, which includes protective measures for the general public in the unlikely event of increased radiation exposure (Taylor et al., 2018).

The continued education-focused operations of LIGO Hanford and new LExC facility would be similar to current operations. Access to the land immediately surrounding the laboratory roads and buildings at LIGO Hanford would continue to be restricted for visitors and most staff.

Given the existing protective measures in place and the limited exposure, any health and safety impacts to occupational health, public health, or the protection of children would be minimal. Therefore, under the Proposed Action, there would be **negligible** impacts to health and safety.

3.5.2.2 No Action Alternative

Under the No Action Alternative, the construction and operation of the LExC facility would not occur. LIGO would continue to operate without the new LExC facility. Under the No Action Alternative, there would be no change to health and safety.

3.6 Transportation

This subsection describes the existing traffic and transportation conditions surrounding LIGO Hanford and the associated environmental consequences from the Proposed Action and No Action Alternative. The ROI for transportation and traffic is HSR 10, Washington SR 240, and SR 225. Although HSR 10 can be accessed to the north from HSR 4S/Stevens Drive, visitors are directed to LIGO Hanford from the south, so HSR 4S/Stevens Drive is not included in the ROI.

3.6.1 Affected Environment

LIGO Hanford is located on HSR 10 on the DOE Hanford Site, approximately 13 miles northwest of the city of Richland in Benton County, Washington. HSR 10 is a two-lane, rural minor arterial road adjacent to LIGO Hanford. In May 2019, HSR 10 had recorded average daily traffic (ADT) of 2,000 vehicles per day during the Hanford Site work week (Monday through Thursday) and 400 vehicles per day on weekends (Friday through Sunday) (Bedlington, pers. comm., 2020).

The majority of LIGO visitor traffic accesses HSR 10 from SR 240 or SR 225 to the south of LIGO Hanford. SR 240 is a two-lane roadway facility classified as an urban other freeway/expressway as it leaves Richland and becomes a rural minor arterial closer to HSR 10. The average annual daily traffic (AADT) from 2018 on SR 240 was 3,900 vehicles per day to the west of HSR 10 and 5,000 vehicles per day to the east of HSR 10, increasing to 5,400 as SR 240 approaches Richland. SR 225 is a two-lane rural

major collector with a 2018 AADT of 1,800 to the south of its intersection with SR 240 (WSDOT, 2020). Roadways in the project area are generally level with long, mild grades and straight sections of roads (TSI, 2010).

LIGO is staffed by approximately 53 employees and typically hosts 2 to 5 visiting academic fellows at any given time. The number of annual visitors is approximately 4,800 per year. To date, visitation at LIGO occurs primarily on weekdays between 9 a.m. and 4 p.m., which falls outside the peak traffic periods for Hanford Site commuter traffic. On average, LIGO Hanford offers field trips 2 to 3 days per week between February and May and September and November. Once per month LIGO hosts public tours on a Saturday, which can draw 100 to 200 visitors in a single day. The majority of LIGO Hanford's visitors arrive in school busses or other group transportation, with only approximately 20 percent using personal vehicles. The exception to this is the Saturday tours, which attract visitors who arrive largely (up to 90 percent) in personal vehicles (Strunk, pers. comm., 2020).

3.6.2 Environmental Consequences

This section identifies the potential direct and indirect impacts related to transportation and traffic that could result from implementation of the Proposed Action and No Action Alternative. Impacts to transportation and traffic were assessed based on an evaluation of the extent to which each alternative would affect traffic levels or patterns. The impact thresholds related to the transportation and traffic analysis are presented in Table 3-7.

TABLE 3-7
Impact Thresholds for Traffic and Transportation

Impact	Description
Negligible	The alternative would not result in a change in traffic or transportation resources or the change would be so small that it would not be noticeable.
Minor	The alternative would result in a noticeable change in traffic on the roadway network within the ROI; however, the change would not exceed roadway capacity or cause delays on the roadway network.
Moderate	The alternative would result in a measurable and consequential change in traffic on the roadway network within the ROI; while some delays may occur, roadway capacity would not be exceeded.
Major	The alternative could result in a substantial change in traffic on the roadway network within the ROI; without extensive mitigation noticeable delays would occur, and roadway capacity would be exceeded.
Quality:	Beneficial – would have a positive effect Negative – would have an adverse effect
Duration:	Short-term – occurs only during the construction period Long-term – continues after the construction period

3.6.2.1 Proposed Action

During both construction and operation, vehicles would access the project site via SR 240, SR 225, and HSR 10. During the construction phase of the Proposed Action, a range of vehicles would be used to

access the site, including vehicles needed to transport construction personnel and deliver equipment. Standard passenger vehicles would be used to transport construction personnel and would access the site daily during the construction period. A range of larger vehicles (e.g., flat-bed trucks) would be used to transport the construction materials and other project equipment, and construction vehicles would be transported to the site to support construction activities. During construction, no more than 45 additional vehicles would be expected to access LIGO Hanford on any given day. Given the relatively small number of vehicles associated with construction, a measurable change in traffic levels or roadway capacity along these roadways is not expected during construction, resulting in **negligible** traffic impacts. Development of a traffic management plan prior to construction would identify BMPs to minimize construction traffic impacts. Construction vehicle traffic would be timed to avoid peak-hour traffic periods at the Hanford Site to the extent possible to further minimize impacts.

After completion of LExC construction, there would be two additional personnel employed at LIGO as part of the Proposed Action. The new LExC would be able to accommodate field trips an additional 1 to 2 days per week, resulting in an additional three buses per week on roadways within the ROI. Visitation at the once-a-month Saturday tours would increase to a maximum of 400 visitors during peak visitation months (March through November). Therefore, changes to daily traffic volumes would be negligible with the exception of one Saturday per month, where up to an additional 200 visitors could visit LIGO Hanford. Increased Saturday visitation would be expected to contribute approximately 50 to 100 extra vehicles per day on HSR 10, in addition to the current weekend ADT of 400 vehicles per day. This minor change to traffic would not exceed roadway capacity or cause delays on the roadway network because it is much lower than the normal workday ADT on HSR 10. Visitation would continue to be accommodated outside of peak traffic periods for Hanford Site commuter traffic.

Given the relatively small changes to daily traffic for the Proposed Action during construction and operation of the LExC, and with the implementation of the measures listed previously, traffic-related impacts are expected to be **minor**, **negative**, and **long-term**.

3.6.2.2 No Action Alternative

Under the No Action Alternative, the LExC facility would not be constructed, visitor traffic to LIGO Hanford would not increase, and associated changes in transportation or traffic would not occur. Therefore, there would be no new impacts related to transportation or traffic.

3.7 Water Resources

Water resources include surface water and groundwater. The ROI for water resources is the Esquatzel Coulee Watershed.

3.7.1 Affected Environment

3.7.1.1 Surface Water

The Proposed Action is located in the Esquatzel Coulee Watershed that drains to the Columbia River located 7 miles east of the site (USGS, 2020). The Columbia River flows south through Richland, Washington, and then turns west, flowing through Portland, Oregon, before discharging into the Pacific Ocean. There are no surface water features such as wetlands, ponds, or streams within the Proposed Action (NSF, 1993).

Section 303(d) of the Clean Water Act requires states to list water bodies that do not meet water quality standards and designated uses (impaired waters). Sections of the Columbia River along the Hanford Site approximately 10 miles north and 12 miles southeast of the Proposed Action are listed by the Washington State Department of Ecology (Ecology) as an impaired water body and have a total maximum daily load for several parameters (Ecology, 2020a). Because of distance and topography, it is unlikely that runoff from the Proposed Action could drain to those two sections of the Columbia River.

The Proposed Action is located within Federal Emergency Management Agency (FEMA) flood insurance rate map 5302370325B (FEMA, 1982) and outside the 100-year (0.2 percent) annual chance floodplain of the Yakima River. The nearest location of the Columbia River is not mapped by FEMA; however, on the other side of the bank in Franklin County, the 100-year (0.2 percent) annual chance floodplain is mapped at an elevation of less than 500 feet, as shown on flood insurance rate map 5300440300B (FEMA, 1980). As the LIGO site is around 525 feet in elevation, it can be inferred that the LIGO is outside the Columbia River floodplain as well. Therefore, it is unlikely that the project would affect, or be affected by, flooding.

3.7.1.2 Groundwater

The Proposed Action is located in the Columbia Plateau physiographic province. Groundwater is found in both an upper unconfined aquifer system and in a deeper basalt-confined aquifer system. Water for irrigation, potable water supply, and fire protection would be supplied to the Proposed Action from these aquifers by onsite wells, as described in Section 3.8, *Utilities*. The direction of groundwater flow in both aquifer layers is generally from west to east towards the Columbia River (DOE, 2004). At the location of the Proposed Action, the upper unconfined aquifer water table is more than 100 feet below ground surface (DOE, 2018). The DOE has an extensive groundwater monitoring program to monitor the location of tritium, iodine-129, and nitrate contaminant plumes that are downgradient and several miles from the Proposed Action (DOE, 2018).

3.7.2 Environmental Consequences

This section identifies the potential direct and indirect impacts to water resources that could result from implementation of the Proposed Action and No Action Alternative. Impacts to water resources were assessed based on an evaluation of the potential to impact either a surface water or groundwater feature within the context of the applicable regulations that protect water resources. Given the lack of surface

water features in the area of the Proposed Action, the impact assessment is primarily focused on the extent to which surface water or groundwater quality would be degraded. Potential impacts of runoff and infiltration on surface and groundwater resources at LIGO are reduced naturally by low annual precipitation, granularity of soils, high surface evaporation rates, high plant transpiration rates, and depth to groundwater. The impact thresholds related to water resources are presented in Table 3-8.

TABLE 3-8
Impact Thresholds for Water Resources

Impact	Description
Negligible	The alternative would either not affect water quality, or the change in water quality would be below or at the level of detection.
Minor	The alternative would result in a detectable change in water quality, but the impact would be small, localized, and of minimal consequence.
Moderate	The alternative would result in a measurable and consequential change in water quality.
Major	The alternative would result in a substantial change in water quality.
Quality:	Beneficial – would have a positive effect Negative – would have an adverse effect
Duration:	Short-term – occurs only during the construction period Long-term – continues after the construction period

3.7.2.1 Proposed Action

Ground-disturbing activities associated with construction have the potential to cause soil erosion and increase stormwater runoff; however, there are no onsite surface water bodies. The Proposed Action would disturb up to 4.7 acres of land and would require coverage under a Construction Stormwater General Permit (Ecology, 2015). The coverage is required for any proposed project that would disturb 1 acre or more of land in the state. This permit requires the filing of a notice of intent and development of a site-specific stormwater pollution prevention plan that includes sediment and erosion control measures. This plan would outline the stormwater BMPs to be implemented during construction activities to prevent impacts to surface water and will be approved prior to the start of any construction activities. BMPs could include the use of silt fence, sediment ponds, vehicle tracking controls, good housekeeping, inspection and maintenance schedules, and training. The impact to surface water during construction after the application of BMPs would be **negligible**.

Groundwater would not be encountered during construction and dewatering would not be necessary, resulting in **negligible** impacts to groundwater levels during construction under the Proposed Action.

The LExC facility would result in an increase of impervious area of up to 70,000 square feet. The design of the facility would include stormwater retention and treatment to offset the increase in stormwater runoff from the increase in impervious area. The stormwater would be managed through infiltration

swales designed in accordance with the Stormwater Management Manual for Eastern Washington (Ecology, 2019). The impact to surface water during operations under the Proposed Action would be **negligible**.

As described in Section 3.8, *Utilities*, groundwater would continue to be withdrawn for irrigation, fire protection, and potable use through the existing well. The proposed increase in potable water is approximately 100,000 gallons per year and irrigation would increase by approximately 30,000 gallons per year. The total increase in well withdrawal is 0.25 gallon per minute (gpm), which is less than 0.2 percent of the 150 gpm well capacity (Washington State Department of Health, 2020). Because of the distance from the groundwater plumes and the minimal increase in flow rate, the well withdrawal would not significantly affect the groundwater table or the downgradient contamination plumes, resulting in **negligible** impacts to groundwater during operations under the Proposed Action.

3.7.2.2 No Action Alternative

Under the No Action Alternative, the construction of the LExC and its associated infrastructure would not occur, so there would be no change to the nature and frequency of visitation in the project area. Therefore, no new impacts to water resources would occur.

3.8 Utilities

This section describes the existing utilities at LIGO Hanford, including water, wastewater, stormwater, electricity, heating and cooling, and communications. The ROI for utilities is the service area of the utilities providing services to LIGO Hanford.

3.8.1 Affected Environment

3.8.1.1 Water

Water is supplied to the existing LIGO facility by an onsite well that was constructed in 1994. The 10-inch domestic use well has a total depth of 1,900 feet and withdraws water from the basalt-confined aquifer system (Ecology, 2020b). The well is upgradient and several miles away from the iodine-129, nitrate, and tritium plumes that DOE monitors in the 200 Area of the Hanford Site (DOE, 2018). The onsite well is permitted for 10,000 gallons per day (gpd) (Caltech, 1998).

3.8.1.2 Wastewater

The existing LIGO Hanford facility disposes of sanitary waste produced by about 40 staff daily and up to 250 visitors a day through a drain field located northeast of the laboratory.

3.8.1.3 Stormwater

Excess stormwater from the existing LIGO Hanford facility infiltrates through perimeter swales or French drains.

3.8.1.4 Electricity

The Benton Public Utility District supplies 2,000 kilowatts of power to LIGO Hanford via a 13.8-kilovolt distribution line from a DOE-owned electrical substation in the 400 Area of the Hanford Site (DOE, 2015). In 2018, Benton Public Utility District provided 198.7 average megawatts to 54,136 customers (Benton PUD, 2020).

3.8.1.5 Heating and Cooling

The existing LIGO Hanford facility receives chilled water from a chiller plant (electrical corner station, chiller plant, and maintenance building) for air conditioning and laser cooling.

3.8.1.6 Communications

Broadband services to LIGO Hanford are provided by Benton Public Utility District (Institute for Local Self-Reliance, 2013).

3.8.2 Environmental Consequences

This section identifies potential direct and indirect impacts related to utilities that could result from implementation of the Proposed Action and No Action Alternative. This assessment of impacts considers the extent to which the Proposed Action would disrupt service for any public utility or burden a public service or utility system. The impact thresholds related to public services and utilities are defined in Table 3-9.

TABLE 3-9
Impact Thresholds for Utilities

Impact	Description
Negligible	The alternative would either not result in a change to utilities, or the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would require or result in a detectable change to utilities; however, the impact would be small, localized, and of little consequence.
Moderate	The alternative would result in a measurable and consequential change to utilities. Mitigation would be needed to offset adverse impacts.t would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change to utilities. Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.
Quality:	Beneficial – would have a positive effect Negative – would have an adverse effect
Duration:	Short-term – occurs only during the construction period Long-term – continues after the construction period

3.8.2.1 Proposed Action

During construction of the Proposed Action, the contractor would provide water for dust suppression using trucks, supply portable toilets for construction workers, and manage stormwater as described in Section 3.7. During construction there would be **negligible** impacts to utilities.

During operations of the Proposed Action, 100,000 gallons per year (274 gpd) of potable water for the LExC would be provided through a 2-inch connection to the existing 8,000-gallon water storage tank. Irrigation of the new vegetative areas would require approximately 30,000 gallons per year (82 gpd) and would obtain water from the same water storage tank. Fire protection of the LExC would be provided by an 8-inch connection to the existing 355,000-gallon fire storage tank. Water for both storage tanks would be obtained from the existing onsite well. Water withdrawals from the onsite well would remain below the 10,000 gpd permitted capacity (Caltech, 1998). The LExC would produce an additional 3,500 gpd of wastewater and the capacity of the existing drain field would be expanded adjacent to its current location as needed and required permits would be obtained prior to any expansion. Electrical power, heating and cooling system, and broadband would connect to the existing facility. The LExC will be designed to Leadership in Energy and Environmental Design (LEED) standards and would require 230,000 kilowatt-hours (0.03 average annual megawatt) annually. This increase in energy requirements is less than 0.02 percent of the capacity of the Benton Public Utility District.

The operation of the Proposed Action is not expected to affect the existing utility infrastructure or exceed the utilities capacities. The long-term impact to utilities would be **negligible**.

3.8.2.2 No Action Alternative

Implementation of the No Action Alternative would result in no change to current conditions. Therefore, no impacts to utilities would occur.

3.9 Cumulative Impacts

Cumulative impacts are those impacts that result from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future projects, regardless of the person or agency undertaking the other projects. Principles of cumulative impact analysis in the CEQ guide *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ, 1997) states: “for cumulative effects analysis to help the decision maker and inform interested parties, it must be limited through scoping to effects that can be evaluated meaningfully.”

The potential for cumulative impacts to the environment from the Proposed Action was evaluated by performing a search for projects and activities in the region that could affect the same environmental resources within a similar timeframe and through observations during the field surveys. The Proposed Action is located in a remote location and any future activities would need to be consistent with the LIGO mission at the site. Consequently, no reasonably foreseeable future actions were identified. In addition, while the site has had a history of wildfires and human occupation, only one archaeological site was found during the field survey and it was determined to be ineligible for listing on the NRHP; therefore, no past cumulative activities were identified.

Mitigation of impacts to biological resources could affect areas off the proposed LExC site. The NSF site manager, Caltech, would work with DOE to determine the appropriate approach and location for the restoration of any BRMP Level 2 or higher habitat. However, the offsite impacts associated with this action would result in a net benefit to biological resources.

Because there are no planned future activities beyond LExC construction and operation at the site and because offsite biological restoration would result in a benefit, no potential negative cumulative impacts associated with this project have been identified. NSF is committed to working with the DOE to help ensure the LExC project does not result in any increased avoidable environmental impacts to the site.

3.10 Impact Summary

Table 3-10 compares the impacts to resources analyzed in this EA. Based on the intensity definitions provided for each resource area (negligible, minor, moderate, and major), the impacts from the Proposed Action would be negligible to minor. Associated BMPs or environmental protection measures are presented, by resource area, in the table. These measures would be implemented by the LIGO operator (currently Caltech) unless otherwise noted.

TABLE 3-10
Summary of Impacts

Impacts	Proposed Action Alternative	No Action Alternative	BMP or Environmental Protection Measure
Air Quality: impacts to air quality during construction	No impact	No impact	Unleaded gasoline and ultra-low sulfur diesel fuel (15-ppm maximum) would be used, and the proper maintenance of equipment with air emission control devices would implemented. Dust control measures and revegetation would occur following construction.
Biological Resources: Vegetation removal during construction	Minor, negative, and short-term	No impact	Level 2 through 5 resources would be revegetated with native plant species as directed by the BRMP. Additionally, in accordance with the BRMP, mitigation areas would be monitored for a minimum of 5 years after planting to ensure the vegetation is developing.
Biological Resources: Impacts from invasive weeds from construction activities	Minor, negative, and short-term	No impact	DOE-approved weed mitigation BMPs would be implemented.
Biological Resources: Impacts to wildlife species during construction.	Minor, negative, and short-term	No impact	N/A

Impacts	Proposed Action Alternative	No Action Alternative	BMP or Environmental Protection Measure
Biological Resources: Impacts of construction on migratory birds that use the project site for nesting, migration stop-over, or wintering purposes	Minor, negative, and short-term	No impact	Pre-construction surveys would be conducted and BMPs to address nesting birds will be implemented if construction commences during the mid-March to mid-July nesting period.
Biological Resources: Impacts to Vegetation during operation and maintenance	Negligible	No impact	A noxious weed management plan would be implemented as part of the sitewide Integrated Biological Control Plan (MSA, 2014)
Biological Resources: Impacts to of wildlife species caused by increased visitation to LIGO Hanford	Negligible	No impact	N/A
Historic Architectural, Archaeological, and Cultural Resources: Potential impacts to historic architectural archaeological resources, or cultural resources	No impact on historic architectural, archaeological, and cultural resources (NEPA)/ No Historic Properties Affected (Section 106 NHPA)	No impact	NSF would direct Caltech to develop an unanticipated discovery plan before initiating project activities to address any resources that might be discovered during construction. If resources were discovered, ground-disturbing activities would be halted and Caltech would notify DOE (the landowner) and NSF who would then consult with the SHPO and other consulting parties, regarding eligibility, effects, necessary mitigation, or other treatment measures.
Geology, Soils, and Seismicity: Impacts to soil from erosion and subsurface disturbance during construction; potential for earthquakes to impact structural integrity of the proposed facility	Minor, negative, short-term	No impact	Geotechnical surveys have been completed and final design plans will evaluate seismicity prior to any construction activities. BMPs would be used to manage erosion.
Hazardous Materials and Solid Waste: Increase in solid waste from construction activities	Negligible	No impact	Landfill disposal of solid waste would occur.
Hazardous Materials and Solid Waste: Use of hazardous materials during construction operation activities	Negligible	No impact	Construction BMPs and applicable pollution prevention and spill mitigation plans would be implemented.

Impacts	Proposed Action Alternative	No Action Alternative	BMP or Environmental Protection Measure
Hazardous Materials and Solid Waste: Increased generation of solid waste during operations	Minor, negative, long-term	No impact	Increased sewer utility infrastructure would be built. Solid waste would be disposed of at existing solid waste facilities with adequate capacity.
Hazardous Materials and Solid Waste: Increased use of hazardous materials during operations	Minor, negative, long-term	No impact	The LIGO facility would abide by the Hanford Site Pollution Prevention Program.
Human Health and Safety: Potential for occupational health impacts to construction workers during construction	Negligible	No impact	Construction would be conducted in accordance to OSHA regulations and DOE and NSF-specific safety regulations.
Human Health and Safety: Health and safety risks for visitors and staff at the proposed facility	Negligible	No impact	Existing protective measures, emergency action plans, and access restrictions would remain in place to protect staff and visitors to LIGO Hanford.
Transportation: Increase in traffic due to construction activities	Negligible	No impact	A traffic management plan would be developed prior to construction to identify BMPs to minimize construction traffic impacts. Construction vehicle traffic would be timed to avoid peak-hour traffic periods at the Hanford Site to the extent possible.
Transportation: Increase in traffic caused by increased visitation to the proposed facility	Minor, negative, long-term	No impact	Visitation would continue to be accommodated outside of peak traffic period for Hanford Site commuter traffic.
Water Resources: Impacts to surface water during construction	Negligible	No impact	A Construction Stormwater General Permit would be obtained and a site-specific stormwater pollution prevention plan that includes stormwater BMPs, and sediment and erosion control measures would be developed. BMPs could include the use of silt fence, sediment ponds, vehicle tracking controls, good housekeeping, inspection and maintenance schedules, and training.

Impacts	Proposed Action Alternative	No Action Alternative	BMP or Environmental Protection Measure
Water Resources: Impacts to groundwater during construction and operation of the proposed facility	Negligible	No impact	N/A
Water Resources: Surface water impacts caused by increased impervious area	Negligible	No impact	Facility would include stormwater retention and treatment to offset the increase in stormwater runoff from the increase in impervious area. Stormwater will be managed through infiltration swales designed in accordance with the Stormwater Management Manual for Eastern Washington.
Utilities: Impacts to utilities during construction	Negligible	None	The contractor would provide water for dust suppression using trucks, supply portable toilets for construction workers, and manage stormwater as described under Water Resources BMPs.
Utilities: Impacts to utilities from operation of the proposed facility	Negligible	None	The proposed facility would be LEED designed. Applicable permits would be obtained.
Visual Resources: Indirect impacts to viewsheds in the region			BMPs would be used to minimize the potential for dust during construction and revegetation will minimize the potential after construction.

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SECTION 4

Notification, Public Involvement, and Consulted Parties

4.1 Agency Coordination

NSF began the process of consultation with federal, state, and local agencies in January 2020 regarding the Proposed Action. Consultation efforts have been conducted in support of general project development, as well as for specific regulatory purposes, including NHPA Section 106.

The agencies that have been consulted specifically with regard to the proposed project site are listed in Table 4-1. NSF has coordinated closely with DOE in the preparation of the draft EA.

TABLE 4-1
Agency Consultation

Federal	DOE, EPA, NPS (Manhattan Project National Historical Park) USFWS, USACE
State of Washington	WA DAHP (SHPO), WA Department of Ecology – Central Office, WA State Department of Fish and Wildlife – South Central Office, Washington Department of Health – Office of Radiation Protection
Benton County	Benton County Planning Department
Native American Tribes	Confederated Tribes of the Colville Reservation, Confederated Tribes of the Umatilla Indian Reservation, Nez Perce Tribe, Yakama Nation, Wanapum Tribe

4.2 Public Notification, Collaboration, and Involvement

4.2.1 Public Notification

4.2.1.1 Scoping

NEPA regulations (40 CFR Section 1501.7) specify that "there shall be an early and open process for determining the scope of issues to be addressed for identifying the significant issues related to a proposed action." NSF has coordinated closely with DOE, the SHPO, and the consulting parties to identify critical issues related to the proposed project to aid in development of the EA. Native American tribes were given project updates and provided the opportunity to comment on project planning through the regularly scheduled Hanford cultural resources meetings. Revisions to the preliminary APE were made following feedback from the Nez Perce Tribe. Tribes were also offered the opportunity to participate in project survey activities, although no tribal representatives participated.

4.2.1.2 Distribution of the Draft Environmental Assessment for Public Review

Pursuant to the requirements of NEPA, this Draft EA was distributed for a 30-day public review period beginning on June 23, 2020. A Notice of Availability for the EA was published on June 23, 2020 and June 28, 2020 in the *Tri-City Herald* and the *Yakima Herald-Republic*. The public comment period ended on July 23, 2020.

Notice of the public review period was provided to the project stakeholder list (refer to Section 8 of this EA). As indicated in the notice, an electronic copy of the Draft EA was posted to the NSF website (https://go.usa.gov/xw8ZD). Due to the impact of the ongoing Coronavirus Disease 2019 (COVID-19) pandemic on the usual methods of accessing information and communicating, such as the closure of local public libraries and the increased consumer demand on mobile and broadband Internet networks, the public and agencies were encouraged to contact NSF directly by email at phy-envr@nsf.gov or by phone (Kimberly Pigford, 703-292-7387) to discuss and resolve issues involving access to the Draft EA or the ability to comment. NSF received no requests for assistance in accessing the Draft EA due to the pandemic.

During the public comment period, NSF accepted written comments on the Draft EA (sent on or before July 23, 2020) at phy-envr@nsf.gov. A total of three comments were received during the public comment period; copies of the comments received are included in Appendix C. The comments received are summarized in Table 4-2.

TABLE 4-2
Comments Received During Draft EA Public Review Process

Commenter	Date	Summary of Comment
Thomas E. Marceau, Department of Anthropology, Washington State University, Tri-Cities	July 3, 2020	Corrected the statement regarding the Lewis and Clark expedition; the text in the EA should state that the explorers stopped at the confluence of the Snake and Columbia Rivers. **Response from NSF:** The Final EA has been updated to reflect the correction as provided.
Brian Moreno, Washington State Commission on Hispanic Affairs	July 20, 2020	No comments at this time. **Response from NSF:** Thank you for your review of the Draft EA.
Nez Perce Tribe Hanford Cultural Resources	July 22, 2020	Stated that ground squirrels are culturally important to the Nez Perce Tribe and asked that the EA be updated to assess the presence of ground squirrels, negative effects as a result of the proposed project, and associated mitigation. Requested that plant surveys be conducted during the growing season for Washington state sensitive or state-threatened plant species to identify presence and appropriate mitigation prior to the Final EA. Requested that the revegetation plan be provided as an appendix to the Final EA. Requested clarification for nesting bird BMPs and how federal changes to the MBTA would affect potential "taking" as a result of the proposed project. **Response from NSF:** Section 3.1 has been revised to change the term "ground squirrel" to "burrowing rodent" to more accurately reflect likely species on the site. DOE species data for the Hanford Site confirm that the Washington ground squirrel does not occur in or near the project area, as it does not occur south of the Columbia River. There would be no potential for effects to this species from the Proposed Action. The nearest recorded instance of Townsend's ground squirrel to the project area is a historical colony record (there is no evidence of current or recent use of this area by the species) from approximately 2 miles

Commenter	Date	Summary of Comment
		north of the project site. The closest active Townsend's ground squirrel colony to the project area is more than 7 miles to the west. Based on the lack of recent observations anywhere near the project area and the distance to known occurrences tracked by DOE, the Townsend's ground squirrel is very unlikely to occur in the project area. No significant effects to this species would be expected. Regarding impacts to vegetation, as noted in your comment, biological resource surveys occurred before the growing season. Although surveys identified whether any suitable habitat was present in or near the project area, they could not confirm the occurrence of specific plants. It is possible that individual state sensitive or state-threatened plants may be impacted by the proposed project; however, it is unlikely that the species exists at the project site in an abundance that would have a population-level effect resulting from construction of the Proposed Action. Therefore, impacts to vegetation would continue to be less than significant. Mitigation for impacts to state sensitive and threatened species at the project site would be provided in accordance with the BRMP, which assigns resource priority levels to habitat at LIGO. State sensitive species are included in Level 3 habitat and state-threatened species are included in Level 4 habitat. As noted in Section 3.1.2.1 of the EA, resource Levels 0 through 3 are present within the project area. Level 3 resources, where state-sensitive species could occur, would be avoided to the extent possible through modifications of the project design. If impacts could not be avoided entirely, compensatory mitigation would be provided as described below. The impacts listed in the Draft EA were for the entire 25.5-acre project site because final building footprints and temporary construction impacts were not yet available. Design plans have been updated for the Final EA and it is estimated that approximately 4.7 acres of ground disturbance would occur during construction of the Proposed Action. Within that impact area, approximately 2.6 acres of impacts would be mitigated at a 3:1 ratio for all Level 3 resources, if they cannot be avoided during final design, and 1:1 ratio for Level 2 resources (up to approximately 1.3 acres). The remaining 0.8 acre is Level 0 and Level 1 resources, which do not require compensatory mitigation. The actual impacts are expected to be less than what is presented in the EA, and final footprints and impact types are not required for the Final EA. The revegetation management plan will be developed based on the recommended mitigation ratios in the BRMP and the final impact footprints. The project will minimize impacts to migratory birds by beginning construction prior to the nesting season. Additional BMPs would be necessary only if construction commences during the nesting season (mid-March to mid-July). The Proposed Action complies with the federal changes to the MBTA and would not result in a "take" as defined by the MBTA.

These comments have been reviewed and considered in completing the NEPA process and are reflected in the revisions to this Final EA as appropriate.

4.2.2 NHPA Section 106 Consultation Process

This section describes the Section 106 consultation process and identifies the Section 106 Consulting Parties. As stated in 36 CFR Section 800.1:

> Section 106 of the National Historic Preservation Act requires Federal agencies to take into account the effects of their undertakings on historic properties and afford the Council [Advisory Council on Historic Preservation (ACHP]) a reasonable opportunity to comment on such undertakings. The procedures in this part define how Federal agencies meet these statutory responsibilities. The section 106 process seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties, commencing at the early stages of project planning. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess its effects and seek ways to avoid, minimize or mitigate any adverse effects on historic properties.

NSF, as the lead federal agency for the proposed undertaking, has invited participation in the consultation process in compliance with Section 106. Table 4-3 summarizes the consultation milestones for this undertaking. Copies of correspondence relating to the Section 106 process are provided in Appendix B.

TABLE 4-3
NHPA Section 106 Consultation Milestones

Date	Details
February 7, 2020	Preliminary APE transmitted to Tribes and Department of Archaeology and Historic Preservation (DAHP) (SHPO).
February 10, 2020	DAHP transmitted letter concurring with the preliminary APE.
February 19, 2020	Project information presented to Tribes and DAHP at DOE's February Monthly Cultural Resources Meeting.
February 21, 2020	Nez Perce Tribe provided comments on the preliminary APE; APE for field survey is revised accordingly.
March 06, 2020	Notification of pending field survey for March 18 transmitted to Tribes.
March 13, 2020	Notification of pending field survey rescheduled for March 17 transmitted to Tribes.
June 1, 2020	Cultural Survey Report with site forms and eligibility recommendations sent to DAHP and Tribes.
June 1, 2020	DAHP concurred with the eligibility and effects determination.
June 4, 2020	Confederated Tribes of the Umatilla Indian Reservation responded to survey report with no comments.
June 22, 2020	Nez Perce Tribe provided comments on Draft EA regarding cultural significance of biological resources.

The DOE provided NSF with a list of Native American tribes with historical ties LIGO Hanford. NSF initiated Section 106 consultation with the identified Native American tribes. The following tribes were

included in Section 106 correspondence and activities as part of their ongoing involvement in cultural resources consultation with the DOE at the Hanford Site: Confederated Tribes of the Colville Reservation; Confederated Tribes of the Umatilla Indian Reservation; Nez Perce Tribe; Yakama Nation; and Wanapum Tribe.

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SECTION 5

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SECTION 6

List of Preparers

The primary persons responsible for contributing to, preparing, and reviewing this report are listed in Table 6-1.

TABLE 6-1
List of Preparers

Name	Role	Education	Years of Experience
Michelle Rau, PMP	Project Manager Senior Reviewer	M.S. Business Administration B.S. Ecology and Evolutionary Biology	23
Laura Dreher	NEPA Lead Transportation and Cultural Resources Author	B.S. Civil Engineering	19
David Sheldon	Cultural Resources and Cultural Surveys/Section 106 Lead	M.S. Resource Management B.A. Anthropology B.A. History	16
Sara Orton	Cultural Resources Reviewer	M.S. Preservation Studies B.A. Political Science	21
Richard Reaves	Lead Biologist	Ph.D. Wetland and Wildlife Ecology B.S. Wildlife Ecology and Resource Management	30
Christina McDonough, PE	Biological Resources; Water Resources, Utilities and Infrastructure	M.E. Environmental Engineering B.S.C.E. Civil Engineering Professional Engineer (PE)	25
Emily Gulick	GIS Lead Geology, Soils, and Seismicity; Hazardous Materials and Solid Waste; Human Health and Safety	B.A. Environmental Studies B.A. Geography	3
Karen Sanders	Technical Editor	J.D., Law B.A. Anthropology	25

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SECTION 7

Acronyms and Abbreviations

Abbreviation	Definition
AADT	average annual daily traffic
ACHP	Advisory Council on Historic Preservation
ADT	average daily traffic
APE	area of potential effects
BMP	best management practice
BP	before present
BRMP	Biological Resources Management Plan
CAA	Clean Air Act
Caltech	California Institute of Technology
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
DAHP	Department of Archaeology and Historic Preservation
DOE	U.S. Department of Energy
E.O.	Executive Order
EA	environmental assessment
Ecology	State of Washington Department of Ecology
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973
FEMA	Federal Emergency Management Agency
FONSI	finding of no significant impact
GHG	greenhouse gas
gpd	gallon(s) per day
gpm	gallon(s) per minute
HSR	Hanford Site Route
LEED	Leadership in Energy and Environmental Design

LExC	LIGO STEM Exploration Center
LIGO	Laser Interferometer Gravitational-Wave Observatory
MBTA	Migratory Bird Treaty Act
MIT	Massachusetts Institute of Technology
MOA	memorandum of agreement
MOU	memorandum of understanding
MSA	Mission Support Alliance
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NRHP	National Register of Historic Places
NSF	National Science Foundation
OSHA	Occupational Safety and Health Administration
ppm	part(s) per million
RCRA	Resource Conservation and Recovery Act
ROI	region of influence
SHPO	State Historic Preservation Officer
SR	State Route
STEM	science, technology, engineering, and math
TCP	traditional cultural property
U.S.	United States
U.S.C.	*United States Code*
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WADNR	Washington State Department of Natural Resources
WSDOT	Washington State Department of Transportation

SECTION 8

List of EA Recipients

The following agencies and organizations were provided a copy of the Draft EA.

Federal Agencies

- U.S. Department of Energy
- U.S. Environmental Protection Agency – Region 10
- U.S. Fish and Wildlife Service – Washington Fish and Wildlife Office
- U.S. Army Corps of Engineers – Northwestern Division, Seattle District
- National Park Service Intermountain Region Office – Manhattan Project National Historic Park

State and Local Agencies

- Washington State Department of Archaeology and Historic Preservation (SHPO)
- Washington State Department of Ecology – Central Office
- Washington State Department of Fish and Wildlife – South Central Office
- Washington Department of Health – Office of Radiation Protection
- Benton County Planning Department

Native American Tribes

- Confederated Tribes of the Colville Reservation
- Confederated Tribes of the Umatilla Indian Reservation
- Nez Perce Tribe
- Yakama Nation
- Wanapum Tribe

Other Interested Parties

- Caltech
- Columbia Basin College
- Committee on Hispanic Affairs
- Educational Service District 123
- Kennewick School District
- First Nations MESA
- University of Washington Bothell
- Washington State University Tri-Cities
- Tri-City Development Council

- Pasco School District
- Richland School District
- Washington State University Tri-Cities 21st Century Community Learning Center
- Washington Office of Superintendent of Public Instruction
- Visit Tri-Cities

APPENDIX A

Ecological Survey Report

Proposed Laser Interferometer Gravitational-Wave Observatory STEM Exploration Center at Hanford near Richland, Benton County, Washington

Ecological Survey Report

Final

May 7, 2020

Prepared for:

National Science Foundation

Contents

Appendixes

Tables

Figures

Acronyms and Abbreviations

Caltech	California Institute of Technology
DOE	U.S. Department of Energy
IPaC	Information for Planning and Consultation
LExC	LIGO STEM Exploration Center
LIGO	Laser Interferometer Gravitational-Wave Observatory
NRCS	Natural Resources Conservation Service
NSF	National Science Foundation
STEM	Science Technology, Engineering and Math
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WHNP	Washington Natural Heritage Program

1. Introduction

The Laser Interferometer Gravitational-Wave Observatory (LIGO) is a national facility for gravitational-wave research and consists of two interferometers, one located in Livingston, Louisiana and the other at the Hanford Site near Richland, Washington. LIGO is funded by the National Science Foundation (NSF) and operated by the California Institute of Technology (Caltech) and the Massachusetts Institute of Technology. The interferometer at the Hanford Site (LIGO Hanford) is located on land owned by the United States (U.S.) and administered by the U.S. Department of Energy (DOE). Per its 1993 Memorandum of Understanding with DOE, NSF has a permit to use the site for LIGO. In 2019, Caltech received a grant for $7.7 million from the State of Washington to construct a LIGO science, technology, engineering, and math (STEM) observatory adjacent to LIGO Hanford. Caltech has begun design work for this facility, calling it the LIGO STEM Exploration Center (LExC) and proposes to begin construction in October 2020.

LExC has the potential to complement and enhance the existing Education and Public Outreach component of NSF's award for the operations of LIGO Hanford. As the permit holder, NSF is considering whether to authorize Caltech to construct and operate LExC within the boundaries of the land described in the permit issued by DOE.

This survey was conducted in support of an environmental assessment being prepared by Jacobs Engineering Group Inc. (Jacobs). Habitat types within the study area were identified and mapped and the site was assessed for the potential for occurrence of federally listed threatened and endangered species.

1.1 Project Details

The proposed LExC would be constructed east of the existing parking lot along the current access road to LIGO Hanford. The visitor center would include construction of a new 13,000-square-foot building and associated infrastructure including water/sewer utilities, electrical service, and telecommunications connection. Utilities would be extended from existing services at LIGO Hanford. LExC construction activities would require excavation to support utilities installation and grading as needed for construction of a parking lot. The project area is approximately 25.5 acres, including approximately 4.9 acres of developed area consisting of buildings, landscaping, and roads and parking areas that were not surveyed for vegetation.

1.2 Location and Description

The LExC project area encompasses approximately 25.5 acres adjacent to LIGO Hanford along Hanford Route 10 in Benton County, Washington (46.454051°, -119.402360°, World Geodetic System 1984 Datum). The project is in Section 11 Township 11 North, Range 27 East (Figures 1 and 2).

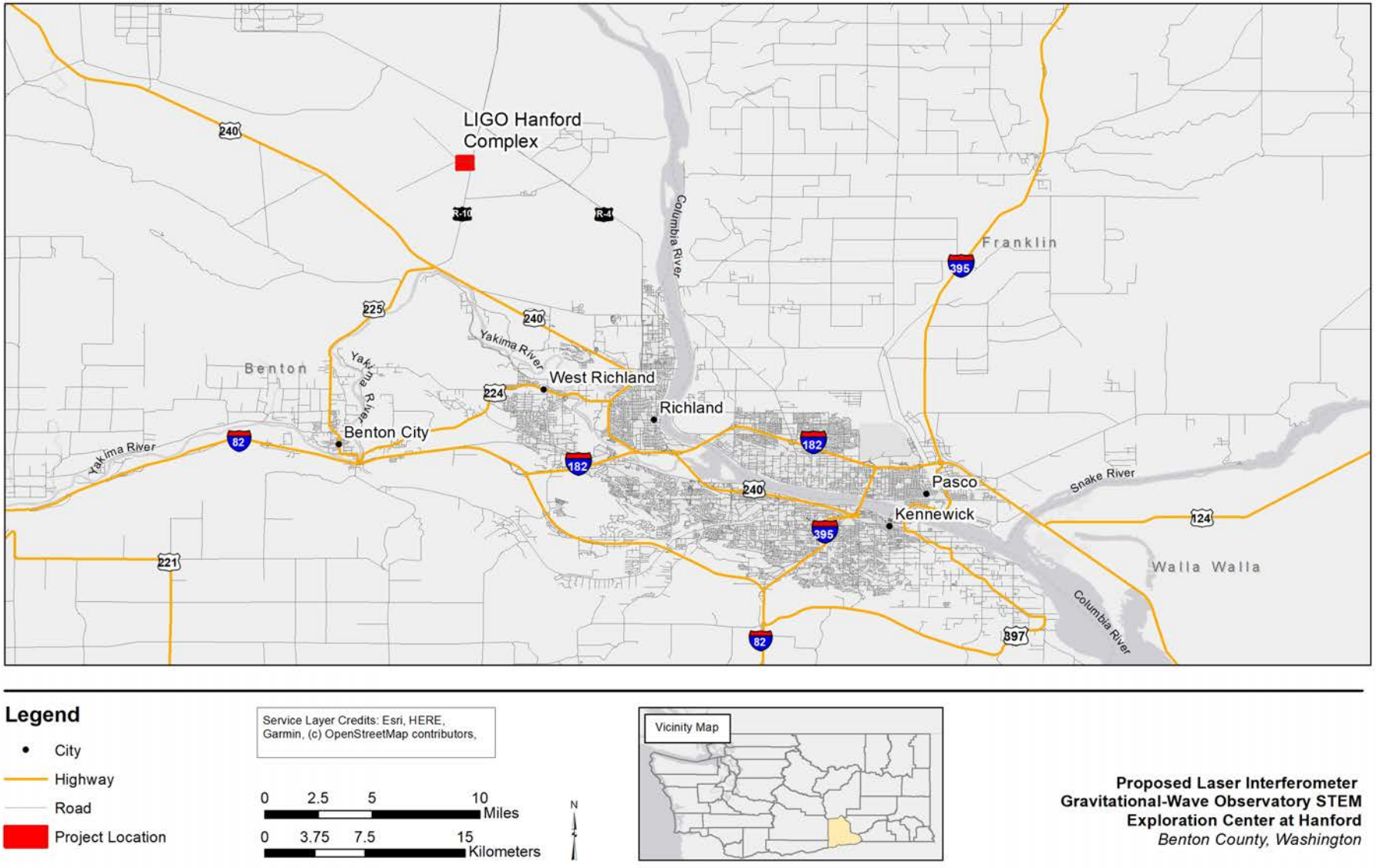
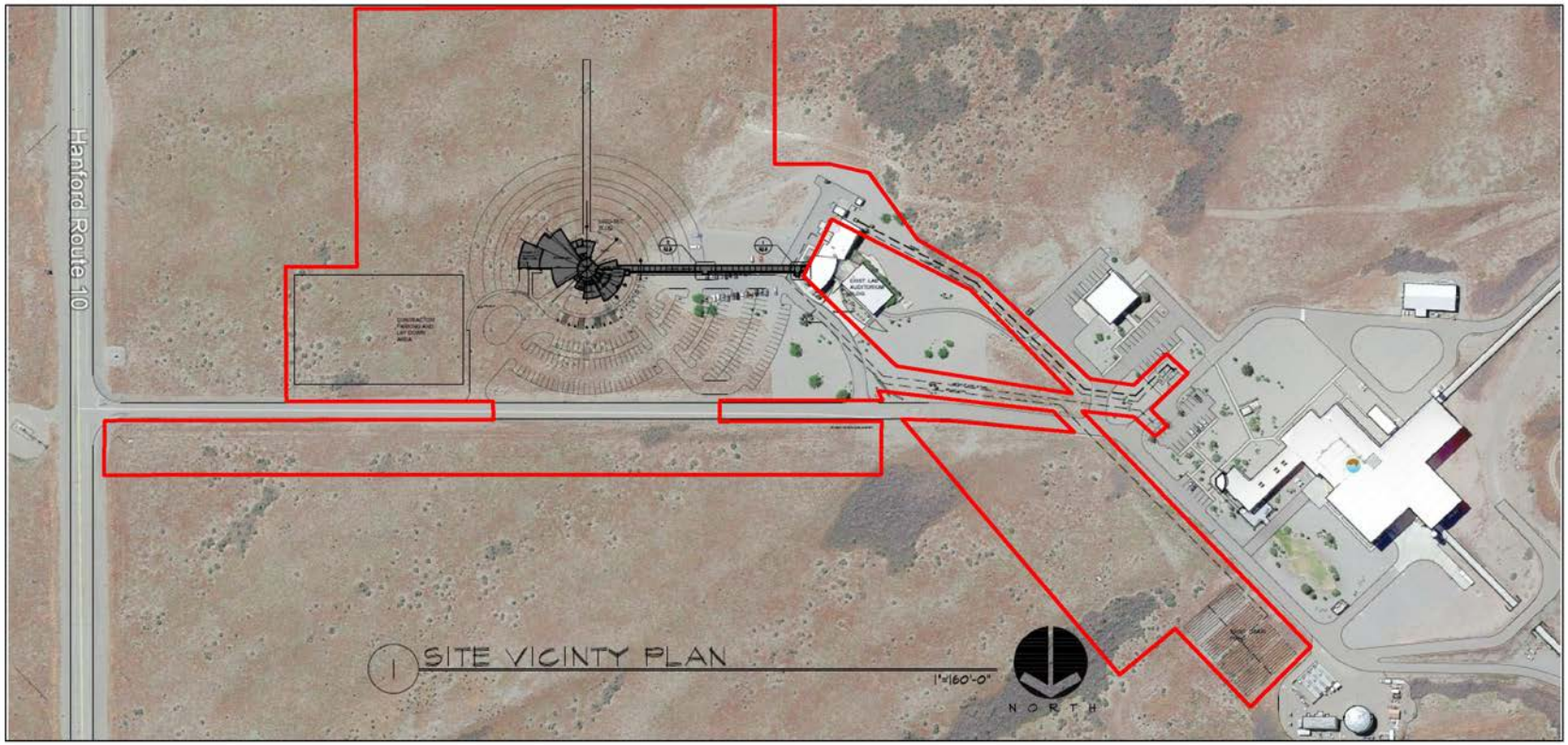


Figure 1. Project Location



Legend

Project Boundary

Terence L Thornhill Architect, Site Plan, Ligo-Sec Exploration Center, Richland WA

N

0 125 250 500 Feet

0 50 100 200 Meters

Proposed Laser Interferometer Gravitational-Wave Observatory STEM Exploration Center at Hanford
Benton County, Washington

Figure 2. Project Area

2. Methodology

To be consistent with recent vegetation mapping efforts at LIGO Hanford, Jacobs staff adapted the methodology outlined in the *Upland Vegetation of the Central Hanford Site* (Easterly et al. 2017) to document habitat types within and adjacent to the study area. This approach combined field observations, onsite photos, and the best available aerial imagery to delineate initial habitat polygons. A digital geographic information system map layer was created with polygons mapped in the field depicting the distribution of major species. Prior to field work, Jacobs staff used the best available satellite imagery for the Hanford Site to create a digital map of anticipated vegetation association polygon boundaries to aid field work.

2.1 Background Review

Jacobs reviewed the following resources to gather information about environmental conditions and potential for federal- and state-listed species of concern, as identified in Section 4.2.5.6 of the *Hanford Site Biological Resources Management Plan* (DOE 2017) prior to the field visit.

- Hanford Site Biological Resources Management Plan (DOE 2017)
- Vascular Plants of the Hanford Site (Sackschewsky and Downs 2001)
- Upland Vegetation of the Central Hanford Site (Easterly et al. 2017)
- 2019 Washington Vascular Plant Species of Special Concern (WNHP 2019)
- U.S. Fish and Wildlife Service Information for Planning and Consultation (IPaC) Online (USFWS 2020a).
- Web Soil Survey interactive mapping application (NRCS 2020)
- National Wetland Inventory Wetlands Mapper (USFWS 2020b)
- National Hydrography (USGS 2020)
- Horn Rapids Dam WA 7.5-minute Topographic Quadrangle Map (USGS 1977)
- Historical Aerial Imagery, 1996 – 2017 (Google Earth 2020)
- Priority Habitats and Species: Maps (WDFW 2020)

2.2 Fieldwork Methods

2.2.1 Vegetation Assessment

Jacobs staff conducted fieldwork on March 18 and 19, 2020. Fieldwork consisted of delineating vegetation polygons based on the boundaries of dominant vegetation within the study area. An extensive on-foot meander survey method was used to document the composition of the vegetation, distribution of individual species, and boundaries of habitat types.

Vegetation associations were recorded using a Trimble Geo 7X set to submeter accuracy that was differentially corrected during post-processing. Species identified during the field survey were noted. Table 1 presents species that were used to define vegetation association polygon boundaries and generate mapping-unit names as defined by Easterly and others (2017).

Table 1. Species Used to Define Polygon Boundaries and Generate Mapping-Units Names

Scientific Name	Common Name	Priority for Mapping Polygon Boundary
Shrubs		
Artemisia tridentata	Big sagebrush	High
Ericameria nauseosa	Rubber rabbitbrush	Low
Chrysothamnus viscidiflorus	Yellow rabbitbrush	High
Purshia tridentata	Antelope bitterbrush	High
Grass		
Achnatherum hymenoides	Indian ricegrass	Low
Agropyron cristatum/desortorium	Crested wheatgrass	Low
Bromus tectorum	Cheatgrass	High
Hesperostipa comata	Needle-and-thread grass	High
Poa secunda	Sandberg bluegrass	High

During fieldwork, photographs were taken of each habitat type across the study area. The photograph points were recorded with a global positioning system point. Photographs of plant portraits of common species were taken.

2.2.2 Significant or Rare Habitats

No habitat types identified as significant or rare have been mapped in or adjacent to the project area. The nearest mapped habitat type is big sagebrush-needle-and-thread grass habitat more than 10,000 feet north of the project area, which is a community type tracked by the State of Washington.

2.2.3 Threatened and Endangered Species and Hanford Priority Species Assessment

Species with potential to occur on LIGO Hanford were identified from the *Hanford Biological Resources Management Plan* (DOE 2017). Species restricted to habitats that do not occur in the project vicinity or that have restricted ranges that do not overlap the project vicinity were removed from consideration. Biologists field-verified potential habitat for threatened and endangered species or federally and state-listed species of concern, as identified in Section 4.2.5.6 of the *Hanford Site Biological Resources Management Plan* (DOE 2017), during the habitat assessment.

Animal species listed as threatened and endangered species or Hanford priority species typically are restricted to specific habitats that do not occur in the project area. No mammal, reptile, or amphibian species listed as a threatened and endangered species or Hanford priority species would be expected to occur in the project area. The state candidate species and federal species of concern sagebrush lizard (*Sceloporus graciosus*) has been documented in the northern portion of the LIGO Hanford Site, but not near the project area, and this species would not be expected to occur in the project area. While the habitat is suitable for black-tailed jackrabbit (*Lepus californicus*), this species has not been observed within 2 miles of the project area.

Greater sage grouse (*Centrocercus urophasianus*) historically were common throughout the area, but are now considered extirpated from the site, as noted in the *Hanford Site Biological Resources Management Plan* (DOE 2017). Bird species protected under the Migratory Bird Treaty Act may nest or forage in the

project area or may use the project area as stopover habitat during migration. Bald eagles are known to nest on the Hanford Site, but not near the project area, and they would not use the project area. Other raptors, including the state-threatened ferruginous hawk (*Buteo regalis*), may forage in the project area, but these birds have not been documented nesting in the project area. Three ferruginous hawk nests are located within 8 miles of the project area, including one within 2 miles.

Federally and state-listed plant species known from the Hanford Site were evaluated to determine whether suitable habitats, as identified in the Rare Plant Field Guide (WDNR 2020), occur in or adjacent to the project site. Species limited to moist or specialized habitats that do not occur in the project area and species that occur as localized endemics outside the project area were eliminated from consideration. No federal threatened or endangered species and no state endangered plant species were identified with potential to occur in the project area. Sixteen plant species listed as state threatened or state sensitive were determined to have slight potential to occur the project area. These species were evaluated and are identified in Table 2.

Table 2. Threatened and Endangered Plant Species and Hanford Priority Species with Potential to Occur in Project Vicinity

Scientific Name	Common Name	Status
Aliciella leptomeria	Great basin gilia	State Threatened
Astragalus columbianus	Columbia milkvetch	State Sensitive
Astragalus geyeri var. *geyeri*	Geyer's milkvetch	State Threatened
Cistanthe rosea	Rosy pussypaws	State Threatened
Corispermum villosum	Hairy bugseed	State Sensitive
Cryptantha leocophaea	Gray cryptantha	State Threatened
Cryptantha scoparia	Miner's candle	State Threatened
Cryptantha spiculifera	Snake River cryptantha	State Sensitive
Cuscuta denticulata	Desert dodder	State Threatened
Eatonella nivea	White eatonella	State Threatened
Eremothera minor	Small-flower evening primrose	State Sensitive
Minuartia pusilla	Annual sandwort	State Threatened
Nicotiana attenuata	Coyote tobacco	State Sensitive
Oenothera caespitosa	Tufted evening primrose	State Sensitive
Oenothera pygmaea	Dwarf evening primrose	State Sensitive
Pediocactus nigrispinus	Snowball cactus	State Sensitive

3. Results

The results provided are limited by the season of the field survey. Only those species expressed at the time of survey or with persistent identifiable remains from the previous year could be identified. The active growing season was just beginning at the time of survey and several emerging plants were not yet identifiable at the time of survey.

3.1 Habitat Types

This section provides descriptions of the habitat types identified during survey. A map of the vegetation types in the project area is provided as Figure 3. A vegetation list is provided as Appendix A, which identifies the species observed and the habitat types they occurred in. Due to rounding errors, the sum of individual habitat types may not sum to the total acreage of the project area.

3.1.1 Highly Altered Habitats

3.1.1.1 Non-vegetated/Highly Disturbed Areas

These areas include the drainfield area at the northern end of the project area and other areas in proximity to developed areas or roads where off-road vehicle use had removed most vegetation. Non-vegetated/highly disturbed areas cover 2.32 acres (8.98 percent of the project area).

The drainfield area is at the northwestern end of the project area (Figure 3) and was highly disturbed from historic installation of subsurface infrastructure and routine access for maintenance. The area is surrounded by a berm and the surface of the drainfield has been excavated to some extent below original grade. The drainfield area provides no intact native vegetation communities and is dominated by non-native species, particularly cheatgrass (*Bromus tectorum*) and Russian thistle (*Salsola tragus*).

There are non-vegetated/highly disturbed areas around the LIGO Hanford Lab Support Building and its parking area and between the road and the drainfield area where vehicles are regularly driven (Figure 3). Vegetation has been substantially altered in these areas and exposed sand is prevalent. Shrub species have been eliminated and grasses and forbs are absent from much of the area where vehicular traffic is the highest. Cheatgrass is the predominant vegetation and other non-native species occur including spring draba (*Draba verna*), Russian thistle, tall tumblemustard (*Sisymbrium altissimum*), and crossflower (*Chorispora tenella*).

Along the LIGO Hanford Access Road, crested wheatgrass (*Agropyron cristatum/desortorium*) has been planted and is locally abundant. Tapertip onion (*Allium acuminatum*) was a minor component near the edges of this habitat type north of LIGO Hanford Access Road.

3.1.1.2 Developed Areas

Developed areas include buildings, landscaping, roads and parking areas, and gravel lots. These areas cover 4.06 acres (16.02 percent of the project area). Developed areas lacked vegetation, except for xeriscaping around buildings. These areas were not assessed for vegetation but are mapped on Figure 3.

3.1.1.3 Russian Thistle

Non-native species, including invasive species were found in all habitat types. However, certain areas accumulated Russian thistle to the exclusion of all other vegetation except for occasional big sagebrush that had not yet succumbed. These areas were clearly evident on aerial photography and were mostly outside of the project area, although inclusions were mapped as a distinct habitat type (Figure 3). The three areas mapped as Russian thistle encompassed 0.47 acre (1.95 percent) of the project area.

The field survey noted that Russian thistle areas were always in depressions. The buildup of masses of dead Russian thistle is very slow to decompose and precludes other species from growing. This was the only habitat type that did not have cheatgrass because of the dense mat of Russian thistle.

Review of historical aerial photographs indicated that these areas are not permanent landscape features, and could be absent from a particular area for a number of years. However, the aerial photographs indicated the mapped areas had been stable since 2015.

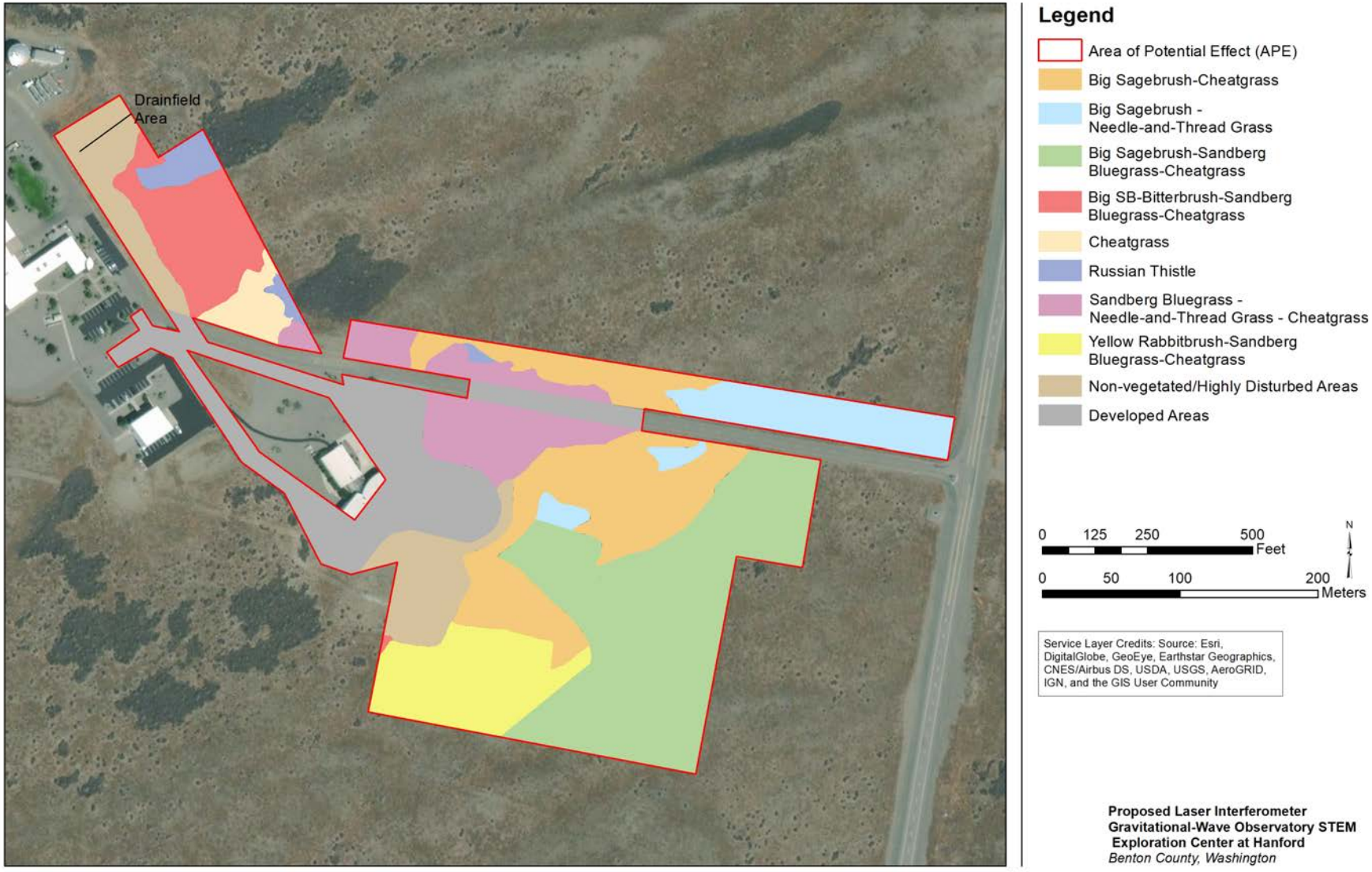


Figure 3. Vegetation Types Observed in the Project Area

3.1.2 Big Sagebrush Steppe

In the absence of disturbance and non-native species, it is likely that the entire project area would consist of Big Sagebrush-Sandberg bluegrass habitat. However, because of the presence of non-native species and reduction in cover of big sagebrush following recent fires, several distinct vegetation communities were identified and mapped. All of these habitat areas displayed evidence of additional anthropomorphic disturbance, such as presence of active or abandoned groundwater wells and limited rutting from vehicle traffic, but that disturbance was not sufficient to substantially alter the vegetation as for areas discussed previously as non-vegetated/highly disturbed areas.

3.1.2.1 Big Sagebrush-Sandberg Bluegrass-Cheatgrass

This habitat type covered the largest amount of the project area, 6.03 acres (24.61 percent of the project acre). The big sagebrush-Sandberg bluegrass-cheatgrass habitat type was limited to the eastern side of the project area and occurred on both sides of the LIGO Hanford Access Road (Figure 3). The three dominant species provided most of the overwintering persistent vegetative cover. Indian ricegrass (*Achnatherum hymenoides*) and needle-and-thread grass (*Hesperostipa comata*) occurred within this habitat type, but plants were widely scattered and never in sufficient numbers to be locally dominant. There were scattered occurrences of small patches of Carey's balsamroot (*Balsamorhiza careyana*) and western yarrow (*Achillea millefolium*). Rosettes of smoothstem blazingstar (*Mentzelia laevicaulis*) were common. Russian thistle and tall tumblemustard occurred throughout this habitat type, but scattered and in low numbers. The non-native ephemeral spring draba carpeted much of the ground and it could be considered a co-dominant species during early spring. Other spring ephemerals, including the native slender phlox (*Microsteris gracilis* var. *humilior*) and non-native jagged chickweed (*Holosteum umbellatum*), also were common, but not in numbers comparable to spring draba.

Where the big sagebrush-Sandberg bluegrass-cheatgrass habitat type approached the LIGO Hanford Access Road, Sandberg bluegrass would be replaced by crested wheatgrass, which was apparently expanding outward from where it likely was planted. Near the interface with the Yellow Rabbitbrush-Sandberg Bluegrass-Cheatgrass habitat type, a few yellow rabbitbrush (*Chrysothamnus viscidiflorus*) occurred and in the southernmost portions of this habitat type, rubber rabbitbrush (*Ericameria nauseosa*) occurred in small numbers. Rubber rabbitbrush was not observed in any other portions of the project area.

Along the LIGO Hanford Access Road, crested wheatgrass has been planted and is locally abundant. On the north side of the LIGO Hanford Access Road, tapertip onion occurred locally in large patches in areas where grass cover was reduced. This species was not observed south of LIGO Hanford Access Road.

3.1.2.2 Big Sagebrush-Needle-and-thread Grass

There were three areas mapped where needle-and-thread grass occurred as a co-dominant herbaceous species with big sagebrush. This habitat type covers 1.7 acres (6.64 percent) within the project area. Big sagebrush and needle-and-thread grass were the dominant species. Sandberg bluegrass exhibited reduced density and was not a dominant species and cheatgrass also was present. Other species included Indian ricegrass, smoothstem blazingstar, Carey's balsamroot, Russian thistle, tall tumblemustard, spring draba, slender phlox, and jagged chickweed.

This habitat type would be included in the *Artemisia tridentata* ssp. *wyomingensis*/*Hesperostipa comata* Group that is considered rare in the State of Washington and is tracked by the state. These small areas are disjunct from the nearest mapped element occurrence, which is in the northern part of LIGO Hanford.

3.1.2.3 Big Sagebrush-Cheatgrass

This habitat type was similar to the big sagebrush-Sandberg bluegrass-cheatgrass habitat type and occurred adjacent to that habitat type (Figure 3). Big sagebrush-cheatgrass was the second most abundant habitat type, covering 4.24 acres (16.41 percent of the project area). Bunchgrasses were not

present except as a minor component of the vegetation. Western yarrow, smoothstem blazingstar, Russian thistle and tall tumblemustard occurred throughout this habitat type. Spring draba was very common and other spring ephemerals included slender phlox and jagged chickweed. Carey's balsamroot was not observed in this habitat type. Along the LIGO Hanford Access Road, crested wheatgrass has been planted and is locally abundant.

3.1.2.4 Big Sagebrush-Bitterbrush-Sandberg Bluegrass-Cheatgrass

This habitat type was similar to the big sagebrush-Sandberg bluegrass-cheatgrass habitat type. Bitterbrush (*Purshia tridentata*) was added as a co-dominant shrub. Western yarrow, spring draba, Russian thistle, and tall tumblemustard were common and jagged chickweed also occurred. Indian ricegrass, Carey's balsamroot, the two rabbitbrush species, and slender phlox were not observed in this habitat type. The two areas mapped for this habitat type (Figure 3) cover 1.71 acres within the project area (6.64 percent). The two areas consist of a small portion of a larger area extending into the project area south the LIGO Hanford Access Road and a large area north of LIGO Hanford Access Road. Bitterbrush was not observed in any other habitat type in the project area.

3.1.2.5 Yellow Rabbitbrush-Sandberg Bluegrass-Cheatgrass

A fairly large area in the south-central portion of the project site, covering 2.09 acres (8.20 percent) of the project area, lacked sagebrush or bitterbrush (Figure 3). Yellow rabbitbrush was the shrub component of this area, with Sandberg bluegrass and cheatgrass, along with spring draba, providing most of the ground cover. Other herbaceous species included western yarrow, smoothstem blazingstar, Russian thistle, tall tumblemustard, spring draba, and jagged chickweed. Small amounts of rubber rabbitbrush (*Ericameria nauseosa*) occurred near the southern end of the project area. Rubber rabbitbrush was visibly more abundant to the south of the project area.

3.1.2.6 Sandberg Bluegrass-Needle-and-Thread Grass-Cheatgrass

The areas mapped for this habitat type were in the central portion of the project area, both north and south of the LIGO Hanford Access Road (Figure 3). This habitat type covered 2.21 acres (8.59 percent of the project area). This community lacked shrub species, with the three grass species being the dominant vegetation. Other herbaceous species included smoothstem blazingstar, Russian thistle, tall tumblemustard, spring draba, slender phlox, and jagged chickweed.

Along the LIGO Hanford Access Road, crested wheatgrass has been planted and is locally abundant.

3.1.2.7 Cheatgrass

One small portion of the project area covering 0.5 acre (1.95 percent of the project area) was dominated entirely by cheatgrass (Figure 3). While a few other species co-occurred, no other species occurred in sufficient numbers to be considered a co-dominant, although the ephemeral spring draba was abundant. Minor amounts of Russian thistle and tall tumblemustard were present, but no bunchgrasses were observed. Most other herbaceous species were absent or occurred only in very low numbers.

3.2 Wildlife Observations

During the field survey, Jacobs staff noted observations of wildlife or signs of wildlife. Three coyotes (*Canis latrans*) were observed moving through the project area and numerous tracks of coyote were observed. A burrow, likely belonging to an American badger (*Taxidea taxus*), was observed at the base of an electrical utility pole at the eastern edge of the project area. Small mammal burrows were observed throughout the project area, but tracks in the vicinity of the burrows were unidentifiable due to distortion from the gusty wind of both days. No other mammals or mammal signs were observed.

No reptiles were observed during the field survey.

Western meadowlark (*Sturnella neglecta*) were heard singing from shrubbery through both days of field work and occasionally sighted. Singing birds were widely spaced on the landscape. Because of the constant singing at this time of year and the spacing, it is likely that meadowlark nest in the project area and that males were establishing breeding territories at the time of survey. Common raven (*Corvus corax*) were observed flying overhead. No other avian species or signs were observed. However, other bird species will utilize the project area during other times of the year. Observations of 24 avian species have been made within 1 mile of the project area during breeding bird surveys (Table 3). These species may occur in the project area, and some of them could nest there. It also is possible that other species may nest or forage in the project area.

Wolf spiders (family Gnaphosidae) and darkling beetles (family Tenebrionidae) were observed throughout the site. No other invertebrates or signs of invertebrates were observed.

Table 3. Bird Species Observed Within 1 Mile of Project Area During Breeding Bird Surveys

Scientific Name	Common Name	Scientific Name	Common Name
Artemisiospiza nevadensis	Sagebrush sparrow	*Haemorhous mexicanus*	house finch
Buteo jamaicensis	Red-tailed hawk	*Hirundo rustic*	Barn swallow
Buteo swainsoni	Swainson's hawk	*Icterus bullockii*	Bullock's oriole
Buteo regalis	Ferruginous hawk	*Lanius ludovicianus*	Loggerhead shrike
Callipepla californica	California quail	*Numenius americanus*	Long-billed curlew
Charadrius vociferus	killdeer	*Oreoscoptes montanus*	Sage thrasher
Chondestes grammacus	Lark sparrow	*Pica hudsonia*	Black-billed magpie
Chordeiles minor	Common nighthawk	Sturnella neglecta	Western meadowlark
Corvus corvax	common raven	*Sturnus vulgaris*	European starling
Eremophila alpestris	Horned lark	*Tyrannus verticalis*	Western kingbird
Euphagus cyanocephalus	Brewer's blackbird	*Zenaida macroura*	Mourning dove
Falco sparverius	American kestrel	*Zonotrichia leucophrys*	White-crowned sparrow

Threatened and Endangered Species and Hanford Priority Species

No threatened and endangered species or Hanford priority plant species were observed during field survey because the surveys occurred prior to expression of these species. No threatened and endangered species or Hanford priority animal species were observed during field survey.

The western meadowlark, which is protected under the Migratory Bird Treaty Act, occurred throughout the project area and adjacent lands. This species was exhibiting territorial breeding behavior, with individual birds in shrubs singing almost continuously. The birds appeared to be trying to establish breeding territories or defend territories from rival males.

The suitability of observed habitats was assessed for species with potential to occur in the project area.

No federally or state endangered, threatened, sensitive, or candidate avian species were observed during the field survey. The state-threatened ferruginous hawk and three state candidate species (loggerhead shrike, sagebrush sparrow, and sage thrasher) have been observed within 1 mile of the project area

during breeding bird surveys. Raptors likely would not nest in the project area, but foraging is likely. Other avian species may forage or nest in the project area.

The burrowing owl (*Athene cunicularia*) could use the project area. However, there was no evidence of burrowing owl use at any of the small mammal burrows observed during the field survey and the species has not been observed in the project vicinity during historical surveys of breeding bird. This species is not expected to occur in the project area.

While no endangered species or Hanford priority invertebrate species were observed during the field survey, non-aquatic invertebrates, particularly lepidopterans (butterflies and moths), may occur in the project area during periods when nectar-providing plants are in bloom.

Sixteen plant species were identified with potential to occur in the project area. The likelihood of occurrence in the project area is discussed for each species.

Annual Sandwort: The field survey was too early in the season to observe plants in vegetative growth. This species typically occurs in undisturbed open rocky ground with sandy soils. There are no areas of open rocky ground within the project area. Annual sandwort is not expected to occur in the project area due to lack of habitat.

Columbia Milkvetch: The field survey was too early in the season to observe plants in vegetative growth. The site is approximately 20 miles from the nearest recorded location. All known populations are in proximity to the Columbia River and the species would not be expected in the project area, which is much farther from the Columbia River than any known populations.

Coyote Tobacco: The field survey was too early in the season to observe plants in vegetative growth. While the species typically expresses after fire, other landscape disturbance also may trigger growth. No fire has been recorded in the project area within the past two years, so fire would not have triggered expression. The anthropogenic disturbance near the LIGO Hanford facility and LIGO Hanford Access Road has resulted in reduced vegetative cover and may provide conditions suitable for this species. Overwintering stalks were not observed and would be very unlikely to make it through the winter in a condition that could be identified. While unlikely due to the lack of regular fire through the area, occurrence of this species in the project area cannot be ruled out.

Desert Dodder: Host species for this parasitic plant occur in the project area. However, there was no evidence of dodder vines from the previous year in any sagebrush or rabbitbrush within the project area. While persistence of dodder vines through the winter is poor, it is likely that the interior of some of the shrubs would have provided sufficient protection for the remnant vines to be observed. Desert dodder is not expected to occur in the project area.

Dwarf Evening Primrose: The field survey was too early in the season to observe plants in vegetative growth. This species typically occurs in open rocky ground with sandy soils. There are no areas of open rocky ground within the project area. Dwarf Evening Primrose is not expected to occur in the project area due to lack of habitat.

Geyer's Milkvetch: The field survey was too early in the season to observe plants in vegetative growth. This species occurs along the Columbia River or drainages. The nearest known population is 18 miles north of LIGO. Because the habitat is atypical for the species and the distance to the nearest population makes dispersal improbable, Geyer's milkvetch is not expected to occur in the project area.

Gray Cryptantha: The field survey was too early in the season to observe plants in vegetative growth. This species does not tolerate disturbance and occurs in destabilized sand dunes, which do not occur in the project area. Gray cryptantha would not be expected in the project area due to lack of habitat.

Great Basin Gilia: The field survey was too early in the season to observe plants in vegetative growth. This species typically occurs in open rocky ground with sandy soils. There are no areas of open rocky

ground within the project area. Great Basin gilia is not expected to occur in the project area due to lack of habitat.

Hairy Bugseed: The field survey was too early in the season to observe plants in vegetative growth. The species typically occurs in open sandy areas including dunes, but it also occurs in waste places. The anthropogenic disturbance near the LIGO facility and LIGO Hanford Access Road has resulted in reduced vegetative cover and may provide conditions suitable for this species. Overwintering stalks were not observed but recent disturbance from vehicle operation could have eliminated remnant stalks. While unlikely, occurrence of this species in the project area cannot be ruled out.

Miner's Candle: The field survey was too early in the season to observe plants in vegetative growth. This species typically occurs in open rocky ground with sandy soils. There are no areas of open rocky ground within the project area. Miner's candle is not expected to occur in the project area due to lack of habitat.

Rosy Pussypaws: Commonly associated species occur in the project area and the habitat is suitable for this species. The survey was conducted before this species would typically begin growth. The nearest known population is 13 miles north of LIGO and the distance to the nearest population makes dispersal improbable. While unlikely, occurrence of this species in the project area cannot be ruled out.

Small-flower Evening Primrose: The field survey was too early in the season to observe plants in vegetative growth. This species typically occurs in open rocky ground with sandy soils. There are no areas of open rocky ground within the project area. Small-flower evening primrose is not expected to occur in the project area due to lack of habitat.

Snake River Cryptantha: Commonly associated species occur in the project area. The survey was conducted before this species would typically begin growth. However, Snake River cryptantha typically occurs in stony soils and soils in the project area are not stony. Because the habitat is not suitable, the species is not expected to occur.

Snowball Cactus: This species does not occur in the project area. While the habitat is marginally suitable for the species, no cacti of any type, including ball cacti, were observed during survey.

Tufted Evening Primrose: The field survey was too early in the season to observe plants in vegetative growth. This species typically occurs in open rocky ground with sandy soils. There are no areas of open rocky ground within the project area. Tufted evening primrose is not expected to occur in the project area due to lack of habitat.

White Eatonella: The field survey was too early in the season to observe plants in vegetative growth. This species typically occurs in open rocky ground with sandy soils. There are no areas of open rocky ground within the project area. White eatonella is not expected to occur in the project area due to lack of habitat.

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Appendix A
Plant List

Scientific Name	Common Name	Habitat Associations
Achillea millefolium	Western yarrow	Big Sagebrush-Sandberg Bluegrass-Cheatgrass, Big Sagebrush-Cheatgrass, Yellow Rabbitbrush-Sandberg Bluegrass-Cheatgrass
Achnatherum hymenoides	Indian ricegrass	Big Sagebrush-Needle-and-thread Grass, Big Sagebrush-Sandberg Bluegrass-Cheatgrass
Agropyron cristatum/desortorium	Crested wheatgrass *	Off-Road Vehicle Traffic Areas, Big Sagebrush-Needle-and-thread Grass, Big Sagebrush-Sandberg Bluegrass-Cheatgrass, Big Sagebrush-Cheatgrass, Sandberg Bluegrass-Cheatgrass
Allium acuminatum	Tapertip onion	Limited to north side of the LIGO Hanford Access Road in Off-Road Vehicle Traffic Areas, Big Sagebrush-Sandberg Bluegrass-Cheatgrass
Artemisia tridentata	Big sagebrush	Drainfield Area, Off-Road Vehicle Traffic Areas, Russian Thistle, Big Sagebrush-Needle-and-thread Grass, Big Sagebrush-Sandberg Bluegrass-Cheatgrass, Big Sagebrush-Cheatgrass, Big Sagebrush-Bitterbrush-Sandberg Bluegrass-Cheatgrass
Balsamorhiza careyana	Carey's balsamroot	Big Sagebrush-Needle-and-thread Grass, Big Sagebrush-Sandberg Bluegrass-Cheatgrass
Bromus tectorum	Cheatgrass *	Drainfield Area, Off-Road Vehicle Traffic Areas, Big Sagebrush-Needle-and-thread Grass, Big Sagebrush-Sandberg Bluegrass-Cheatgrass, Big Sagebrush-Cheatgrass, Big Sagebrush-Bitterbrush-Sandberg Bluegrass-Cheatgrass, Sandberg Bluegrass-Needle-and-thread Grass-, Cheatgrass
Chorispora tenella	crossflower	Drainfield Area, Off-Road Vehicle Traffic Areas,
Chrysothamnus viscidiflorus	Yellow rabbitbrush	Big Sagebrush-Sandberg Bluegrass-Cheatgrass, Yellow Rabbitbrush-Sandberg Bluegrass-Cheatgrass
Draba verna	Spring draba *	Drainfield Area, Off-Road Vehicle Traffic Areas, Big Sagebrush-Needle-and-thread Grass, Big Sagebrush-Sandberg Bluegrass-Cheatgrass, Big Sagebrush-Cheatgrass, Big Sagebrush-Bitterbrush-Sandberg Bluegrass-Cheatgrass, Sandberg Bluegrass-Needle-and-thread Grass-Cheatgrass, Cheatgrass
Ericameria nauseosa	Rubber rabbitbrush	Yellow Rabbitbrush-Sandberg Bluegrass-Cheatgrass
Hesperostipa comata	Needle-and-thread grass	Big Sagebrush-Needle-and-thread Grass, Sandberg Bluegrass-Needle-and-thread Grass-Big Sagebrush-Sandberg Bluegrass-Cheatgrass,

Scientific Name	Common Name	Habitat Associations
Holosteum umbellatum	Jagged chickweed *	Big Sagebrush-Needle-and-thread Grass, Big Sagebrush-Sandberg Bluegrass-Cheatgrass, Big Sagebrush-Cheatgrass, Big Sagebrush-Bitterbrush-Sandberg Bluegrass-Cheatgrass, Sandberg Bluegrass-Needle-and-thread Grass-, Cheatgrass
Mentzelia laevicaulis	Smoothstem blazingstar	Big Sagebrush-Needle-and-thread Grass, Big Sagebrush-Sandberg Bluegrass-Cheatgrass, Big Sagebrush-Cheatgrass, Big Sagebrush-Bitterbrush-Sandberg Bluegrass-Cheatgrass, Sandberg Bluegrass-Needle-and-thread Grass-, Cheatgrass
Microsteris gracilis var. humilior	Slender phlox	Big Sagebrush-Needle-and-thread Grass, Big Sagebrush-Sandberg Bluegrass-Cheatgrass, Big Sagebrush-Cheatgrass, Big Sagebrush-Bitterbrush-Sandberg Bluegrass-Cheatgrass, Sandberg Bluegrass-Needle-and-thread Grass-
Poa secunda	Sandberg bluegrass	Big Sagebrush-Sandberg Bluegrass-Cheatgrass, Big Sagebrush-Cheatgrass, Big Sagebrush-Bitterbrush-Sandberg Bluegrass-Cheatgrass, Sandberg Bluegrass-Needle-and-thread Grass-, Cheatgrass
Purshia tridentata	Bitterbrush	Big Sagebrush-Bitterbrush-Sandberg Bluegrass-Cheatgrass
Salsola tragus	Russian thistle *	all
Sisymbrium altissimum	Tall tumblemustard *	Drainfield Area, Off-Road Vehicle Traffic Areas, Big Sagebrush-Needle-and-thread Grass, Big Sagebrush-Sandberg Bluegrass-Cheatgrass, Big Sagebrush-Cheatgrass, Big Sagebrush-Bitterbrush-Sandberg Bluegrass-Cheatgrass, Sandberg Bluegrass-Needle-and-thread Grass-, Cheatgrass

* Non-native species

Appendix B
Site Photographs

Achillea millefolium

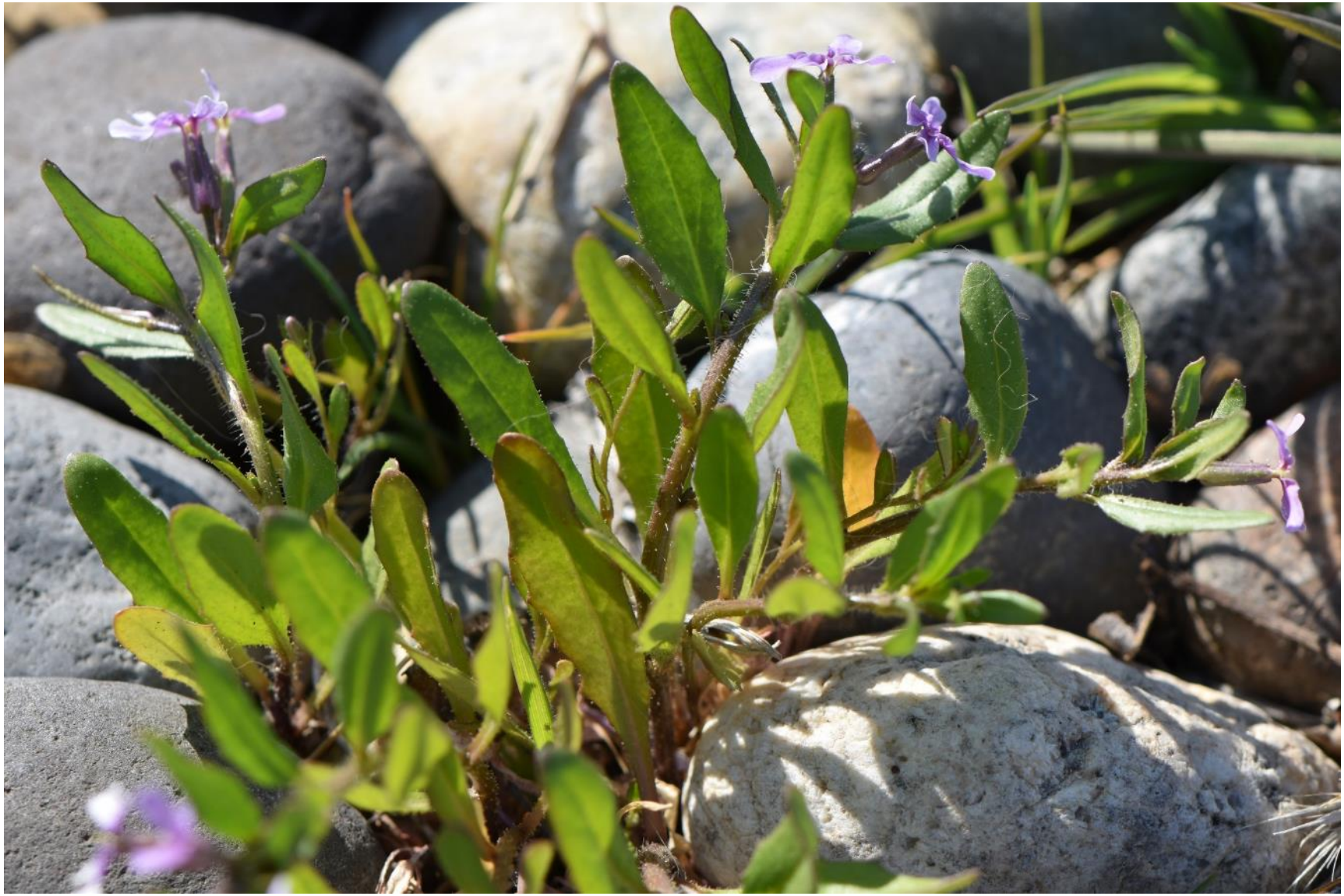
Achnatherum hymenoides

Allium acuminatum

Artemisia tridentata

Balsamorhiza careyana

Bromus tectorum



Chorispora tenella

Chrysothamnus viscidiflorus

Draba verna

Hesperostipa comata

Holosteum umbellatum

Mentzelia laevicaulis

Microsteris gracilis var. *humilior*

Purshia tridentata

Salsola tragus

Sisymbrium altissimum

Typical Russian Thistle Habitat Type

Transition from Big Sagebrush-Cheatgrass to Yellow Rabbitbrush-Sandberg Bluegrass-Cheatgrass

Cheatgrass Habitat Type

Typical Unpaved Disturbed Area

Typical Off Road Vehicle Traffic Area

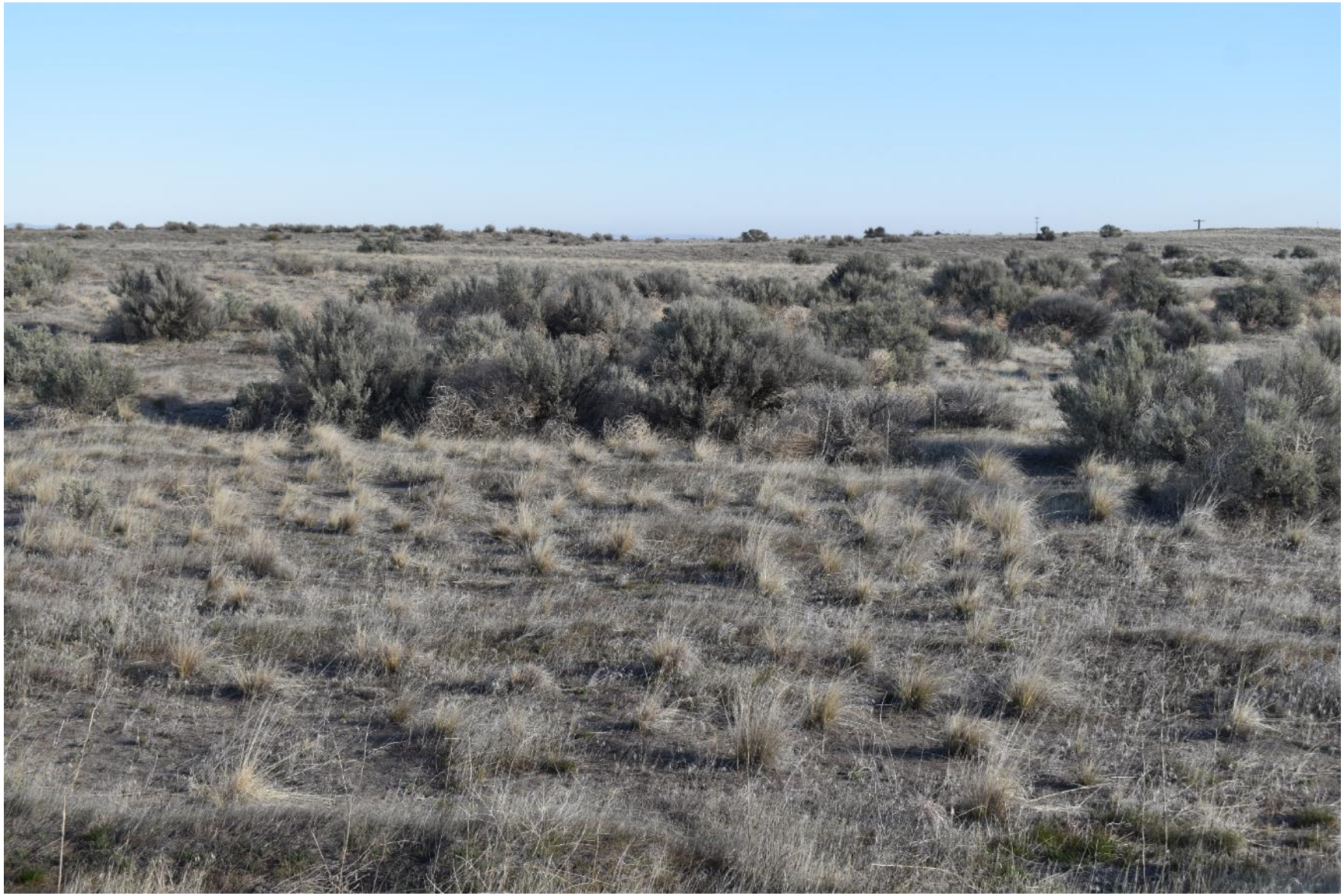
Drainfield Area

Transition from Crested wheatgrass dominated area adjacent to LIGO Access Road to Big Sagebrush-Sandberg Bluegrass-Cheatgrass

Disturbed Area Adjacent to LIGO Access Road

Sandberg Bluegrass-Needle-and-thread Grass-Cheatgrass

Big Sagebrush-Sandber Bluegrass-Cheatgrass



Big Sagebrush-Needle-and-thread Grass

Transition from Off Road Vehicle Traffic Area to Big Sagebrush-Bitterbrush-Sandberg Bluegrass-Cheatgrass

Typical minor disturbance – includes off road vehicle access

APPENDIX B

NHPA Section 106 Correspondence

NATIONAL SCIENCE FOUNDATION
2415 Eisenhower Avenue
Alexandria, Virginia 22314

February 7, 2020

Dr. Allyson Brooks
State Historic Preservation Officer / Director
Dept of Archaeology and Historic Preservation
PO Box 48343
Olympia, WA 98504-8343

Re: Section 106 consultation initiation; proposed Area of Potential Effects; notice of upcoming informational meeting and cultural resource survey (DAHP Identification number pending)

Dear Dr. Brooks,

With this letter, the National Science Foundation (NSF) seeks to inform you of a proposed federal undertaking and to initiate Section 106 consultation, per the National Historic Preservation Act. We also invite your comments on the proposed Area of Potential Effects (APE) and your participation at an upcoming informational meeting and cultural resources survey, as described below. NSF is the lead agency for this undertaking. Because the proposed undertaking would occur on federal land administered by the Department of Energy (DOE), DOE is providing support and the two agencies will coordinate closely on this consultation. Concurrent to this letter, NSF has notified tribes about the proposal and the upcoming meeting and survey.

Background

The Laser Interferometer Gravitational-Wave Observatory (LIGO) is a national facility for gravitational-wave research and consists of two interferometers, located in Livingston, Louisiana and Hanford, Washington. LIGO operation is funded by NSF and operated by the

California Institute of Technology (CalTech) and the Massachusetts Institute of Technology (MIT). The interferometer in Hanford (LIGO Hanford) is located on land owned by the United States and administered by DOE. Per its 1993 Memorandum of Understanding (MOU) with DOE, NSF has a permit to use the site for LIGO.

Proposed LIGO Exploration Center

In 2019, CalTech received a grant for $7.7 million from the State of Washington to construct a LIGO STEM Observatory adjacent to the interferometer, in Richland, WA. CalTech has begun design work for this facility, calling it the LIGO Stem Exploration Center (LExC) and proposes to begin construction in October 2020. LExC has the potential to complement and enhance the existing Education and Public Outreach component of NSF's award for the operations of LIGO Hanford. NSF, as the permit holder, is therefore considering whether to authorize Caltech to construct and operate LExC within the boundaries of the land described in the permit issued by DOE. Pursuant to the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act, NSF will conduct a review of potential environmental impacts of this proposal. NSF intends to conduct Section 106 consultation concurrent with the NEPA process.

Proposed Area of Potential Effects

The proposed LExC would be constructed east of the existing parking lot along the current access road to LIGO (see attached plan). The visitor center would include construction of a new 234, 227 f^2 building and associated infrastructure including water/sewer utilities, electrical service and telecommunications connection. All utilities would be extended from existing services at the LIGO. LExC construction activities would require excavation to support utilities installation and grading as needed for construction of a parking lot. The project area is approximately 14.7 acres.

NSF proposes to include the full project area, as shown in the enclosed, as the Area of Potential Effects (APE) for the determination of potential effects to historic properties. This is the area that would contain all proposed development, as well as staging and construction vehicles. LExC operations would be limited to this area. Following input from your office and the tribes, NSF will refine the APE document in response to any comments received; place it on the relevant USGS quad map; and indicate the locations of the proposed facilities, related staging area, and utilities on the final APE document. NSF will also consider your comments in refining the scope of the cultural resource survey.

Informational Meeting

CalTech will be presenting information about the proposed LExC at DOE's February meeting with the SHPO and tribes; due to travel constraints, NSF will be available by phone to hear about any concerns and to address questions about NSF's role and the Section 106 consultation process. Further information about the February meeting is provided below:

Date: February 19, 2020
Location: 2420 Stevens Place, Richland WA
Time and teleconference option will be included on the agenda provided by DOE.

Upcoming Cultural Resource Survey

NSF has engaged a contractor, Jacobs Engineering, Inc., to perform the cultural resource survey that will be needed to identify any historic properties within the APE. We expect that the survey will occur in late February or the first part of March. We will be in touch, via email, with you and the tribes with the dates for the survey, as well as the survey methodology, so that you may provide input on how to adequately identify any historic properties within the APE. You are also invited to observe the survey.

In summary, please review this preliminary information on the proposed LExC, and provide us with any comments you may have on the proposed APE on or before **Friday, February 21, 2020**. Comments should be forwarded via email to Kristen Hamilton at krihamil@nsf.gov. If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to your response.

Sincerely,

Caroline M. Blanco

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
National Science Foundation

Cc (via email): Warren Hurely and So Yon Bedlington, DOE
Rob Whitlam, SHPO
Arrow Coyote, Confederated Tribes of the Colville Reservation
Bambi Rodriguez, Nathan May, and Teara Farrow Ferman, Confederated Tribes of the Umatilla Indian Reservation
Mike Sobotta, Josiah Pinkman, Lucy Samuels, Jared Norman, and Jessica Glindeman, Nez Perce Tribe
Rose Ferri, and Laurene Contreras, Yakama Nation
Rex Buck and Alyssa Buck, Wanapum
Keith Mendez, MSA Cultural Resources, Cultural Resource Program Database Manager for the Hanford Site

Attachments:

- Proposed LExC site overview
- Proposed LExC site plan
- Proposed APE

Allyson Brooks Ph.D., Director
State Historic Preservation Officer

February 10, 2020

Ms. Caroline M. Blanco
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314

RE: LIGO STEM Observatory Project
Log No.: 2020-02-01140-NRCS

Dear Ms. Blanco:

Thank you for contacting our Department. We have reviewed the materials you provided for the Area of Potential Effect (APE) for the proposed LIGO STEM Observatory Project at Hanford, Benton County, Washington.

We concur with your proposed Area of Potential Effect (APE) as described and presented in the letter, figures, and text.

We look forward to receiving the results of your tribal consultations, professional cultural resources survey report, and the Determination of Effect.

We would also appreciate receiving any correspondence or comments from concerned tribes or other parties that you receive as you consult under the requirements of 36CFR800.4(a)(4).

These comments are based on the information available at the time of this review and on behalf of the State Historic Preservation Officer in compliance with the Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations 36CFR800.4.). Should additional information become available, our assessment may be revised.

Thank you for the opportunity to comment and we look forward to the results of your efforts and your Determination of Effect.

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(360) 586-3080
email: *rob.whitlam@dahp.wa.gov*

Subject: [Comments requested by 2/21/20] Proposed Exploration Center at the Laser Interferometer Gravitational Observatory (LIGO) Site, Benton County, Washington

Date: Friday, February 7, 2020 at 1:58:51 PM Eastern Standard Time

From: Hamilton, Kristen

To: rob.whitlam@dahp.wa.gov, rbuck@gcpud.org, abuck1@gcpud.org, BambiRodriguez@ctuir.org, Arrow.Coyote@colvilletribes.com, NathanMay@ctuir.org, TearaFarrowFerman@ctuir.org, Mikes@nezperce.org, josiahp@nezperce.org, lucys@nezperce.org, jaredn@nezperce.org, jessicag@nezperce.org, rferri@ynerwm.com, tsherwood@ynerwm.com, laurene_contreras@yakama.com

CC: Bedlington, So Yon, keith_m_mendez@rl.gov, RLCulturalResources@rl.gov, Hurley, Warren F, Blanco, Caroline M, Coles, Mark W., Landry, Michael R., Rau, Michelle/TPA

Attachments: NSF LIGO SHPO LETTER.2.7.20.pdf, LExC eclosure.zip

Good morning,

Please see the attached letter, which provides information about a proposed undertaking, including notification of an information session about the project, a draft proposed Area of Potential Effects (APE), and a heads-up on an upcoming cultural resource survey that you are invited to observe. We invite your comment on the proposed APE (see enclosures). Note that the proposed APE is being shared now so that we can solicit your input and refine the scope of our upcoming survey. In the next stage, the APE will be adjusted to clearly depict how the APE encompasses the proposed project site plan. Further, NSF will be uploading the APE, once revised, into WISAARD to establish a DAHP identification number.

Please provide any written comments to krihamil@nsf.gov on or before Friday, February 21, 2020.

We look forward to consulting with you on this proposed project.

Thank you,
Kristen Hamilton

***

Kristen Hamilton
Environmental Compliance Officer
Office of the General Counsel
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314
(793)292-4820
krihamil@nsf.gov

Subject: [EXTERNAL] - RE: [Comments requested by 2/21/20] Proposed Exploration Center at the Laser Interferometer Gravitational Observatory (LIGO) Site, Benton County, Washington

Date: Friday, February 21, 2020 at 5:19:33 PM Eastern Standard Time

From: Rose Ferri

To: Hamilton, Kristen

CC: Trina Sherwood, Laurene Contreras, laurene_contreras@yakama.com, Luciana Chester, Whitlam, Rob (DAHP), Hurley, Warren F

Kristen
YN ERWM has no concerns with this APE as described. We look forward to continued consultation on this project.
Please send us the assigned HCRC number. Keith stated in our meeting this week he had assigned one for this project.
Thank you

Yakama Nation ERWM Cultural Staff
Rose Ferri, Trina Sherwood, and Luciana Chester

From: Hamilton, Kristen <KRIHAMIL@nsf.gov>
Sent: Friday, February 7, 2020 10:59 AM
To: rob.whitlam@dahp.wa.gov; rbuck@gcpud.org; abuck1@gcpud.org; BambiRodriguez@ctuir.org; Arrow.Coyote@colvilletribes.com; NathanMay@ctuir.org; TearaFarrowFerman@ctuir.org; Mikes@nezperce.org; josiahp@nezperce.org; lucys@nezperce.org; jaredn@nezperce.org; jessicag@nezperce.org; Rose Ferri <rferri@ynerwm.com>; Trina Sherwood <tsherwood@ynerwm.com>; laurene_contreras@yakama.com
Cc: Bedlington, So Yon <so.bedlington@rl.doe.gov>; keith_m_mendez@rl.gov; RLCulturalResources@rl.gov; Hurley, Warren F <Warren.Hurley@rl.doe.gov>; Blanco, Caroline M <cblanco@nsf.gov>; Coles, Mark W. <mcoles@nsf.gov>; Landry, Michael R. <mlandry@caltech.edu>; Rau, Michelle/TPA <Michelle.Rau@jacobs.com>
Subject: [Comments requested by 2/21/20] Proposed Exploration Center at the Laser Interferometer Gravitational Observatory (LIGO) Site, Benton County, Washington

Good morning,

Please see the attached letter, which provides information about a proposed undertaking, including notification of an information session about the project, a draft proposed Area of Potential Effects (APE), and a heads-up on an upcoming cultural resource survey that you are invited to observe. We invite your comment on the proposed APE (see enclosures). Note that the proposed APE is being shared now so that we can solicit your input and refine the scope of our upcoming survey. In the next stage, the APE will be adjusted to clearly depict how the APE encompasses the proposed project site plan. Further, NSF will be uploading the APE, once revised, into WISAARD to establish a DAHP identification number.

Please provide any written comments to krihamil@nsf.gov on or before Friday, February 21, 2020.

We look forward to consulting with you on this proposed project.

Thank you,
Kristen Hamilton

***

Kristen Hamilton
Environmental Compliance Officer
Office of the General Counsel
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314
(793)292-4820
krihamil@nsf.gov

Subject: [EXTERNAL] - RE: [Comments requested by 2/21/20] Proposed Exploration Center at the Laser Interferometer Gravitational Observatory (LIGO) Site, Benton County, Washington

Date: Friday, February 21, 2020 at 7:04:22 PM Eastern Standard Time

From: Lucy Samuels

To: Hamilton, Kristen

CC: Maurita Oatman, Michael Sobotta, Jessica Glindeman, Jared Norman

Good afternoon Kristen,

The Nez Pece Tribe Hanford Cultural Resources (HCR) has reviewed the LIGO Hanford LExC Expansion, and we have a few questions regarding the project. First, we noticed the APE doesn't completely measure up accurately. In the maps provided, the APE boundary extends further southward, compared to the construction staging area pushing/utilizing space on the eastward boundary line. Although the APE boundary is 800' x 800', the dimensions should be presented accurately for space planned to be used; and if there is unused area(s) accounted towards the south end of the APE boundary, it cannot be compensated or applied to the spaced used on the eastern side of the APE boundary. Along those same lines, what other construction activities are being planned throughout the LIGO campus? For example, the lines connecting the new building to the four black boxes/buildings at the bottom of the site plan map? Has a construction plan been identified about which construction activities will be completed first and which can occur last? Furthermore, if Caltech is found not to be considered for construction and operation, will a contract be open for bids to build and operate the LExC? How will NSF choose construction and operation entities for the LExC? Lastly, the Nez Pece Tribe HCR would like to participate in the survey rather than "observe" survey activities.

Thank you and have a nice weekend!

-LS

Lucy Samuels
Hanford Cultural Resources Tech. II
Nez Perce Tribe
lucys@nezperce.org
(O) 208.621.3762
(C) 208.791.7954

From: Hamilton, Kristen <KRIHAMIL@nsf.gov>
Sent: Friday, February 7, 2020 10:59 AM
To: rob.whitlam@dahp.wa.gov; rbuck@gcpud.org; abuck1@gcpud.org; BambiRodriguez@ctuir.org; Arrow.Coyote@colvilletribes.com; NathanMay@ctuir.org; TearaFarrowFerman@ctuir.org; Michael Sobotta <mikes@nezperce.org>; Josiah Pinkham <josiahp@nezperce.org>; Lucy Samuels <lucys@nezperce.org>; Jared Norman <jaredn@nezperce.org>; Jessica Glindeman <jessicag@nezperce.org>; rferri@ynerwm.com; tsherwood@ynerwm.com; laurene_contreras@yakama.com
Cc: Bedlington, So Yon <so.bedlington@rl.doe.gov>; keith_m_mendez@rl.gov; RLCulturalResources@rl.gov; Hurley, Warren F <Warren.Hurley@rl.doe.gov>; Blanco, Caroline M <cblanco@nsf.gov>; Coles, Mark W. <mcoles@nsf.gov>; Landry, Michael R. <mlandry@caltech.edu>; Rau, Michelle/TPA <Michelle.Rau@jacobs.com>
Subject: [Comments requested by 2/21/20] Proposed Exploration Center at the Laser Interferometer Gravitational Observatory (LIGO) Site, Benton County, Washington

Good morning,

Please see the attached letter, which provides information about a proposed undertaking, including notification of an information session about the project, a draft proposed Area of Potential Effects (APE), and a heads-up on an upcoming cultural resource survey that you are invited to observe. We invite your comment on the proposed APE (see enclosures). Note that the proposed APE is being shared now so that we can solicit your input and refine the scope of our upcoming survey. In the next stage, the APE will be adjusted to clearly depict how the APE encompasses the proposed project site plan. Further, NSF will be uploading the APE, once revised, into WISAARD to establish a DAHP identification number.

Please provide any written comments to krihamil@nsf.gov on or before Friday, February 21, 2020.

We look forward to consulting with you on this proposed project.

Thank you,
Kristen Hamilton

***

Kristen Hamilton
Environmental Compliance Officer
Office of the General Counsel
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314
(793)292-4820
krihamil@nsf.gov

Subject: Proposed LExC Building at LIGO-Hanford: HCRC Number
Date: Monday, February 24, 2020 at 10:29:10 AM Eastern Standard Time
From: Blanco, Caroline M
To: rferri@ynerwm.com, tsherwood@ynerwm.com, lcontreras@ynerwm.com, laurene_contreras@yakama.com, lChester@ynerwm.com
CC: Whitlam, Rob (DAHP), Hurley, Warren F, Mendez, Keith M, Hamilton, Kristen, Rau, Michelle/TPA

Dear Rose, Trina, and Luciana,

It was a pleasure participating in last week's call with you regarding the proposed LExC building at LIGO-Hanford. By this message, I am following-up on your email from last Friday, February 21st, in which you indicated that the Yakama Nation ERWM Cultural Staff has no concerns with the proposed Area of Potential Effects for the proposed LExC building that was described in our correspondence to you. Thank you for your response.

I am also responding to your question about the HCRC number that was assigned to this matter. According to the information provided by Keith Mendez during our call, that number is HCRC 2020-600-004. (I am copying Keith on this message in case I incorrectly wrote that number down.)

Thank you, again, and Kristen and I look forward to our continued consultation with you on this matter.

Best regards,

Caroline

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
National Science Foundation
Tel: 703.292.4592
Email: cblanco@nsf.gov

Subject: Proposed Exploration Center at the Laser Interferometer Gravitational Observatory (LIGO) Site, Benton County, Washington
Date: Tuesday, February 25, 2020 at 7:21:01 PM Eastern Standard Time
From: Blanco, Caroline M
To: Lucy Samuels
CC: MauritaO@nezperce.org, mikes@nezperce.org, jessicag@nezperce.org, jaredn@nezperce.org, Hamilton, Kristen
Attachments: Attach 2.NSF LExC site plan .pdf, Attach 3.NSF LEXC Proposed APE.pdf

Dear Lucy,

Thank you for your message (dated February 21, 2020) to Kristen in response to our request for comments on the Area of Potential Effects (APE). In your message, you raised several issues, which I have attempted to address below. If, however, after reviewing my responses, you believe I have misunderstood your questions or concerns, or, if you would like to discuss any issues further, I would be more than happy to schedule a call with you so that we can talk through any outstanding questions or concerns. Below are the issues you raised in your recent message and my responses to them:

Issue: "First, we noticed the APE doesn't completely measure up accurately. In the maps provided, the APE boundary extends further southward, compared to the construction staging area pushing/utilizing space on the eastward boundary line. Although the APE boundary is 800' x 800', the dimensions should be presented accurately for space planned to be used; and if there is unused area(s) accounted towards the south end of the APE boundary, it cannot be compensated or applied to the spaced used on the eastern side of the APE boundary."
Response: The map depicting the APE (attached) includes a box that is 800' X 800' (14.7 acres), which covers the area to be used for: 1) the contractor parking and laydown area; 2) the proposed LExC Building, including the tunnel that extends westward to existing structures; and 3) the parking spaces associated with the proposed LExC Building. The Site Plan map (also attached) does include a rectangular box, however, that rectangular box is not intended to represent the APE; rather, it is only on the Site Plan to show where the contractor parking and laydown area are located. To the south and west of that rectangular box on the Site Plan map are drawings of the proposed LExC Building and the associated parking spaces. Also included on the Site Plan map are several existing structures at the LIGO-Hanford site that are located to the west of the proposed LExC Building. The APE depicted on the APE map is designed to be inclusive of all areas intended to be used for the proposed construction (i.e., the contractor parking and laydown area; the proposed LExC Building, itself; the tunnel to the existing structures; and the associated parking spaces). While not intended to create confusion, our 800' X 800' APE includes all of the areas to be used for the proposed construction plus additional buffer space.

Issue: "Along those same lines, what other construction activities are being planned throughout the LIGO campus?For example, the lines connecting the new building to the four black boxes/buildings at the bottom of the site plan map? Has a construction plan been identified about which construction activities will be completed first and which can occur last?"

Response: You may recall that over the past year, two construction projects were approved at the LIGO-Hanford site: 1) the A+ Upgrade, designed to extend the existing laboratory by installing a new beamtube attached to the existing Y arm beamtube and an associated new end station; and 2) the addition of wind fences at the end stations of the two arms of the LIGO-Hanford facility. Other than the proposed LExC Building, I am unaware of any other construction activities planned throughout the LIGO campus. The "lines" connecting the proposed LExC Building to the existing structures at the bottom of the Site Plan map that you mentioned in your email are actually a tunnel designed to connect the proposed LExC Building to the existing structures at the site and is part of the proposed LExC project. At this juncture, I do not know the status of the construction of the A+ Upgrade or the wind fences, however, if you wish, I can find out what the status is of those projects. As Dr. Landry mentioned in our meeting last week, construction of

the proposed LExC Building would begin in October of this year, if approved.

Issue: "Furthermore, if Caltech is found not to be considered for construction and operation, will a contract be open for bids to build and operate the LExC? How will NSF choose construction and operation entities for the LExC?"

Response: Caltech is the awardee of a state grant to construct the proposed LExC Building. NSF's role is not to fund the construction of the proposed building; rather, NSF has a permit from the landowner (the U.S. Department of Energy) authorizing the LIGO-Hanford facility to be located at the site. As the permittee, NSF will, after completing its environmental reviews, determine whether or not to approve the construction of the LExC Building at the LIGO-Hanford facility. Caltech, as the recipient of the state grant money, will be the entity conducting the procurement process for the construction of the LExC Building (if it is approved), and will also be the entity to select the winning bid. Caltech, as the operator of the LIGO-Hanford facility (pursuant to an NSF award), will also be the operator of the LExC, if it is approved.

Issue: "Lastly, the Nez Pece Tribe HCR would like to participate in the survey rather than "observe" survey activities."

Response: NSF has hired an environmental contractor to conduct the survey activities, however, we would welcome the input of the Nez Pece Tribe HCR during those survey activities.

Thank you, again, for your email from last Friday regarding the issues mentioned above. I hope that my responses provided in this message addresses those issues. If you have any remaining questions or concerns, please do not hesitate to contact me and I would be more than happy to have a conversation with you to help resolve any outstanding issues.

Best regards,

Caroline

Caroline M. Blanco
Tribal Liaison
Federal Preservation Officer
Assistant General Counsel
National Science Foundation
Tel: 703.292.4592
Email: cblanco@nsf.gov

Subject: March 18 survey- Proposed Exploration Center at LIGO Hanford

Date: Friday, March 6, 2020 at 3:18:54 PM Eastern Standard Time

From: Hamilton, Kristen

To: rob.whitlam@dahp.wa.gov, rbuck@gcpud.org, abuck1@gcpud.org, BambiRodriguez@ctuir.org, Arrow.Coyote@colvilletribes.com, NathanMay@ctuir.org, TearaFarrowFerman@ctuir.org, Mikes@nezperce.org, josiahp@nezperce.org, lucys@nezperce.org, jaredn@nezperce.org, jessicag@nezperce.org, rferri@ynerwm.com, tsherwood@ynerwm.com, laurene_contreras@yakama.com

CC: Blanco, Caroline M, RLCulturalResources@rl.gov, Hurley, Warren F, Sheldon, David/PDX, Bedlington, So Yon, Rau, Michelle/TPA

Good afternoon, the National Science Foundation invites you to participate in the following survey. Please confirm attendance at least a day ahead of the field work.

Project:	NSF LIGO Facility Proposed STEM Exploration Center
Project Type	Section 106 Cultural Survey (Pedestrian Survey Only)
LIGO Contact:	Jeffrey Jones, LIGO Operations Manager (509)438-0823
Field Contact:	David Sheldon, Jacobs Archaeologist (360)219-6953
Where to meet:	LIGO Lab Support Building, check in at front desk Driving directions: https://www.ligo.caltech.edu/WA/page/lho-directions-contact
What time to meet:	7:45 AM March 18, 2020
What to bring:	Substantial footwear for field survey, safety vest, water and a lunch.
Additional Information:	If you plan on attending please confirm with David S eldon via phone or text at least one day in advance of the fieldwork.

Kristen Hamilton
Environmental Compliance Officer
Office of the General Counsel
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314
(793)292-4820
krihamil@nsf.gov

From:	Rose Ferri
To:	Kristen Hamilton; rob.whitlam@dahp.wa.gov; rbuck@gcpud.org; abuck1@gcpud.org; BambiRodriguez@ctuir.org; Arrow.Coyote@colvilletribes.com; NathanMay@ctuir.org; TearaFarrowFerman@ctuir.org; Mikes@nezperce.org; josiahp@nezperce.org; lucys@nezperce.org; jaredn@nezperce.org; jessicag@nezperce.org; Trina Sherwood; laurene_contreras@yakama.com; Luciana Chester
Cc:	Blanco, Caroline M; RLCulturalResources@rl.gov; Hurley, Warren F; Sheldon, David/PDX; Bedlington, So Yon; Rau, Michelle/TPA
Subject:	[EXTERNAL] RE: March 18 survey- Proposed Exploration Center at LIGO Hanford
Date:	Friday, March 6, 2020 3:09:44 PM

Kristen

Yakama nation would like to participate in this work however it has been scheduled during our regular monthly Cultural Issues meeting. The third week of the month is when we have standing meetings with DOE, BPA, PNSO, FWS. I am not sure if this could be accommodated, but it would be nice if it could.

Thank you

Rose

Rose Ferri MS
Project Tracking/Resource Analyst
1019 S 40th Ave
Yakima, WA 98908
Direct line 509-907-1500
Cell 509-307-2009

From: Hamilton, Kristen <KRIHAMIL@nsf.gov>
Sent: Friday, March 6, 2020 12:19 PM
To: rob.whitlam@dahp.wa.gov; rbuck@gcpud.org; abuck1@gcpud.org; BambiRodriguez@ctuir.org; Arrow.Coyote@colvilletribes.com; NathanMay@ctuir.org; TearaFarrowFerman@ctuir.org;

Mikes@nezperce.org; josiahp@nezperce.org; lucys@nezperce.org; jaredn@nezperce.org; jessicag@nezperce.org; Rose Ferri <rferri@ynerwm.com>; Trina Sherwood <tsherwood@ynerwm.com>; laurene_contreras@yakama.com
Cc: Blanco, Caroline M <cblanco@nsf.gov>; RLCulturalResources@rl.gov; Hurley, Warren F <Warren.Hurley@rl.doe.gov>; Sheldon, David/PDX <David.Sheldon@jacobs.com>; Bedlington, So Yon <so.bedlington@rl.doe.gov>; Rau, Michelle/TPA <Michelle.Rau@jacobs.com>
Subject: March 18 survey- Proposed Exploration Center at LIGO Hanford

Good afternoon, the National Science Foundation invites you to participate in the following survey. Please confirm attendance at least a day ahead of the field work.

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What time to meet:	7:45 AM March 18, 2020
What to bring:	Substantial footwear for field survey, safety vest, water and a lunch.
Additional Information:	If you plan on attending please confirm with David Sheldon via phone or text at least one day in advance of the fieldwork.

Kristen Hamilton
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From:	Hamilton, Kristen
To:	rob.whitlam@dahp.wa.gov; rbuck@gcpud.org; abuck1@gcpud.org; BambiRodriguez@ctuir.org; Arrow.Coyote@colvilletribes.com; NathanMay@ctuir.org; TearaFarrowFerman@ctuir.org; Mikes@nezperce.org; josiahp@nezperce.org; lucys@nezperce.org; jaredn@nezperce.org; jessicag@nezperce.org; rferri@ynerwm.com; tsherwood@ynerwm.com; laurene_contreras@yakama.com; LChester@ynerwm.com
Cc:	Blanco, Caroline M; RLCulturalResources@rl.gov; Hurley, Warren F; Sheldon, David/PDX; Bedlington, So Yon; Rau, Michelle/TPA
Subject:	[EXTERNAL] Re: March 18 survey- Proposed Exploration Center at LIGO Hanford
Date:	Friday, March 13, 2020 3:47:26 AM

Good morning, we've confirmed that David Sheldon, Jacobs Archaeologist, is still able to travel to conduct the cultural resources survey at LIGO next week. In the meantime, however, it's come to our attention that the scheduled date of Wednesday, March 18th, conflicts with the monthly standing DOE cultural resources meeting. To avoid this certain conflict, we have rescheduled this survey for Tuesday, March 17th, see below notice. For those who have other conflicts next week, please feel free to give David Sheldon a call if you'd like to discuss any concerns prior to the survey, or if you'd like an out brief following the survey. If you do plan to attend, please confirm with him at least a day ahead of the field work.

Project:	NSF LIGO Facility Proposed STEM Exploration Center
Project Type	Section 106 Cultural Survey (Pedestrian Survey Only)
LIGO Contact:	Jeffrey Jones, LIGO Operations Manager (509)438-0823
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Where to meet:	LIGO Lab Support Building, check in at front desk Driving directions: https://www.ligo.caltech.edu/WA/page/lho-directions-contact
What time to meet:	7:45 AM March 17, 2020 (changed from March 18th)
What to bring:	Substantial footwear for field survey, safety vest, water and a lunch.
Additional Information:	If you plan on attending please confirm with David Sheldon via phone or text at least one day in advance of the fieldwork.

From: "Hamilton, Kristen" <KRIHAMIL@nsf.gov>
Date: Friday, March 6, 2020 at 3:20 PM
To: "rob.whitlam@dahp.wa.gov" <rob.whitlam@dahp.wa.gov>, "rbuck@gcpud.org" <rbuck@gcpud.org>, "abuck1@gcpud.org" <abuck1@gcpud.org>,

"BambiRodriguez@ctuir.org" <BambiRodriguez@ctuir.org>, "Arrow.Coyote@colvilletribes.com" <Arrow.Coyote@colvilletribes.com>, "NathanMay@ctuir.org" <NathanMay@ctuir.org>, "TearaFarrowFerman@ctuir.org" <TearaFarrowFerman@ctuir.org>, "Mikes@nezperce.org" <Mikes@nezperce.org>, "josiahp@nezperce.org" <josiahp@nezperce.org>, "lucys@nezperce.org" <lucys@nezperce.org>, "jaredn@nezperce.org" <jaredn@nezperce.org>, "jessicag@nezperce.org" <jessicag@nezperce.org>, "rferri@ynerwm.com" <rferri@ynerwm.com>, "tsherwood@ynerwm.com" <tsherwood@ynerwm.com>, "laurene_contreras@yakama.com" <laurene_contreras@yakama.com>
Cc: "Blanco, Caroline M" <cblanco@nsf.gov>, "RLCulturalResources@rl.gov" <RLCulturalResources@rl.gov>, "Hurley, Warren F" <Warren.Hurley@rl.doe.gov>, "Sheldon, David/PDX" <David.Sheldon@jacobs.com>, "Bedlington, So Yon" <so.bedlington@rl.doe.gov>, "Rau, Michelle/TPA" <Michelle.Rau@jacobs.com>
Subject: March 18 survey- Proposed Exploration Center at LIGO Hanford

Good afternoon, the National Science Foundation invites you to participate in the following survey. Please confirm attendance at least a day ahead of the field work.

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Kristen Hamilton
Environmental Compliance Officer
Office of the General Counsel

National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314
(793)292-4820
krihamil@nsf.gov

Subject: Re: March 18 survey- Proposed Exploration Center at LIGO Hanford

Date: Friday, March 13, 2020 at 6:46:53 AM Eastern Daylight Time

From: Hamilton, Kristen

To: rob.whitlam@dahp.wa.gov, rbuck@gcpud.org, abuck1@gcpud.org, BambiRodriguez@ctuir.org, Arrow.Coyote@colvilletribes.com, NathanMay@ctuir.org, TearaFarrowFerman@ctuir.org, Mikes@nezperce.org, josiahp@nezperce.org, lucys@nezperce.org, jaredn@nezperce.org, jessicag@nezperce.org, rferri@ynerwm.com, tsherwood@ynerwm.com, laurene_contreras@yakama.com, LChester@ynerwm.com

CC: Blanco, Caroline M, RLCulturalResources@rl.gov, Hurley, Warren F, Sheldon, David/PDX, Bedlington, So Yon, Rau, Michelle/TPA

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From: "Hamilton, Kristen" <KRIHAMIL@nsf.gov>
Date: Friday, March 6, 2020 at 3:20 PM
To: "rob.whitlam@dahp.wa.gov" <rob.whitlam@dahp.wa.gov>, "rbuck@gcpud.org" <rbuck@gcpud.org>, "abuck1@gcpud.org" <abuck1@gcpud.org>, "BambiRodriguez@ctuir.org" <BambiRodriguez@ctuir.org>, "Arrow.Coyote@colvilletribes.com" <Arrow.Coyote@colvilletribes.com>, "NathanMay@ctuir.org" <NathanMay@ctuir.org>, "TearaFarrowFerman@ctuir.org" <TearaFarrowFerman@ctuir.org>, "Mikes@nezperce.org" <Mikes@nezperce.org>,

"josiahp@nezperce.org" <josiahp@nezperce.org>, "lucys@nezperce.org" <lucys@nezperce.org>, "jaredn@nezperce.org" <jaredn@nezperce.org>, "jessicag@nezperce.org" <jessicag@nezperce.org>, "rferri@ynerwm.com" <rferri@ynerwm.com>, "tsherwood@ynerwm.com" <tsherwood@ynerwm.com>, "laurene_contreras@yakama.com" <laurene_contreras@yakama.com>
Cc: "Blanco, Caroline M" <cblanco@nsf.gov>, "RLCulturalResources@rl.gov" <RLCulturalResources@rl.gov>, "Hurley, Warren F" <Warren.Hurley@rl.doe.gov>, "Sheldon, David/PDX" <David.Sheldon@jacobs.com>, "Bedlington, So Yon" <so.bedlington@rl.doe.gov>, "Rau, Michelle/TPA" <Michelle.Rau@jacobs.com>
Subject: March 18 survey- Proposed Exploration Center at LIGO Hanford

Good afternoon, the National Science Foundation invites you to participate in the following survey. Please confirm attendance at least a day ahead of the field work.

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Kristen Hamilton
Environmental Compliance Officer
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2415 Eisenhower Avenue
Alexandria, VA 22314
(793)292-4820
krihamil@nsf.gov

Subject: Re: March 18 survey- Proposed Exploration Center at LIGO Hanford
Date: Monday, March 16, 2020 at 11:42:52 AM Eastern Daylight Time
From: Hamilton, Kristen
To: rob.whitlam@dahp.wa.gov, rbuck@gcpud.org, abuck1@gcpud.org, BambiRodriguez@ctuir.org, Arrow.Coyote@colvilletribes.com, NathanMay@ctuir.org, TearaFarrowFerman@ctuir.org, Mikes@nezperce.org, josiahp@nezperce.org, lucys@nezperce.org, jaredn@nezperce.org, jessicag@nezperce.org, rferri@ynerwm.com, tsherwood@ynerwm.com, laurene_contreras@yakama.com, LChester@ynerwm.com
CC: Blanco, Caroline M, RLCulturalResources@rl.gov, Hurley, Warren F, Sheldon, David/PDX, Bedlington, So Yon, Rau, Michelle/TPA
Attachments: LIGO - Hanford LExC_REVISED APE.jpg

Good morning, this is a reminder that the proposed LExC cultural resources survey is to take place tomorrow(Tuesday, March 17th), with additional details below. In addition, please note that NSF has worked with CalTech to clarify where possible utility work could occur, and have expanded the Area of Potential Effects to include all possible areas of disturbance. The cultural resources survey tomorrow will cover this expanded APE (see attached), and we welcome any comments on this revised APE as we seek to finalize it.

Thank you, and we look forward to your continued participation in this review.

From: "Hamilton, Kristen" <KRIHAMIL@nsf.gov>
Date: Friday, March 13, 2020 at 6:46 AM
To: "rob.whitlam@dahp.wa.gov" <rob.whitlam@dahp.wa.gov>, "rbuck@gcpud.org" <rbuck@gcpud.org>, "abuck1@gcpud.org" <abuck1@gcpud.org>, "BambiRodriguez@ctuir.org" <BambiRodriguez@ctuir.org>, "Arrow.Coyote@colvilletribes.com" <Arrow.Coyote@colvilletribes.com>, "NathanMay@ctuir.org" <NathanMay@ctuir.org>, "TearaFarrowFerman@ctuir.org" <TearaFarrowFerman@ctuir.org>, "Mikes@nezperce.org" <Mikes@nezperce.org>, "josiahp@nezperce.org" <josiahp@nezperce.org>, "lucys@nezperce.org" <lucys@nezperce.org>, "jaredn@nezperce.org" <jaredn@nezperce.org>, "jessicag@nezperce.org" <jessicag@nezperce.org>, "rferri@ynerwm.com" <rferri@ynerwm.com>, "tsherwood@ynerwm.com" <tsherwood@ynerwm.com>, "laurene_contreras@yakama.com" <laurene_contreras@yakama.com>, "LChester@ynerwm.com" <LChester@ynerwm.com>
Cc: "Blanco, Caroline M" <cblanco@nsf.gov>, "RLCulturalResources@rl.gov" <RLCulturalResources@rl.gov>, "Hurley, Warren F" <Warren.Hurley@rl.doe.gov>, "Sheldon, David/PDX" <David.Sheldon@jacobs.com>, "Bedlington, So Yon" <so.bedlington@rl.doe.gov>, "Rau, Michelle/TPA" <Michelle.Rau@jacobs.com>
Subject: Re: March 18 survey- Proposed Exploration Center at LIGO Hanford

Good morning, we've confirmed that David Sheldon, Jacobs Archaeologist, is still able to travel to conduct the cultural resources survey at LIGO next week. In the meantime, however, it's come to our attention that the scheduled date of Wednesday, March 18th, conflicts with the monthly standing DOE cultural resources meeting. To avoid this certain conflict, we have rescheduled this survey for Tuesday, March 17th, see below notice. For those who have other conflicts next week, please feel free to give David Sheldon a call if you'd like to discuss any concerns prior to the survey, or if you'd like an out brief following the survey. If you do plan to attend, please confirm with him at least a day ahead of the field work.

Project:	NSF LIGO Facility Proposed STEM Exploration Center

Project Type	Section 106 Cultural Survey (Pedestrian Survey Only)
LIGO Contact:	Jeffrey Jones, LIGO Operations Manager (509)438-0823
Field Contact:	David Sheldon, Jacobs Archaeologist (360)219-6953
Where to meet:	LIGO Lab Support Building, check in at front desk Driving directions: https://www.ligo.caltech.edu/WA/page/lho-directions-contact
What time to meet:	7:45 AM March 17, 2020 (changed from March 18th)
What to bring:	Substantial footwear for field survey, safety vest, water and a lunch.
Additional Information:	If you plan on attending please confirm with David Sheldon via phone or text at least one day in advance of the fieldwork.

From: "Hamilton, Kristen" <KRIHAMIL@nsf.gov>
Date: Friday, March 6, 2020 at 3:20 PM
To: "rob.whitlam@dahp.wa.gov" <rob.whitlam@dahp.wa.gov>, "rbuck@gcpud.org" <rbuck@gcpud.org>, "abuck1@gcpud.org" <abuck1@gcpud.org>, "BambiRodriguez@ctuir.org" <BambiRodriguez@ctuir.org>, "Arrow.Coyote@colvilletribes.com" <Arrow.Coyote@colvilletribes.com>, "NathanMay@ctuir.org" <NathanMay@ctuir.org>, "TearaFarrowFerman@ctuir.org" <TearaFarrowFerman@ctuir.org>, "Mikes@nezperce.org" <Mikes@nezperce.org>, "josiahp@nezperce.org" <josiahp@nezperce.org>, "lucys@nezperce.org" <lucys@nezperce.org>, "jaredn@nezperce.org" <jaredn@nezperce.org>, "jessicag@nezperce.org" <jessicag@nezperce.org>, "rferri@ynerwm.com" <rferri@ynerwm.com>, "tsherwood@ynerwm.com" <tsherwood@ynerwm.com>, "laurene_contreras@yakama.com" <laurene_contreras@yakama.com>
Cc: "Blanco, Caroline M" <cblanco@nsf.gov>, "RLCulturalResources@rl.gov" <RLCulturalResources@rl.gov>, "Hurley, Warren F" <Warren.Hurley@rl.doe.gov>, "Sheldon, David/PDX" <David.Sheldon@jacobs.com>, "Bedlington, So Yon" <so.bedlington@rl.doe.gov>, "Rau, Michelle/TPA" <Michelle.Rau@jacobs.com>
Subject: March 18 survey- Proposed Exploration Center at LIGO Hanford

Good afternoon, the National Science Foundation invites you to participate in the following survey. Please confirm attendance at least a day ahead of the field work.

Project:	NSF LIGO Facility Proposed STEM Exploration Center
Project Type	Section 106 Cultural Survey (Pedestrian Survey Only)
LIGO Contact:	Jeffrey Jones, LIGO Operations Manager (509)438-0823
Field Contact:	David Sheldon, Jacobs Archaeologist (360)219-6953
Where to meet:	LIGO Lab Support Building, check in at front desk Driving

	directions: https://www.ligo.caltech.edu/WA/page/lho-directions-contact
What time to meet:	7:45 AM March 18, 2020
What to bring:	Substantial footwear for field survey, safety vest, water and a lunch.
Additional Information:	If you plan on attending please confirm with David Sheldon via phone or text at least one day in advance of the fieldwork.

Kristen Hamilton
Environmental Compliance Officer
Office of the General Counsel
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314
(793)292-4820
krihamil@nsf.gov

NATIONAL SCIENCE FOUNDATION
2415 Eisenhower Avenue
Alexandria, Virginia 22314

June 1, 2020

Attention: Robert Whitlam, Ph. D., State Archaeologist
Department of Archaeology & Historic Preservation
P.O. Box 48343
Olympia, Washington 98504-8343

Project Name: LIGO STEM Observatory Project

Subject: Revision of APE; Completion of Section 106 Cultural Resources Survey Report; Request for Concurrence (HCRC#2020-600-004, WISAARD project number 2020-04-02572)

Dr. Whitlam,

The National Science Foundation (NSF), as the lead federal agency for the proposed Laser Interferometer Gravitational-Wave Observatory (LIGO) STEM Exploration Center (LExC), is following up on our February 7, 2020 initiation of Section 106 consultation letter. In accordance with 36 CFR 800.4, our cultural resources contractor, Jacobs Engineering Group Inc., completed a pedestrian survey to identify historic properties within the Area of Potential Effects (APE) and documented the results of these efforts in a cultural resources survey report. We request your concurrence on our finding of "No Historic Properties Affected," as described below and as supported by the attached documentation.

Please note that, following consultation with the interested tribes, the APE was slightly expanded from the initial map your department received as a part of the "Area of Potential Effects" notification on February 7, 2020. The APE map was modified to better reflect the description of proposed ground disturbance associated with the installation of utilities required for this undertaking. Additional areas of direct impact for associated utility corridors were added to the APE.

The cultural resources survey of the revised APE was completed on March 17, 2020 and the results documented in a Cultural Resources Survey Report. The revised APE is captured on the map figures presented in Appendix A of the report. The report also includes the results of initial consultation efforts with area tribes and documentation of a single historic archaeological site, 45BN02067 (temporary site number LIGO20-S-01). Site 45BN02067 was evaluated against the National Register of Historic Places (NRHP) criteria for eligibility and was determined ineligible for listing on the NRHP. Based on the results

of the Cultural Resources Survey Report, NSF has determined that the undertaking will result in a finding of "No Historic Properties Affected."

Please review the Cultural Resources Survey Report, 45BN02067 site form, and resource eligibility determination for 45BN2067 that were submitted through WISAARD under the project number 2020-04-02572. We respectfully request that you provide concurrence or comments within 30 days. If you have questions, please contact me at (703)292-4592 or cblanco@nsf.gov.

Yours sincerely,

/s/

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
National Science Foundation

Cc (via email): Rob Whitlam, SHPO
Warren Hurley and So Yon Bedlington, DOE
Arrow Coyote, Confederated Tribes of the Colville Reservation
Bambi Rodriguez, Nathan May, and Teara Farrow Ferman, Confederated Tribes of the Umatilla Indian Reservation
Mike Sobotta, Josiah Pinkman, Lucy Samuels, Jared Norman, and Jessica Glindeman, Nez Perce Tribe
Rose Ferri, Trina Sherwood, Luciana Chester, and Laurene Contreras, Yakama Nation
Rex Buck and Alyssa Buck, Wanapum
Keith Mendez, MSA Cultural Resources, cultural resource program database manager for the Hanford Site

Attachments:

HCRC#2020-600-004 Cultural Resources Report

Comments from consulting parties/tribes on LExC

Allyson Brooks Ph.D., Director
State Historic Preservation Officer

June 1, 2020

Ms. Caroline M. Blanco
National Science Foundation
2415 Eisenhower Avenue
Arlington, Virginia 22230

Re: LIGO STEM Observatory Project
HCRC#*2020-600-004*
Log No: 2020-04-02572-NSF

Dear Ms. Blanco:

Thank you for contacting our department. We have reviewed the materials you provided for proposed LIGO STEM Observatory Project at the Hanford Site, Benton County, Washington.

We concur with your Determination of No Historic Properties Affected with the stipulation for an unanticipated discovery plan.

We would appreciate receiving any correspondence or comments from concerned tribes or other parties that you receive as you consult under the requirements of 36CFR800.4(a)(4).

In the event that archaeological or historic materials are discovered during project activities, work in the immediate vicinity should be discontinued, the area secured, and the concerned tribes and this department notified.

These comments are based on the information available at the time of this review and on the behalf of the State Historic Preservation Officer in conformance with Section 106 of the National Historic Preservation Act and its implementing regulations 36CFR800. Should additional information become available, our assessment may be revised.

Thank you for the opportunity to comment and a copy of these comments should be included in subsequent environmental documents.

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(360) 890-2615
email: *rob.whitlam@dahp.wa.gov*

Subject: [EXTERNAL] - RE: HCRC 2020-600-004: Request for concurrence- NO HISTORIC PROPERTIES AFFECTED
Date: Thursday, June 4, 2020 at 12:27:55 PM Eastern Daylight Time
From: Nathan May
To: Hamilton, Kristen
CC: Bambi Rodriguez

Hey Kristen,

We have reviewed the proposed LIGO STEM Exploration Center (LExC), HCRC 2020-600-004 survey report and have no comments at this time.

Please let me know if you have any questions.

Regards,

Nathan J. May
Archaeologist
Confederated Tribes of the Umatilla Indian Reservation
Department of Natural Resources
Cultural Resources Protection Program
46411 Timine Way
Pendleton, Oregon 97801
NathanMay@ctuir.org
Direct Line: 541-429-7128

From: Hamilton, Kristen [mailto:KRIHAMIL@nsf.gov]
Sent: Monday, June 1, 2020 11:01 AM
To: rob.whitlam@dahp.wa.gov; LChester@ynerwm.com; rbuck@gcpud.org; abuck1@gcpud.org; Bambi Rodriguez <BambiRodriguez@ctuir.org>; Arrow.Coyote@colvilletribes.com; Nathan May <NathanMay@ctuir.org>; Teara Farrow Ferman <TearaFarrowFerman@ctuir.org>; Mikes@nezperce.org; josiahp@nezperce.org; lucys@nezperce.org; jaredn@nezperce.org; jessicag@nezperce.org; rferri@ynerwm.com; tsherwood@ynerwm.com; laurene_contreras@yakama.com
Cc: Blanco, Caroline M <cblanco@nsf.gov>; RLCulturalResources@rl.gov; Warren.Hurley@rl.doe.gov; David.Sheldon@jacobs.com; so.bedlington@rl.doe.gov; Michelle.Rau@jacobs.com; Kimberly.pigford@nsf.gov
Subject: HCRC 2020-600-004: Request for concurrence- NO HISTORIC PROPERTIES AFFECTED

Good morning,
Attached is NSF's request for the SHPO's concurrence on a "No Historic Properties Affected" finding for the proposed LIGO STEM Exploration Center (LExC), HCRC 2020-600
-004, along with a record of comments we receied from the consulting parties/tribes and the results of the March survey.
If, in reviewing the attached survey report, the consulting parties share additional input (by July 1), we will provide updates as appropriate.

provide updates as appropriate.

Rob, we appreciate if you can confirm that it is acceptable for NSF to submit this letter via email, or if there is another preferred way for the SHPO's office to receive such communications during this time.

Many thanks to all who contributed to this Section 106 consultation,

Kristen

Kristen Hamilton
Environmental Compliance Officer
Office of the General Counsel
National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314
(793)292-4820
krihamil@nsf.gov

APPENDIX C

Public and Agency Comments

From:	phy-envr
To:	Rau, Michelle/TPA; Gulick, Emily/SDO; Dreher, Laura/COS
Cc:	Pigford, Kimberly
Subject:	FW: [EXTERNAL] - Review Comment: Cultural Resources Section for New LIDAR Construction
Date:	Thursday, July 16, 2020 1:05:32 PM

See below comment, thanks. This is the only comment submitted so far.

From: "tembro4@gmail.com" <tembro4@gmail.com>
Date: Friday, July 3, 2020 at 5:29 PM
To: phy-envr <phy-envr@nsf.gov>
Cc: "'Burghart, Rebecca A'" <Rebecca_Burghart@nps.gov>
Subject: [EXTERNAL] - Review Comment: Cultural Resources Section for New LIDAR Construction

Dear Ms. Pigford,

I worked on the Hanford Site for 22 years as Cultural Resources Lead before retiring in 2016 to begin teaching archaeology at Washington State University, Tri-Cities (thought it important to let you know who is submitting this "random" comment). I have only a single comment, a correction actually, that involves the following statement on page 3-10: "American explorers Lewis and Clark stopped at the confluence of the Columbia and Yakima Rivers on their way to the Pacific Ocean." In actuality, Lewis and Clark met the Wanapum at the junction of the Snake and Columbia Rivers (the event was re-enacted when the Wanapum met Christian Clark [great, great, great (?) grandson of William Clark] at that location for the bicentennial celebration in 2005 – an event I was invited to attend. Some of the Lewis and Clark party did travel upriver to view the confluence of the Yakima River (called the Tapteal by the Tribes) with the Columbia while they were in camp, but the entire party left the area by continuing down the Columbia to Astoria. Thank you for the opportunity to review the draft EIS.

Thomas E. Marceau
Department of Anthropology
Washington State University, Tri-Cities

Subject: FW: [EXTERNAL] - Re: Reminder: Comments on Draft Environmental Assessment for the LIGO STEM Exploration Center Due July 23
Date: Monday, July 20, 2020 at 1:54:58 PM Eastern Daylight Time
From: Hamilton, Kristen
To: phy-envr

From: "Moreno, Brian (CHA Commissioner)" <Brian.Moreno@cha.wa.gov>
Date: Monday, July 20, 2020 at 1:54 PM
To: "Hamilton, Kristen" <KRIHAMIL@nsf.gov>
Subject: [EXTERNAL] - Re: Reminder: Comments on Draft Environmental Assessment for the LIGO STEM Exploration Center Due July 23

Thank you, I have no comments at this time.

From: Hamilton, Kristen <KRIHAMIL@nsf.gov>
Sent: Monday, July 20, 2020 10:50:07 AM
Subject: Reminder: Comments on Draft Environmental Assessment for the LIGO STEM Exploration Center Due July 23

Dear Interested Stakeholder:

This is a reminder that comments on the Draft Environmental Assessment for the LIGO STEM Exploration Center are due this Thursday, July 23, 2020. The Draft EA can be reviewed at: https://go.usa.gov/xw8ZD. You may send your comments via this email address; if you are unable to email your comments, please contact me at (703) 292-7387.

Sincerely,

Kimberly Pigford
Financial and Operations Specialist
Division of Physics

From: phy-envr <phy-envr@nsf.gov>
Date: Wednesday, June 24, 2020 at 8:46 AM
Subject: Notice of Availability of the Draft Environmental Assessment for the LIGO STEM Exploration Center

Dear Interested Stakeholder:

In compliance with the National Environmental Policy Act of 1969 (NEPA), as amended, the National Science Foundation (NSF) has prepared a Draft Environmental Assessment (EA) to evaluate the potential environmental effects of proposed construction of the Laser Interferometer Gravitational-Wave Observatory (LIGO) STEM Exploration Center at Hanford near Richland, Washington.

The Draft EA identifies and analyzes the potential consequences of the Proposed Action and No Action Alternative. The Proposed Action would authorize the construction and operation of the 13,000 square-foot STEM facility and associated infrastructure, including water and sewer utilities, and tele communications connection. Under the No Action Alternative, NSF would not authorize the construction of the facility. The Draft EA analyzes impacts to biological, cultural, geologic, hazardous materials and solid waste, human health and safety, transportation, water resources, and utilities and also proposes mitigation measures to minimize the adverse impacts of implementing the Proposed Action where such impacts may occur.

This letter is to notify you of the availability of the Draft EA on NSF's website https://go.usa.gov/xw8ZD and invite your comments. In consideration of the potential impact of the ongoing coronavirus (COVID-19) pandemic on the usual methods of access to information and ability to communicate, such as the mass closure of local public libraries and challenges with the sufficiency of an increasingly-overburdened internet, the NSF encourages all interested stakeholders to contact us directly by email or telephone to resolve any issues involving access to the Draft EA or the ability to comment.

Please submit any comments by July 23, 2020. The NSF point of contact for the NEPA process is Mrs. Kimberly Pigford, National Science Foundation, Division of Physics; phy-envr@nsf.gov; if you are unable to email your comments, please contact Mrs. Pigford at (703) 292-7387.

Sincerely,

Kimberly Pigford
Financial and Operations Specialist
Division of Physics

Subject: [EXTERNAL] - RE: Draft, Environmental Assessment for the STEM Exploration Center
Date: Wednesday, July 22, 2020 at 3:28:57 PM Eastern Daylight Time
From: Michael Sobotta
To: phy-envr
CC: Josiah Pinkham, Lucy Samuels, Maurita Oatman, Jessica Glindeman, Jonathan Matthews, Jared Norman, Bambi Rodriguez, Nathan May, roseferri.erwm@gmail.com, Alyssa Buck
Attachments: NPT Comments Environmental Assessment for the Laser Interferometer Gravitational 072220.docx

Please find our attached comments on the draft National Science Foundation (NSF) Environmental Assessment for the Laser Interferometer Gravitational-Wave Observatory (LIGO) STEM Exploration Center.

From: Jared Norman <jaredn@nezperce.org>
Sent: Tuesday, July 21, 2020 2:32 PM
To: phy-envr@nsf.gov
Cc: Michael Sobotta <mikes@nezperce.org>; Josiah Pinkham <josiahp@nezperce.org>; Lucy Samuels <lucys@nezperce.org>; Maurita Oatman <MauritaO@nezperce.org>; Jessica Glindeman <jessicag@nezperce.org>
Subject: Draft, Environmental Assessment for the STEM Exploration Center

Kimberly,

The Nez Perce Tribe Hanford Cultural Resources has received the draft for the National Science Foundation (NSF) Environmental Assessment for the Laser Interferometer Gravitational-Wave Observatory (LIGO) STEM Exploration Center at Hanford near Richland, WA

I have no comments or concerns at this time.

Thank you,

Jared.

Jared Norman, MA, RPA
Archaeologist
Hanford Cultural Resources
PO Box 365 Lapwai, ID 83540

PO Box 365 Lapwai, ID 83540
(208) 621-3764 | ext. 3764
Cell: (208)-660-3837

Please consider the environment before printing this e-mail

Nez Perce Tribe, Hanford Cultural Resources review and comments on NEPA document: titled, "**Environmental Assessment for the Laser Interferometer Gravitational-Wave Observatory (LIGO) STEM Exploration Center at Hanford near Richland, Washington"**

Section 3.1.1.2 Wildlife:

This section mentions ground squirrels but doesn't identify species or their population status but then concludes there is minimal impact.

Comment: Ground squirrels are culturally important to the Nez Perce Tribe.

Washington ground squirrels and Townsend's ground squirrels are found in the Columbia Plateau of Washington and Oregon. Historically, these species were distributed over much of the shrub-steppe habitat of southeastern Washington and northcentral Oregon, but their range has contracted due to habitat loss, primarily from agricultural development. The Townsends ground squirrel declines may make them eligible for state listing once proposed inventories are completed in the region.

After a phone conversation with Heidi Newsome, USFWS wildlife biologist, it was discovered that both Washington ground squirrels and Townsends ground squirrels are known to exist on the nearby Hanford Monument. According to Ms. Newsome, the Washington ground squirrels are presently known to exist on the opposite side of the Columbia River from the proposed site while the Townsends are likely the ones mentioned in this EA. The Washington Ground squirrel is listed by the State of Washington as Threatened, whereas the Townsends ground squirrel have declined in regional population, leading to the USFWS/WDFW to schedule this year to document their numbers as part of a new study. The Covid-19 virus restrictions has caused the research to be postponed this year.

We request that the final EA provide more information about the two species of ground squirrels. Both species are in decline and recent information should be available prior to completing the final FONSI. The wildlife section should include an assessment of the APE with specifics about whether colonies are present, whether the area of permanent displacement (build site) will have permanent negative effects to known colonies; and whether temporary construction disturbance will have temporary negative effects to these or other known colonies. Mitigation for any permanent colony displacement should be 3:1 habitat improvement, and 1:1 ratio for habitat improvement of temporary disturbance.

Section 3.1.1.3 Special Status Species:

This section states that plant surveys were performed too early in the year to determine whether plant species listed under state sensitive or state-threatened (Table 3-1) might exist within the project footprint, or their preferred habitats will be permanently or temporarily displaced from construction activities.

This plant species evaluation does not provide an analysis of whether species in Table 3-1 actually exist or not. Performing the survey in the spring before the plants are grown is not an adequate survey. The questions we ask is," if they did exist in the APE, what would DOE and the National Science Foundation (NSF) require for NEPA compliance of this project? What would be the avoidance, minimization, and potential mitigation as required by the state of Washington under their State threatened status or sensitive species listings? Without actually performing a presence/absence survey during when they are in growth for identification, we must assume they exist and then ask for required mitigation as directed

by the State of Washington. The right solution is for Project lead to perform an adequate plant survey of these sensitive and state-listed plants species within or near the project footprint, and whether their preferred habitats also exist in or near the project footprint.

Section 3.1.2 Environmental Consequences

This section needs to use the rating system in table 3-2 and the rating system from BRMP to provide a summary of the presence of plant species shown in table 3-1 or their preferred habitat aces within the APE permanently displaced by the project structures and associated hard surfaces areas within the APE.

Section 3.1.2.1 Construction Phase:

Quotes from the narrative: 1) "The design of the proposed Action is in process, so opportunities to minimize the project footprint and associated impacts to vegetation will continue to be refined through final design…" and 2) "However, the field survey (vegetation) was too early in the season to observe plants in vegetative growth and several state sensitive and threatened plant species have the potential to occur within the project area."

Comment: Since the final footprint is not yet defined, and that the plant survey results were too early, we ask that prior to finalizing the FONSI that a more thorough plant survey be completed that can adequately address whether sensitive plants species do exist in the final displaced footprint and the area or in the temporary construction disturbance. We also ask that the mitigation ratio for the 6.3 acres of permanently displaced land area be a 3:1 ratio and be directed at revegetation restoration somewhere in the project vicinity. We do support the 1:1 ratio for native revegetation for the 19.1 acres of temporary construction disturbance. Obviously these are not final quantities, so the final EA needs to represent the correct acres once the design is complete.

We request improvements to the EA narrative: The construction phase narrative should generate a table by combining Table 3-1 list of sensitive plant species to include the BRMP ratings, and table 3-2 habitat quality ratings for their preferred habitats in order to provide a concise summary of the final findings of the listed plant species located within the APE, the acres of their preferred habitats within the APE, the habitat quality ratings for those temporarily displaced habitats, and quality rating for those permanently displaced habitats. The revegetation ratios also need to be provided in the table for each of the habitat quality ratings (BRMP) and for those acres that support or could potential support sensitive plant species of Table 3-1. By summarizing this information in a table form, it will more clearly illustrate the habitat displacement information relative to the EA decisions and show severity of impact and final mitigation for the higher valued areas.

Once a new plant survey is completed under growing conditions, please include their information in the above-mentioned table with species presence, their acres of associated habitats within the APE, and their mitigation ratio, if any.

In conclusion, the vegetation impacts are incomplete until appropriate surveys are completed for those species on the list of table 3-1. Your conclusion states "…implementing the agreed upon minimization and mitigation measures, impacts to vegetation during construction would be **minor, negative, and short-term"** (bold emphasis by author(s) of the EA). Until a survey of state-sensitive species is completed, the revegetation plan will not accurately represent required minimization or mitigation efforts as required by NEPA and the State of Washington.

Migratory Birds: (page3-7)

"Pre-construction surveys and nesting bird BMPs would be implemented if construction occurs during the mid-March to mid-July nesting period"

Comment: We are not sure what this accomplishes. By performing breeding bird and nesting surveys prior to or during construction will only identify what is potentially displaced. Please provide a description for all related Best Management Practices (BMPs) that are mentioned in this EA, how they will be implemented, and what they will accomplish.

Migratory Bird treaty Act: There have been federal changes to the Federal *Migratory Bird Treaty Act* and would like to know how that effects potential "taking" and how these new changes affect the revegetation plan?

Final comment: The revegetation plan needs to be provided in the Appendix and be part of the final EA since it provides BMPs details for "avoiding, minimizing and mitigating" impacts to migratory birds, mammals, and potentially discovered sensitive plants, once a better plant survey is completed.

Subject: [EXTERNAL] - RE: Draft, Environmental Assessment for the STEM Exploration Center
Date: Wednesday, July 22, 2020 at 1:46:36 PM Eastern Daylight Time
From: Michael Sobotta
To: Jared Norman, phy-envr
CC: Josiah Pinkham, Lucy Samuels, Maurita Oatman, Jessica Glindeman

The Nez Perce Tribe HCR does have comments on the EA, comments will be sent by the end of today.

From: Jared Norman <jaredn@nezperce.org>
Sent: Tuesday, July 21, 2020 2:32 PM
To: phy-envr@nsf.gov
Cc: Michael Sobotta <mikes@nezperce.org>; Josiah Pinkham <josiahp@nezperce.org>; Lucy Samuels <lucys@nezperce.org>; Maurita Oatman <MauritaO@nezperce.org>; Jessica Glindeman <jessicag@nezperce.org>
Subject: Draft, Environmental Assessment for the STEM Exploration Center

Kimberly,

The Nez Perce Tribe Hanford Cultural Resources has received the draft for the National Science Foundation (NSF) Environmental Assessment for the Laser Interferometer Gravitational-Wave Observatory (LIGO) STEM Exploration Center at Hanford near Richland, WA

I have no comments or concerns at this time.

Thank you,

Jared.

Jared Norman, MA, RPA
Archaeologist
Hanford Cultural Resources
PO Box 365 Lapwai, ID 83540
(208) 621-3764 | ext. 3764
Cell: (208)-660-3837

Subject: [EXTERNAL] - Draft, Environmental Assessment for the STEM Exploration Center
Date: Tuesday, July 21, 2020 at 5:31:48 PM Eastern Daylight Time
From: Jared Norman
To: phy-envr
CC: Michael Sobotta, Josiah Pinkham, Lucy Samuels, Maurita Oatman, Jessica Glindeman

Kimberly,

The Nez Perce Tribe Hanford Cultural Resources has received the draft for the National Science Foundation (NSF) Environmental Assessment for the Laser Interferometer Gravitational-Wave Observatory (LIGO) STEM Exploration Center at Hanford near Richland, WA

I have no comments or concerns at this time.

Thank you,

Jared.

Jared Norman, MA, RPA
Archaeologist
Hanford Cultural Resources
PO Box 365 Lapwai, ID 83540
(208) 621-3764 | ext. 3764
Cell: (208)-660-3837