# 4.0 ENVIRONMENTAL SETTING, IMPACTS, AND MITIGATION MEASURES

## 4.1 INTRODUCTION

This section of the Environmental Impact Report (EIR) presents potential environmental impacts of the proposed Helios project. The scope of the analysis and key attributes of the analytical approach are presented below to assist readers in understanding the manner in which the impact analysis has been conducted in this EIR.

## 4.2 APPROACH TO IMPACT ANALYSIS

- The preparation of this EIR was preceded by an Initial Study (included in **Appendix 1.0**), which determined that the Helios project would not result in significant or potentially significant impacts on certain resource areas. Therefore, this EIR evaluates impacts in 14 of the 16 resource areas on the CEQA checklist.

- For each of the 14 resource areas evaluated in the sections that follow, the EIR describes the existing environmental setting, the potential for the proposed project to significantly affect the existing resources, and recommended mitigation measures that could reduce or avoid potentially significant impacts. Each of the resource sections also clearly identifies those impacts that were determined in the Initial Study to be less than significant, and thus, do not require detailed evaluation in this EIR.

- The analyses of impacts in this EIR are based primarily on three factors, depending on the primary cause of the impact. For example, impacts related to geologic, hydrological, and biological resources are analyzed primarily on the basis of the location and acreage of ground disturbance that is projected to occur as a result of the implementation of the Helios project. Impacts related to traffic, traffic-related air quality and noise, and utilities, on the other hand, are analyzed primarily on the basis of the total population associated with full development of the Helios project. Impacts related to air quality and hazardous materials are analyzed based on the research programs that would be accommodated by the proposed project.

- With respect to those impacts that are population-based, it should be noted that the total adjusted daily population for the project was used in the analysis and this number accounts for both employees and visitors. As noted in **Section 3.0, Project Description**, the proposed project would accommodate a total of 500 people, including 132 existing Lawrence Berkeley National Laboratory (LBNL) and UC Berkeley staff and 368 persons who would be new to the site. The EIR assesses operational environmental impacts in terms of the maximum building occupancy, including guests and employees, and impacts from the use of the proposed auditorium.

- The extent of the area evaluated for impacts (the study area) differs among resources depending on the locations where impacts would be expected. For example, traffic impacts due to the proposed Helios project are assessed for the regional roadway network, whereas geology and soils impacts

from the proposed project are assessed for the project site only. The settings sections describe both local resources and regional resources that occur throughout the broader geographic area.

- The environmental setting sections describe the baseline environmental conditions. For purposes of the analyses in this EIR, the year 2007 is used to establish the baseline or existing conditions. Impacts are evaluated in terms of environmental changes as a result of implementation of the Helios project as compared to existing conditions in 2007. In the case of near-term traffic impacts (and traffic-related air quality and noise impacts), year 2012 is used as the baseline year because the proposed project is expected to be operational by that year. Evaluation of 2012 conditions with the addition of project traffic presents a more conservative analysis of traffic impacts than year 2007 conditions as it takes into account traffic from other near-term projects that would be constructed by then.

- Because the proposed project is an element of the growth projected under the 2006 Long Range Development Plan (LRDP), relevant mitigation measures adopted by The Regents in conjunction with the approval of the 2006 LRDP have been included in and made part of the Helios project. The analysis presented in the subsequent sections evaluates environmental impacts that would result from project implementation following the application of the 2006 LRDP mitigation measures.

## 4.3 LEVELS OF SIGNIFICANCE

The EIR uses a variety of terms to describe the levels of significance of adverse impacts identified during the course of the environmental analysis. The following are definitions of terms used in this EIR:

- **Significant and Unavoidable Impact.** Impacts that exceed the defined standards of significance and cannot be eliminated or reduced to a less than significant level through the implementation of feasible mitigation measures.

- **Significant Impact.** Impacts that exceed the defined standards of significance and that can be eliminated or reduced to a less-than-significant level through the implementation of feasible mitigation measures.

- **Potentially Significant Impact.** Significant impacts that may ultimately be determined to be less than significant; the level of significance may be reduced in the future through implementation of policies or guidelines (that are not required by statute or ordinance), or through further definition of the project detail in the future. Potentially Significant Impacts may also be impacts about which there is not enough information to draw a firm conclusion; however, for the purpose of this EIR, they are considered significant. Such impacts are equivalent to Significant Impacts and require the identification of feasible mitigation measures.

- **Less Than Significant Impact.** Impacts that are adverse but that do not exceed the specified standards of significance.

- **No Impact.** The project would not create an impact.

## 4.4 KEY TO IMPACT ANALYSIS

**Table 4.0-1, Key to Impact Analysis**, below presents the various project components and identifies the sections of the Draft EIR that address the environmental impacts of the components, to the extent that the project component would result in a particular impact that would not result from the rest of the project. This table also identifies sections of the Draft EIR that specifically address the various wastewater and access road intersection options.

**Table 4.0-1**
**Key to Impact Analysis**

| Project Component | Section of Draft EIR |
|---|---|
| Main Building | All sections |
| Auditorium | All sections, specifically **Section 4.12, Transportation and Traffic** |
| Cooling Towers and Emergency Generator | All sections, specifically **Section 4.1, Aesthetics; Section 4.2, Air Quality**; **4.9, Noise; Section 4.13, Utilities and Service Systems** |
| Wastewater Options | All sections, specifically **Section 4.3, Biological Resources**; **Section 4.6, Hazards and Hazardous Materials** |
| Access Road | All sections, specifically **Section 4.3, Biological Resources**; **Section 4.6, Hazards and Hazardous Materials**; **Section 4.7, Hydrology and Water Quality** |
| Hydromodification Vault | All sections, specifically **Section 4.7, Hydrology and Water Quality** |

# 4.1 AESTHETICS

## 4.1.1 Introduction

This section presents existing visual resources at the project site and analyzes the potential for implementation of the proposed Helios project to affect those resources. Information presented in the discussion and analysis presented below was obtained from site visits, the Lawrence Berkeley National Laboratory (LBNL) 2006 Long Range Development Plan (LRDP) Environmental Impact Report (EIR), and environmental documents associated with LBNL projects.

For purposes of this analysis, visual or aesthetic resources are generally defined as the natural and built landscape features that are visible to humans from public vantage points. The overall visual character of a given area results from the unique combination of natural landscape features including landform, water, and vegetation patterns as well as built features such as buildings, roads and other structures.

Two computer-generated visual simulations illustrating "before" (current) and "after" (proposed) visual conditions from representative public vantage points near the project site are presented as part of this analysis. The locations of the visual simulation vantage points were selected in consultation with visual resources professionals and LBNL staff and were chosen to represent public viewpoints that provide the most direct views of potential site changes.

In response to the Notice of Preparation for this EIR, several commenters expressed concern regarding quality of life, but no specific comments related to scenic resources, scenic vistas, visual character, or light and glare were received.

## 4.1.2 Environmental Setting

### *Regional Location*

The Helios project is located at LBNL, in the eastern hills of the cities of Berkeley and Oakland in Alameda County. The LBNL site is located on approximately 200 acres that are owned by the University of California (see **Figure 3.0-1, Regional Location**). Situated on the steeply sloping hillsides above the UC Berkeley campus, the LBNL site rises from an elevation 500 feet near its main entrance along Cyclotron Road at the Blackberry Canyon Gate to about 1,000 feet at the northern border of the site. The hills are covered in a mix of grass and native stands of native oaks and California bay as well as introduced eucalyptus or conifers provide a natural-appearing landscape backdrop to the Berkeley Laboratory site.

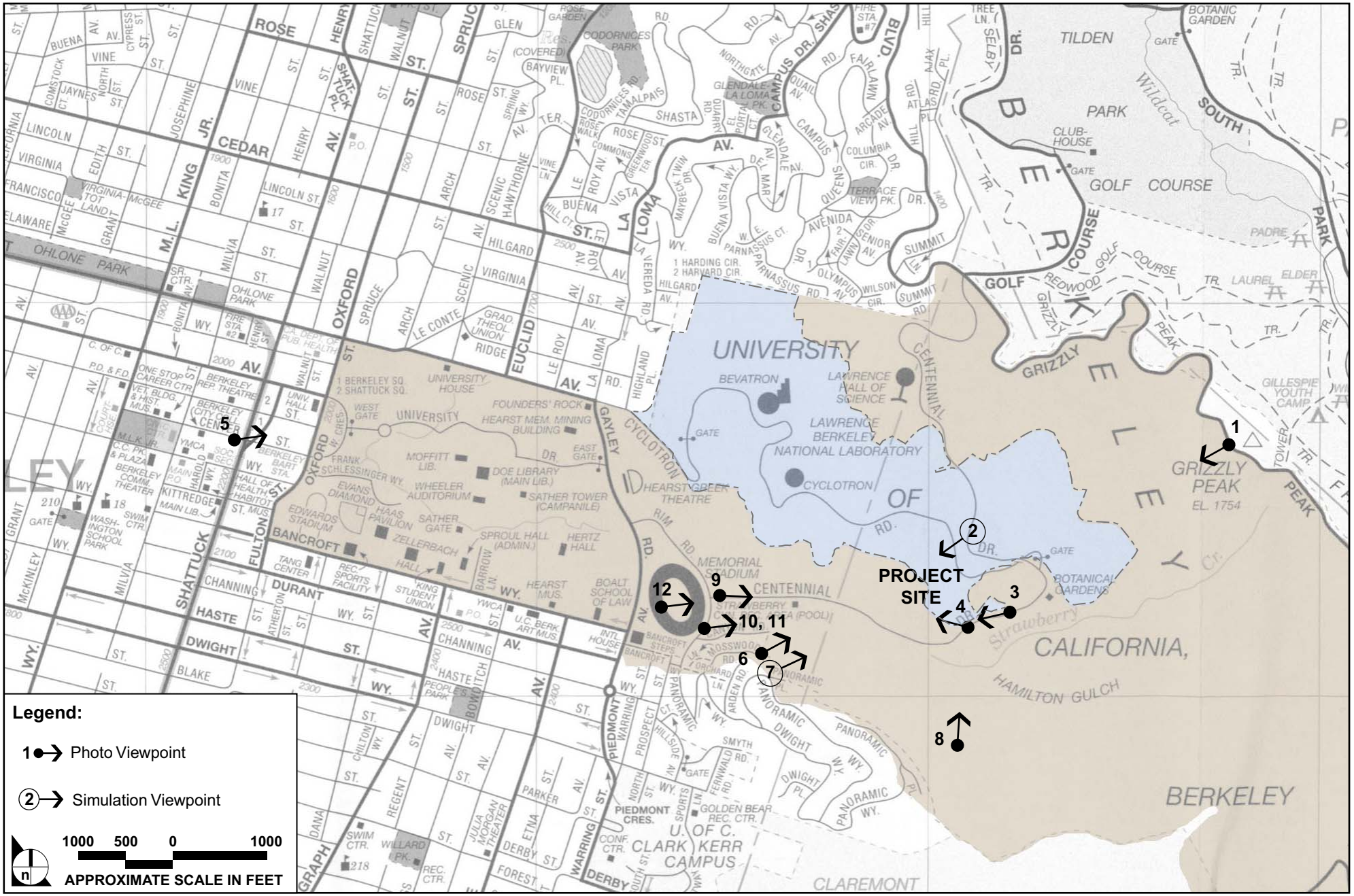
The entire LBNL site cannot be viewed from any one single off-site vantage point. However, portions of the Berkeley Lab site are visible from residential neighborhoods, public roadways, and public vantage points in the adjoining areas. Views of individual buildings or groups of buildings are available from public vantage points such as the Memorial Stadium, the Lawrence Hall of Science, and Grizzly Peak Boulevard. Portions of the LBNL site are visible in medium range views (less than 1 mile) from nearby elevated off-site locations such as the residential neighborhoods in the north and northwestern portions of the city of Berkeley. Long-range views (greater than 1 mile) available from downtown Berkeley and the Berkeley Marina encompass portions of the LBNL site. **Figure 4.1-1, Photo Viewpoint Locations,** provides a key to the photo viewpoints used in this analysis and shows the range of public views that were selected.

## *Surrounding Land Uses*

The LBNL site is surrounded by open space, institutional uses, and residential and neighborhood commercial areas (see **Figure 4.8-1, 2006 LRDP Land Use Diagram** in **Section 4.8, Land Use and Planning**). UC Berkeley, including the Strawberry Canyon open space area, lies south and southeast of the LBNL site. Residential neighborhoods and a small neighborhood commercial area in the city of Berkeley lie to the north and northwest, and regional open space, including the 2,000-acre Tilden Regional Park, lies to the northeast.

The LBNL site is largely buffered by undeveloped land owned by the University of California, although the northwest corner of LBNL abuts residential neighborhoods in the city of Berkeley. Access to the Berkeley Lab's hillside site is not available to the general public; three controlled-access vehicular gates include the main Blackberry Canyon Gate on Cyclotron Road and the Strawberry Canyon and Grizzly Peak gates on Centennial Drive. Visitors primarily use the Blackberry Canyon Gate. The Grizzly Peak Gate is an exit-only gate for use after the morning commute hours. The western part of the LBNL site lies within the Berkeley city limits, whereas the eastern part, including the project site, is within the city of Oakland.

The visual character of LBNL's built environment can be described as eclectic. Established in the 1930s, the laboratory now includes buildings of various ages and architectural styles. Many buildings display an industrial look and utilitarian quality. A number of buildings are painted in neutral colors to blend with the natural setting. Some of the buildings are recognizable landmarks including Building 50 (Bevatron) and the distinctive domed Advanced Light Source building, which was constructed as the Cyclotron in the 1940s. Portions of these buildings are visible from some public locations; however, mature trees interspersed through the site screen views of buildings from many other locations.




**SOURCE:** MAP SOURCE: LBNL LRDP EIR, Impact Sciences, Inc. - August 2007

FIGURE **4.1-1**

Photo Viewpoint Locations

924-001•09/07

Views of the Berkeley Lab from nearby areas generally include natural landform and tree clusters as well as buildings or other structures, roadways, fencing and pavement situated on the hillside.

## *Project Site*

The project site is located at the southeast portion of LBNL in the Redwood cluster area (see **Figures 3.0-1 and 3.0-2** in **Section 3.0, Project Description**). The site lies east of Chicken Creek, south of Lawrence Road, west of the Molecular Foundry building, and north of the UC Berkeley fence line (see **Figure 3.0-3** in **Section 3.0, Project Description**). The entire project site, including the access road, is approximately 6 acres and is currently undeveloped, except for portions of an existing access road, approximately 12 feet wide. The Helios site has been heavily disturbed and graded in conjunction with the recent construction of the adjacent Molecular Foundry building and earlier roadway construction south along the hillside. Non-native grasses occupy the area where the building and parking area are proposed. Adjacent to the north are recently planted trees associated with the Molecular Foundry construction. Vehicular access to the site is proposed along a 1,200-foot road connection to Centennial Drive, an area which currently includes a narrow service road that provides access from Centennial Drive to Buildings 73, 62, and 66 and ends roughly 700 feet south from the proposed building footprint. The proposed project would upgrade this to a two-lane roadway and extend it to the proposed Helios building with a linear 50-space parking area and a passenger drop-off area. The area that would be occupied by the proposed access road includes more dense vegetation comprised of seasonal scrub, evergreen trees, and grasses. **Figure 4.1-2, Public Views of the Site and Surroundings**, shows the existing access road where it meets Centennial Drive just below (west of) the UC Botanical Gardens.

## *Site Viewshed*

For purposes of this study, the project viewshed is defined as the general area from which the Helios project would be visible to the public. Due to screening provided by intervening vegetation, topography and existing development, the Helios site is not visible from most areas located beyond the LBNL site itself. However, public views of the site are available from a limited number of places within the surrounding area including intermittent points along Centennial Drive, Grizzly Peak Boulevard, and Stadium Rim Way. In addition, the project site can be seen from places with the Strawberry Canyon open space area and from a limited portion of the nearby Panoramic Hill residential streets. The following section describes potentially affected existing views which are available from these areas.

## *Site Visibility and Public View Corridors*

A set of 12 photographs, presented as **Figures 4.1-2** through **4.1-4 Public Views of Site and Surroundings,** document representative public views of the Helios project site as seen from relatively close range and distances of up to approximately 1.5 miles away.

Grizzly Peak Boulevard, a winding two-lane roadway, forms the boundary between University property and a portion of the 2,000-acre Tilden Park as well as between University land and private land in the city of Oakland. Scenic vistas with expansive views of the bay and beyond are available from places along Grizzly Peak Boulevard, which is a designated Alameda County and City of Oakland scenic route. Photo 1 on **Figure 4.1-2**, is a view taken from the road, approximately 0.75 mile away to the northeast where an open vista is available from a limited portion of the road. From this area, existing LBNL facilities appear amidst surrounding hillside vegetation with the Berkeley cityscape and the San Francisco Bay in the backdrop. As shown in the photo, the Molecular Foundry building appears near the center of the image and the project site would be just to the right and down slope.

Motorists and bicyclists on Centennial Drive have limited views of the project site and access road. Portions of the roadside are surrounded by dense vegetation which screens views towards the site or surrounding landscape from the road. Photo 3 shown in **Figure 4.1-2**, taken from Centennial Drive below the UC Botanical Gardens, shows the existing service access road and the area where the Helios Access Road is proposed. As shown in Photo 4 on **Figure 4.1-2**, heavy tree cover exists in this location on both sides of the road. On the portion of Centennial Drive to the east and uphill of the site, the vegetation pattern is more open. From this area, views toward the site are available with cityscape and bay vistas seen in the backdrop. In Photo 2 on **Figure 4.1-2**, taken from Centennial Drive near McMillan Road, the site appears below and behind the recently planted redwood trees near the center of the image. A corner of the Molecular Foundry building also appears at the left side of this photo.

Located south of Strawberry Canyon, Panoramic Hill is composed of relatively steep terrain with considerable mature vegetation and about 150 to 180 hillside structures. Views of the Helios project site are available from limited areas within the Panoramic Hill neighborhood. Photos 6 and 7 on **Figure 4.1-3**, taken from public sidewalks in this neighborhood, portray the presence of intervening vegetation and development which largely screen views of the project site.

As depicted in Photo 8 on **Figure 4.1-3**, the project site is also visible from limited portions of the Jordan fire trail, a popular jogging/hiking trail located in Strawberry Canyon. In this view, the recently

1. Grizzly Peak Boulevard looking southwest

2. Centennial Drive near McMillan Road looking southwest *

3. Centennial Drive looking southwest towards project access road

4. Centennial Drive at proposed access road looking west

* simulation viewpoint

**SOURCE:** Environmental Vision - August 2007

FIGURE **4.1-2**

Public Views of Site and Surroundings

5. BART Station at Center Street at Shattuck Avenue looking northeast

6. Public path near Panoramic Way looking northeast

7. Panoramic Way looking northeast *

8. Jordan Fire Trail (Strawberry Canyon) looking north

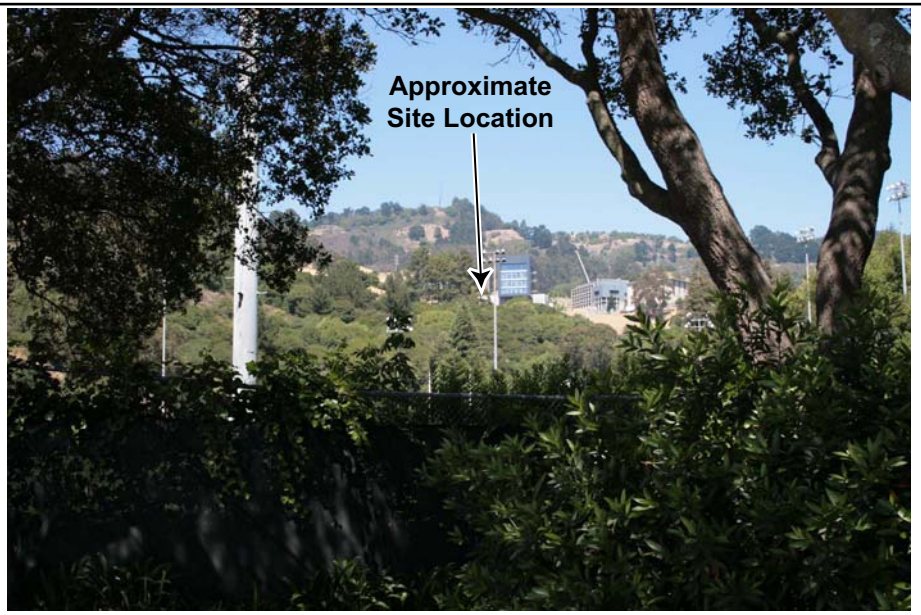
* simulation viewpoint

**SOURCE:** Environmental Vision - August 2007

FIGURE **4.1-3**

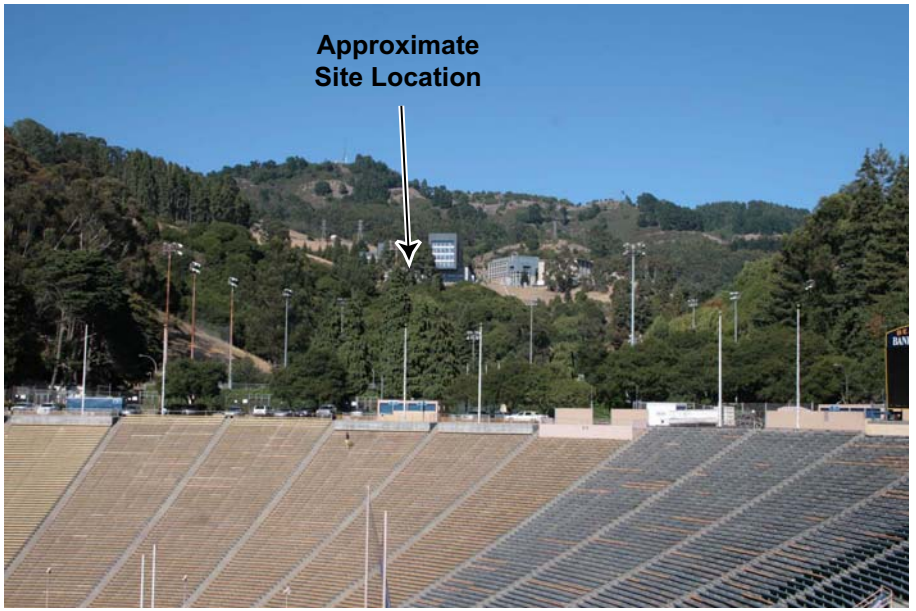
Public Views of Site and Surroundings

9. Centennial Drive looking east




10. Stadium Rim Way looking east

11. Rugby Fields on Stadium Rim Way looking east




12. Memorial Stadium looking east

**SOURCE:** Environmental Vision - August 2007

FIGURE **4.1-4**

Public Views of Site and Surroundings

constructed Molecular Foundry building is visible near the center of the image and the densely vegetated canyon of Chicken Creek is visible just to its left. Due to intervening mature vegetation, views of the site are screened from many locations along the trail.

The project site can also be seen from Stadium Rim Way and portions of the UC Berkeley campus. Photos 9 and 10 on **Figure 4.1-4** are views from Stadium Rim Way north of Centennial Drive. Views of the project site along this road are generally screened by existing mature vegetation. However, at the rugby field where the vegetation pattern is more open, views are available towards the site (see Photo 11). As shown in Photo 12 on **Figure 4.1-4**, the site is also visible from places within the Memorial Stadium seating area.

Due to intervening topography, vegetation and structures, the project site is generally not visible from elsewhere in the city of Berkeley and its environs including the downtown district and more distant areas. Photo 5 on **Figure 4.1-3**, taken from the downtown Berkeley near the BART station, demonstrates that views of the project site from this location are obstructed by intervening structures and vegetation.

## 4.1.3 Regulatory Considerations

### *Local Plans and Policies*

The proposed project would be located at LBNL, which is operated by the University of California and conducts work within the University's mission on land that is owned or controlled by The Regents of the University of California. As a state entity, the University is exempted by the state constitution from compliance with local land use regulations, including general plans and zoning. However, the University seeks to cooperate with local jurisdictions to reduce any physical consequences of potential land use conflicts to the extent feasible. LBNL is located in both the city of Berkeley and the city of Oakland. The following sections summarize objectives and policies from the LBNL 2006 LRDP and LBNL Design Guidelines, the City of Berkeley and City of Oakland General Plans and local ordinances that relate to visual quality.

#### 2006 LRDP Principles and Strategies[1]

The "Vision" section of the 2006 LRDP proposes four fundamental principles that form the basis for the LRDP's development strategies. The two principles most applicable to aesthetic aspects of new

[1] While this Environmental Impact Report presents a "stand alone" impact analysis that does not rely upon tiering from any programmatic CEQA document, Berkeley Lab does actively follow the 2006 Long Range Development Plan (LRDP) as a planning guide for Lab development. Accordingly, relevant 2006 LRDP principles, strategies, and design guidelines are identified in this section.

development are to "Preserve and enhance the environmental qualities of the site as a model of resource conservation and environmental stewardship" and to "Build a more campus-like research environment." (LRDP, Section 2 – "Vision")

Development strategies provided by the 2006 LRDP are intended to minimize potential environmental impacts that could result from implementation of the 2006 LRDP. Development strategies set forth in the 2006 LRDP that are applicable to aesthetics include the following:

- Protect and enhance the site's natural and visual resources, including native habitats, streams and mature tree stands by focusing future development primarily within the already developed areas of the site;
- Increase development densities within areas corresponding to existing cluster of development to preserve open space, enhance operational efficiencies and access;
- To the extent possible site new projects to replace existing outdated facilities and ensure the best use of limited land resources;
- To the extent possible site new projects adjacent to existing development where existing utility and access infrastructure may be utilized;
- Create a more "collegial" environment that encourages and facilitates interaction among the variety of Berkeley Laboratory employees and guests;
- Site and design new facilities in accordance with University of California energy efficiency and sustainability policy to reduce energy, water and material consumption and provide improved occupant health, comfort and productivity;
- Exhibit the best practices of modern sustainable development in new projects as a way to foster a greater appreciation of sustainable practices at the Laboratory;
- Eliminate parking from the sides of major roadways, thereby improving safety and allowing one-way roads to be converted to two-way traffic;
- Maintain or reduce the percentage of parking spaces relative to the adjusted daily population;
- Consolidate parking into larger lots and/or parking structures, locate these facilities near Laboratory entrances to reduce traffic within the main site;
- Remove parking from areas targeted for outdoor social spaces and service areas;
- Preserve and enhance the native rustic landscape and protect sensitive habitats;
- Consolidate service functions wherever possible in the Corporation Yard;
- Improve the pedestrian spaces at the heart of the research clusters and adjacent to research facilities so as to support interaction among Laboratory users;

- Retain and improve walkways as appropriate throughout the open space portions of the site, carefully integrating these pathways to minimize intrusion in the natural environment;
- Improve wayfinding for visitors in particular through a comprehensive and coordinated signage system and through the naming of buildings and research clusters;
- Develop new campus-like outdoor spaces such as plazas within clusters of facilities and improve those that already exist;
- Maintain and enhance tree stands to reduce the visibility of Laboratory buildings from significant public areas in neighboring communities;
- Improve the overall appearance and experience of the Laboratory through improvements to the main entry gates, and the landscape areas associated with roadways, parking lots, and pedestrian pathways;
- Continue to use sustainable practices in selection of plant materials and maintenance procedures;
- Develop all new landscape improvements in accordance with the Laboratory's vegetation management program to minimize the threat of wildland fire damage to facilities and personnel;
- Utilize native, drought-tolerant plant materials to reduce water consumption; focus shade trees and ornamental plantings at special outdoor use areas; and
- Minimize impervious surfaces to reduce storm water run-off and provide landscape elements and planting to stabilize slopes, reduce erosion and sedimentation.

**LBNL Design Guidelines**

The LBNL Design Guidelines were developed in parallel with the 2006 LRDP and provide specific guidelines for site planning, landscape and building design as a means to implement the 2006 LRDP's development principles as each new project is developed. Specific design guidelines are organized by a set of design objectives that essentially correspond to the strategies provided in the 2006 LRDP. The LBNL Design Guidelines provide the following specific planning and design guidance for the aesthetic aspects of new development to achieve these design objectives.

The design guidelines would be applied to the proposed project. As part of the design review and approval process, the proposed project would be evaluated for adherence to the LRDP Land Use Map, the design guidelines, the Building Heights Map, and any other relevant plans and policies. Approvals would be subject to satisfactory compliance with these provisions. Design objectives that are contained within the design guidelines and applicable to the aesthetics analysis include the following:

- Provide screening landscape elements to visually screen large buildings;
- Create landform elements consistent with design on the Hill;

- Mass and site buildings to minimize their visibility;
- Screen roofscapes;
- Respect view corridors;
- Integrate buildings into the overall landscape using appropriate materials;
- Create a cohesive identity across the Laboratory as a whole by following established precedents for new landscape elements;
- Provide appropriate site lighting for safety and security;
- Create new commons spaces in clusters that currently lack them;
- Allow sunlight to reach the commons spaces;
- Create as high a density and critical mass around commons spaces as possible;
- Create new keystone structures in clusters that currently lack them;
- Utilize artifacts to create identity and add interest to each cluster;
- Create consistency between buildings in individual clusters;
- Develop research clusters in a way that is mindful of future expansion;
- Design pathway layouts that support pedestrian flow and encourage casual interaction;
- Construct new walkway structures such as stairs, bridges, slope retention for walkways and guardrails of materials compatible with the surrounding landscape;
- Minimize visual and environmental impacts of new parking lots;
- Site and design parking structures to integrate with the natural surroundings; and
- Organize service functions to minimize conflicts and visual impacts.

**City of Berkeley General Plan**

The Urban Design and Preservation Element of the City of Berkeley Draft General Plan contains few policies related specifically to visual quality. Policies relevant to the proposed project include:

> Policy UD-10: The University of California: The City of Berkeley strongly supports actions by the University to maintain and retrofit its historic buildings, and strongly opposes any University projects that would diminish the historic character of the campus or off-campus historic buildings. (see Land Use Policies LU-36 and LU-37)

Policy UD-31: Views: Construction should avoid blocking significant views, especially ones toward the Bay, the hills, and significant landmarks such as the Campanile, Golden Gate Bridge, and Alcatraz Island. Whenever possible, new buildings should enhance a vista or punctuate or clarify the urban pattern.

Policy UD-32: Shadow: New buildings should be designed to minimize impacts on solar access and minimize detrimental shadows.

**City of Oakland General Plan**

The Open Space, Conservation, and Recreation (OSCAR) Element of the City of Oakland's General Plan was adopted in 1996. OSCAR policies pertaining to aesthetics and visual resources relevant to the proposed project include the following:

Policy OS-10.1: Protect the character of existing scenic views in Oakland, paying particular attention to: (a) views of the Oakland Hills from the flatlands; (b) views of downtown and Lake Merritt; (c) views of the shoreline; and (d) panoramic views from Skyline Boulevard, Grizzly Peak Road, and other hillside locations.

Policy OS-10.2: Encourage site planning for new development, which minimizes adverse visual impacts and takes advantage of opportunities for new vistas and scenic enhancement.

## 4.1.4 Impacts and Mitigation Measures

### *Significance Criteria*

The impact of the proposed project on aesthetics would be considered significant if it would exceed the following Standards of Significance, in accordance with Appendix G of the *CEQA Guidelines* and the UC CEQA Handbook:

- Have a substantial adverse effect on a scenic vista;
- Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State scenic highway;
- Substantially degrade the existing visual character or quality of the site and its surroundings; or
- Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area.

## *Issues Not Discussed Further*

The Helios project Initial Study found that implementation of the project would have no impact on scenic resources within a State scenic highway, as there are no scenic routes located within the vicinity of the project site. This issue is not discussed further in this section.

## *Methodology and Visual Simulations*

Field observations of the project site and surroundings were conducted in July and August 2007 in order to observe existing visual conditions in the project vicinity, to photograph representative public views of the site, and to identify key viewing locations for purposes of preparing visual simulations. In addition to the field observations, the visual impact assessment is based on review of project materials including topographic maps, project drawings and technical data supplied by the LBNL project design team, aerial and ground-level photographs of the project area, and computer-generated visual simulations which portray the project's appearance from representative public viewing locations. The evaluation of potential visual impacts associated with the Helios project is based, in part, on comparing the "before" and "after" visual conditions as portrayed in the simulation images and assessing the degree of visual change that the project would bring about.

A set of visual simulations is presented in this aesthetics analysis to illustrate "before" and "after" visual conditions in the project area. The simulations illustrate the location, scale and appearance of the proposed project as seen from two representative public viewpoints: (1) Centennial Drive near McMillan Road approximately 500 feet from the project site (**Figure 4.1-5, Visual Simulation-Centennial Drive**) and (2) the Panoramic Hill neighborhood, at a point along Panoramic Way approximately 0.33 mile from the project site (**Figure 4.1-6, Visual Simulation-Panoramic Way**). These viewpoints were selected to represent public viewpoints that provide the most direct view of the potential site changes and would therefore be the most appropriate locations from which to prepare visual simulations. Computer modeling and rendering techniques were employed to produce the visual simulation images. The computer-generated visual simulations are the results of an objective analytical and computer modeling process described briefly below.

The visual study employs photographs taken in July and August 2007, using a single lens reflex (SLR) digital camera with a 50mm lens equivalent, which represents a horizontal view angle of approximately 40 degrees. Existing topographic and site data supplied by LBNL provided the basis for developing an initial digital model. The three-dimensional computer model of the proposed building was combined with the digital site model to produce a computer model of the proposed project. For each of the

Existing view from Centennial Drive near McMillan Road (VP 2)

Visual simulation of proposed project

**SOURCE:** Environmental Vision - September 2007

FIGURE **4.1-5**

Visual Simulation - Centennial Drive

Existing view from Panoramic Way (VP 7)


Visual simulation of proposed project

**SOURCE:** Environmental Vision - September 2007

FIGURE **4.1-6**

Visual Simulation - Panoramic Way

simulation viewpoints, viewer location was digitized from topographic maps using 5 feet as the assumed eye level. Computer "wireframe" perspective plots were overlaid on photographs to verify scale and viewpoint location. Digital visual simulation images were then produced based on computer renderings of the 3-D model combined with digital versions of the selected site photographs.

## *Project Characteristics*

The project proposes a 160,000-foot, 7-level research building, a parking area, an access road, and other utility improvements on the hillside below the existing Molecular Foundry building on the LBNL site. **Figures 3.0-4** and **3.0-5** present a plan and elevation drawing of the proposed project. The proposed Helios Facility would have a footprint of approximately 150 by 500 feet. At its highest, the structure would be approximately 89 feet above the main entry level. The Helios building is designed to step down with the hillside landform so as to place the building parallel with the contours of the hillside to create distinct lower and upper hillside entry points.

The exterior cladding of the building would be similar in appearance and quality to the Molecular Foundry building and other nearby buildings and would include the use of metal, concrete, and glass. Roof-mounted equipment would be grouped together to the extent feasible and shielded from view by a parapet wall. Photovoltaic panels would also be located on the roof of the higher northerly portion of the building.

The project includes development of a linear 50-space paved parking area, approximately 25 by 500 feet that would be located along the access road, extending south of the project site, providing perpendicular vehicle parking access. The proposed access road would lead to a small roundabout passenger drop-off area adjacent to the building lower level entrance. A variety of retaining walls would be needed for the building, parking area, and access road. The concrete that would be used for these would mimic retaining walls associated with the Molecular Foundry building.

Photo-voltaic (PV) panels, or solar panels, are proposed to be implemented at various locations on the project site to gather sunlight to convert to electricity. PV panels would be located on the roof, within the parapet wall, surrounded by the proposed boiler room, exhaust fans, and greenhouse. PV panels would also be located on the roof level outside of the parapet wall, which is on a slightly lower terrace than the rooftop equipment level. A parking canopy with PV panels is proposed along the access road. The retaining walls used to construct the access road would act as support structures for the parking canopy which would be made of PV panels to gather additional energy resources. PV film would be integrated between two plates of glass and used along the southern façade of the Helios project. The proposed PV

glass louvers would be mechanized to screen direct sunlight from users and pedestrians of the facility, while maintaining sufficient sun exposure.

## *Mitigation Measures included in the Proposed Project*

The following mitigation measures, adopted as part of the 2006 LRDP, are required by the 2006 LRDP for the proposed project and are thus included as part of the proposed project. The analysis presented below evaluates environmental impacts that would result from project implementation following the application of these mitigation measures. These mitigation measures that are included in the project would be monitored pursuant to the Mitigation Monitoring and Reporting Plan that will be adopted for the proposed project.

**LRDP MM VIS-4a**: All new buildings on the LBNL hill site constructed pursuant to the 2006 LRDP shall incorporate design standards that ensure lighting would be designed to confine illumination to its specific site, in order to minimize light spillage to adjacent LBNL buildings and open space areas. Consistent with safety considerations, LBNL project buildings shall shield and orient light sources so that they are not directly visible from outside their immediate surroundings.

**LRDP MM VIS-4b**: New exterior lighting fixtures shall be compatible with existing lighting fixtures and installations in the vicinity of the new building, and will have an individual photocell. In general, and consistent with safety considerations, exterior lighting at building entrances, along walkways and streets, and at parking lots shall maintain an illumination level of not more than 20 Lux (approximately 2 foot-candles).

**LRDP MM VIS-4c**: All new buildings on the LBNL hill site constructed pursuant to the 2006 LRDP shall incorporate design standards that preclude or limit the use of reflective exterior wall materials or reflective glass, or the use of white surfaces for roofs, roads, and parking lots, except in specific instances when required for energy conservation.

## *Project Impacts and Mitigation Measures*

**Helios Impact VIS-1: Construction activities associated with the project would create temporary aesthetic nuisances for adjacent land uses. (*Potentially Significant*; *Less than Significant with Mitigation)***

Construction activities associated with the project would include earth moving, building construction, paving, and landscape installation. Project construction would be visible from locations along public roadways including Grizzly Peak Boulevard and Centennial Drive, from locations on the UC Berkeley Campus and from limited areas in the Panoramic Hill neighborhood. This work would entail the use of heavy equipment and could be most noticeable to local residents. The proposed project would involve grading and construction on an already disturbed site. This effect would be temporary, and it is anticipated that project construction would be completed within a 26 to 34-month period. The impact is considered potentially significant. With the implementation of the proposed mitigation measure, the impact would be less than significant.

**Helios Mitigation Measure VIS-1**: LBNL and their contractors shall minimize the use of on-site storage and when necessary store building materials and equipment away from public view to the maximum extent feasible and shall keep activity within the project site and laydown areas.

**Significance after Mitigation**: Less than significant

**Helios Impact VIS-2: The proposed project would alter views of the LBNL site and would result in a substantial adverse effect to a scenic vista or substantially damage scenic resources.** ***(Significant; Significant and Unavoidable)***

*Scenic Vistas*

For purposes of this study, a scenic vista is considered an open and expansive public view encompassing valued landscape features such as ridgeline, open bay waters, distinctive urban skyline or major landmarks.

**Figure 4.1-5** shows a "before" and "after" view of the project site looking northwest from Centennial Drive near the intersection with McMillan Road. From this location, expansive urban landscape views include portions of the cities of Oakland, Emeryville, and Berkeley with the bay and the San Francisco peninsula in the backdrop. In the foreground on the left, the recently constructed Molecular Foundry building appears with a row of recently planted trees seen down slope and to the right. This visual simulation illustrates a close range, somewhat elevated view of the project from about 300 feet away. Portions of the new building would appear near the center of the view, to the right of the Molecular Foundry building. As seen from the roadway, the building would be below eye level. Four exhaust stacks are visible above the roofline of the proposed Helios building. The exhaust stacks are shown extending approximately 15 feet beyond the parapet wall. As these stacks are the highest component of the proposed project, they would partially block portions of the view from Centennial Drive. Existing trees would partially screen the Helios Facility. The new building massing would be seen against a

backdrop comprised of wooded and open hillside. As shown in the simulation, the Helios Facility would be visible from the roadway; however, it would not obstruct distant views of the cityscape or the bay. The new building would appear within the context of existing facilities currently seen from this location including the new Molecular Foundry building. In this respect, the project would represent an incremental change to the existing view. Initially, existing trees would partially screen the building. Additional visual screening will be provided over time, as these trees mature.

The proposed project would be visible from limited portions of Centennial Drive and Grizzly Peak Boulevard. Where scenic vistas of the San Francisco Bay or Golden Gate Bridge are available from points along these public roadways, the project would not obstruct or substantially affect these existing views. The **Figure 4.1-5** simulation indicates that, in the case of Centennial Drive, the project is also below eye level and partially screened by an existing row of trees. In the case of Grizzly Peak Boulevard which lies further uphill from the project, the project would be situated at an elevation well below the eye level of a typical viewer and would therefore not obstruct views of scenic elements such as Alcatraz Island or the Golden Gate Bridge.

As demonstrated by the visual simulation and described above, although it would be visible, the Helios project would not have a substantial effect on existing views experienced by the public from Centennial Drive or Grizzly Peak Boulevard.

***Other Public Views***

The project would introduce a new building and access road improvements on a site which includes numerous existing buildings and other facilities. To varying degrees these changes would be visible to the public from limited areas in the vicinity. **Figure 4.1-6** presents a "before" and "after" view of the project site from Panoramic Way in the Panoramic Hill neighborhood, located about 0.33 mile away. Residential roadways in this hillside district are typically enclosed by dense vegetation including numerous mature trees, thus open views toward the project are extremely limited. The existing **Figure 4.1-6** view portrays a public view toward the project site where a break in the foreground tree canopies provides an opening. The view is framed by trees and an existing house in the foreground and the site appears as an open disturbed area near the center of the view. The **Figure 4.1-6** simulation indicates that the proposed Helios Facility would be visible from this Panoramic Hill vantage point and would appear beyond dense tree canopy seen in the foreground and middle ground. The new building would also be seen amidst hillside tree clusters and against a wooded hillside backdrop.

As seen in the **Figure 4.1-6** simulation from Panoramic Hill, the project would alter the site's character by introducing an additional built element into a hillside landscape setting which includes existing

structures. Public views of the project from this general area are largely screened by intervening development and dense vegetation. However, the proposed Helios Facility would not be screened when seen from this Panoramic Hill simulation viewpoint. In these cases, because it would not be screened by existing vegetation, the project could appear somewhat more noticeable than existing structures which are partially screened by hillside vegetation or landscaping. This effect could adversely affect the visual character of the site and its surroundings as seen from a limited area within the Panoramic Hill neighborhood.

It is expected that the Helios project would also affect existing views seen from limited areas situated at higher elevations within Strawberry Canyon including points along the Jordan fire/recreation trail. Photo 8 on **Figure 4.1-3** presents an open view toward the project. When seen from this area the project would appear within the context of various built elements including roadways, parking lots, buildings, and other structures associated with the laboratory as well as hillside grasslands and groupings of mature trees. As discussed in the Project Description, the proposed project would implement a landscaping plan to screen the building and for the proposed green roofs. The landscaping plan would place 20 36-inch box trees along the western and southwestern edge of the access road. The trees that would be selected for planting would be consistent with the fire fuel clearance requirements, and both the LBNL and UC Berkeley fire marshals would review the plan. These trees would help screen some portion of the building from public views, including the Panoramic Way view. Even with the implementation of the project's landscaping plan, however, the majority of the Helios building and portions of the access road would still be visible to the public. The impact is considered significant. In addition to the project's landscaping plan, Helios Mitigation Measure VIS-2 is proposed to reduce this visual impact.

**Helios Mitigation Measure VIS-2:** Trees and mature vegetation removal that is required for the access road construction will be minimized to reduce the potential visibility of the improved roadway.

**Significance after Mitigation**: The implementation of the project's landscaping plan and the proposed mitigation measure would not reduce the impact to scenic resources to a less than significant level. This impact is considered significant and unavoidable.

**Helios Impact VIS-3: The proposed project would alter the existing visual character of the Berkeley Laboratory site but would not substantially degrade the existing visual character and quality of the site and its surroundings. (*Less than Significant*)**

The project would introduce a new research building, a parking area, and an improved access road on the hillside down slope and adjacent to/north of the recently completed Molecular Foundry building within the LBNL site. With a footprint of approximately 150 by 500 feet, the project design calls for placing the

building parallel with the contours of the hillside and creating a narrow, stepped design, oriented north-south. This design approach would visually integrate the new building massing into the hillside, thus reducing its potential visibility. Distinct lower and upper hillside entry points would also be created.

In terms of its exterior appearance, the new Helios Facility would display characteristics that are similar to the Molecular Foundry building. Materials would include the use of metal, concrete, and glass. The aesthetic treatment of concrete used for new retaining walls associated with the Helios project, parking area and access road would mimic the existing retaining walls at the nearby Molecular Foundry building. A parapet wall would screen views of roof-mounted equipment including solar panels, however the stacks associated with the exhaust fans would be visible beyond the parapet wall by approximately 15 feet. Project design and implementation would be in keeping with the guidelines of the 2006 LRDP and in this respect, the project would contribute a more coherent appearance to the existing hillside structures through the use of similar materials and by adding to an existing cluster of buildings.

The new building would be constructed on a disturbed portion of the LBNL site. With the exception of access road improvements, the project would not result in removal of any significant vegetation. Because the proposed access road would utilize the alignment of an existing service road, the need for grading and tree removal would be minimized.

Taken together, these changes would result in a noticeable visual effect on the site's existing visual character. However, as described above the project would not substantially degrade the overall visual character of the LBNL site. Therefore, this impact is considered less than significant.

**Mitigation Measure**: No project-level mitigation measure required.

**Helios Impact VIS-4: The proposed project would create a new source of substantial light or glare that would not adversely affect day or nighttime views in the area.** ***(Potentially Significant; Less than Significant with Mitigation)***

The project would create new sources of light and glare within an already developed area. Sources of new light and glare could include expansive windows, metal and steel materials, and a surface parking lot. During the day, sunlight could reflect off the windows and the metal and steel materials of the buildings, PV panels and louvers, and the cars using the surface parking lots, and could thereby create additional glare. During the nighttime, the project site would be lit for nighttime operations and security reasons. These new sources could potentially affect day and nighttime views and could conflict with local lighting regulations and policies. However, LRDP Mitigation Measures VIS-4a and VIS-4b are

included in the proposed project, which would ensure the project's potential lighting impacts are less than significant level.

The proposed project also includes LRDP Mitigation Measure VIS-4c which requires all new buildings on the LBNL hill site constructed pursuant to the 2006 LRDP to incorporate design standards that preclude or limit the use of reflective exterior wall materials or reflective glass, or the use of white surfaces for roofs, roads, and parking lots, except in specific instances when required for energy conservation. Although in compliance with this mitigation measure, the project design would include non-reflective materials, the Helios project includes PV panels and louvers that could result in glare. The angle of the PV panels and louvers could create new sources of glare that could reflect to public gathering areas and viewpoints, including Memorial Stadium and the Jordan fire/recreation trail in Strawberry Canyon, and the impact is considered potentially significant. Helios Mitigation Measures VIS-4a through VIS-4c are proposed to reduce light and glare impacts.

**Helios Mitigation Measure VIS-4a**: Upon project implementation, the contractor shall install the PV panels at adequate angles that minimize the amount of glare that could be created while maintaining the functionality of the PV system.

**Helios Mitigation Measure VIS-4b**: Upon project implementation, the contractor shall install a mechanized system that controls the angle of the proposed PV louvers. This system shall be designed to ensure screening to building occupants while eliminating PV louver angles that would create substantial sources of glare.

**Helios Mitigation Measure VIS-4c**: To the maximum extent feasible, glazing materials shall be installed on the glass that comprises the PV louvers. The glazing shall be installed only if it can reduce glare while maintaining the functionality of the PV film within the glass.

**Significance after Mitigation**: Implementation of Helios Mitigation Measures VIS 4a and VIS 4b would reduce the glare impact of the proposed project's PV system to a less than significant level. Implementation of Helios Mitigation Measure VIS-4c would further reduce the glare impact of the PV louvers.

## 4.1.5 References

Lawrence Berkeley National Laboratory. 2007. 2006 Long Range Development Plan Final Environmental Impact Report, SCH No. 2000102046, July.

# 4.2 AIR QUALITY

## 4.2.1 Introduction

This section presents existing air quality conditions in the project area and analyzes the potential air quality impacts associated with implementation of the proposed Helios project. This section also provides a description of the regulatory framework for air quality management on a federal, state, regional, and local level. In addition, this section will evaluate the types and quantities of air emissions that would be generated on a temporary basis due to project construction and over the long term due to the project's operation. Radiological air emissions will be discussed in a regulatory context; however, radiological air emissions are not expected and therefore are not quantified nor are their impacts evaluated.

The analysis of air quality impacts is based on air quality regulations administered by the U.S. Environmental Projection Agency (U.S. EPA), the California Air Resources Board (CARB), and the Bay Area Air Quality Management District (BAAQMD) with each agency responsible for different aspects of the proposed project's activities. The roles of these agencies are discussed in detail in the Regulatory Considerations section. Other sources used in this assessment include the *BAAQMD CEQA Guidelines* [for] *Assessing the Air Quality Impacts of Projects and Plans* established by the BAAQMD in December 1999; and the *Bay Area 2005 Ozone Strategy*, adopted by the BAAQMD in January 2006. Other sources of information used in this section include Lawrence Berkeley National Laboratory (LBNL) documents, the general plans for the cities of Berkeley and Oakland, the EIR for the Berkeley General Plan, other environmental documents associated with LBNL projects, and the University of California CEQA Handbook prepared by the UC Office of the President.

In response to the Notice of Preparation for this EIR, a commenter expressed concern regarding carbon emissions associated with tree removal (loss of carbon sequestration) from the project site and Strawberry Canyon. As discussed in **Section 3.0, Project Description**, the proposed project would replace any removed trees at a minimum ratio of 1:1. In addition, as a result of ongoing vegetation management activities in Strawberry Canyon, the replacement forest of native species would have less biomass than the exotic eucalyptus-dominated forest, and should burn less frequently, in smaller conflagrations of lower intensity, resulting in a substantially lower release of carbon and particulates should a major firestorm occur. In addition, the fossil fuels needed to rebuild homes and buildings lost to a wildfire would have an enormous cost in terms of the greenhouse gas emissions associated with the energy required for replacement lumber, metal, cement, and other materials associated with rebuilding burned structures. Reducing the risk and severity of wildlife through vegetation management activities minimizes the threat to property and the greenhouse gas emissions associated with rebuilding.

The management of forests in the context of carbon sequestration and global warming is an emerging field, and California does not currently have any protocols for measuring or mitigating associated impacts from forest-disturbing activities. Furthermore, the proposed project would conduct research dedicated to reducing reliance on fossil fuels and subsequent carbon emissions and facilitating carbon sequestration. These research and development actions would more than offset any reduction in carbon sequestration resulting from project-related tree removal. Other commenters requested that the EIR address cumulative impacts of LBNL development on human and ecological health and safety. The cumulative health impacts of future operations associated with LBNL and UC Berkeley are discussed in **Section 5.0, Cumulative Impacts**, of this EIR. Some commenters expressed concern with respect to exposure of the public and the environment to nanomaterials released inadvertently to the environment. The impact related to the use of nanomaterials in the proposed facility is addressed in **Section 4.6, Hazards and Hazardous Materials**, of this EIR.

## 4.2.2 Environmental Setting

### *Climate and Meteorology*

The project area is located in the cities of Berkeley and Oakland within the boundaries of the San Francisco Bay Area Air Basin (SFBAAB or the Basin). The climate of the Bay Area is Mediterranean in character, with mild, rainy winter weather from November through March and warm, dry weather from June through October. In summer, the Pacific high-pressure system typically remains near the coast of California; subsidence of warm air over the cooler marine air associated with the Pacific high creates frequent summer atmospheric temperature inversions. Subsidence inversions may be several hundred to several thousand feet deep, effectively trapping pollutants in a stagnant volume of air near the ground with little dispersion ability. Typically, May through October is considered the ozone smog season when transport studies have shown precursor emissions generated in Oakland and Berkeley are often transported to other regions of the Bay Area and beyond (e.g., Central Valley) that are more conducive to the formation of ozone. In winter, the Pacific high-pressure system moves southward, allowing ocean-formed storms to move through the region. The frequent storms and infrequent periods of sustained sunny weather are not conducive to ozone formation. Radiational cooling during the evening, however, sometimes creates thin inversions and concentrates air pollutant emissions near the ground.

Mean minimum temperatures in the project area range from high 50s in the summer to the low 40s in the winter. The average temperature in the area is the mid 50s with mean maximum summer temperatures in the low 80s and winter temperatures in the low 60s. Annual and daily temperatures in the region have fairly small oscillations due to the moderating effects of the nearby ocean. In contrast to the steady temperature regime, rainfall is highly variable and confined almost exclusively to the "rainy" period from

November through April. The area receives approximately 30 inches of rainfall annually, of which about 95 percent occurs during November to April. Precipitation may vary widely from year to year as a shift in the annual storm track of a few hundred miles can mean the difference between a very wet year and drought conditions. Winds in the project area typically vary diurnally. The usual pattern consists of daytime winds originating offshore from the west and northwest as air is funneled through the Golden Gate, and nighttime winds originating from the east and southeast due to the cooling of land areas. Summer afternoon sea breezes can often exceed 20 miles per hour. Peak annual winds occur during winter storms. South and southeast winds typically also precede weather systems passing through the region.

## *Regional Air Quality*

The determination of whether a region's air quality is healthful or unhealthful is made by comparing contaminant levels in ambient air samples to national and state standards. Health-based air quality standards have been established by California and the federal government for the following criteria air pollutants: ozone ($O_3$), carbon monoxide (CO), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), respirable particulate matter less than 10 microns in diameter ($PM_{10}$), fine particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). These standards were established to protect sensitive receptors with a margin of safety from adverse health impacts due to exposure to air pollution. California has also established standards for sulfates, visibility reducing particles, hydrogen sulfide, and vinyl chloride. The state and national ambient air quality standards for each of the monitored pollutants and their effects on health are summarized in **Table 4.2-1, Ambient Air Quality Standards**.

The National Ambient Air Quality Standards (NAAQS) (other than $O_3$, $PM_{10}$, $PM_{2.5}$ and those based on annual averages or arithmetic mean) are not to be exceeded more than once per year. The NAAQS for $O_3$, $PM_{10}$, and $PM_{2.5}$ are based on statistical calculations over one- to three-year periods, depending on the pollutant. The SFBAAB is currently designated as a marginal nonattainment area with respect to the national standard for $O_3$ and is designated as attainment or unclassifiable for all other pollutants. Additional details regarding the attainment status are provided later in this section in **Table 4.2-5, National Ambient Air Quality Standards and Status – San Francisco Bay Area Air Basin**. Air quality of a region is considered to be in attainment of the state standards if the measured ambient air pollutant levels for $O_3$, CO, $SO_2$ (1- and 24-hour), $NO_2$, $PM_{10}$, $PM_{2.5}$, and visibility reducing particles are not exceeded, and all other standards are not equaled or exceeded at any time in any consecutive three-year period. The SFBAAB is currently designated as a nonattainment area with respect to the state standards for $O_3$, $PM_{10}$, and $PM_{2.5}$ and is designated as attainment or unclassified for all other pollutants. Additional details regarding the attainment status are provided later in this section in **Table 4.2-6, California Ambient Air Quality Standards and Status – San Francisco Bay Area Air Basin**.

**Table 4.2-1**
**Ambient Air Quality Standards**

| Air Pollutant | State Standard | Federal Primary Standard | Most Relevant Health Effects |
|---|---|---|---|
| Ozone | 0.070 ppm, 8-hr. avg.<br>0.09 ppm, 1-hr. avg. | 0.08 ppm, 8-hr. avg. (3-year average of annual 4th highest daily maximum) | (a) Short-term exposures: (1) Pulmonary function decrements and localized lung edema in humans and animals; and (2) Risk to public health implied by alterations in pulmonary morphology and host defense in animals; (b) Long-term exposures: Risk to public health implied by altered connective tissue metabolism and altered pulmonary morphology in animals after long-term exposures and pulmonary function decrements in chronically exposed humans; (c) Vegetation damage; and (d) Property damage |
| Carbon Monoxide | 9.0 ppm, 8-hr. avg.<br>20 ppm, 1-hr. avg. | 9 ppm, 8-hr. avg.<br>35 ppm, 1-hr. avg. | (a) Aggravation of angina pectoris and other aspects of coronary heart disease; (b) Decreased exercise tolerance in persons with peripheral vascular disease and lung disease; (c) Impairment of central nervous system functions; and (d) Possible increased risk to fetuses |
| Nitrogen Dioxide | 0.25 ppm, 1-hr. avg. | 0.053 ppm, annual arithmetic mean | (a) Potential to aggravate chronic respiratory disease and respiratory symptoms in sensitive groups; (b) Risk to public health implied by pulmonary and extra-pulmonary biochemical and cellular changes and pulmonary structural changes; and (c) Contribution to atmospheric discoloration |
| Sulfur Dioxide | 0.04 ppm, 24-hr. avg.<br>0.25 ppm, 1-hr. avg. | 0.030 ppm, annual arithmetic mean<br>0.14 ppm, 24-hr. avg. | (a) Bronchoconstriction accompanied by symptoms which may include wheezing, shortness of breath and chest tightness, during exercise or physical activity in person with asthma |
| Respirable Particulate Matter | 20 μg/m$^3$, annual arithmetic mean<br>50 μg/m$^3$, 24-hr. avg. | 150 μg/m$^3$, 24-hr. avg. | (a) Excess deaths from short-term exposures and exacerbation of symptoms in sensitive patients with respiratory disease; and (b) Excess seasonal declines in pulmonary function, especially in children |
| Fine Particulate Matter | 12 μg/m$^3$, annual arithmetic mean | 15 μg/m3, annual arithmetic mean (3-year average)<br>35 μg/m3, 24-hr. avg. (3-year average of 98th percentile) | (a) Increased hospital admissions and emergency room visits for heart and lung disease; (b) Increased respiratory symptoms and disease; and (c) Decreased lung function and premature death |
| Sulfates | 25 μg/m$^3$, 24-hr. avg. | None | (a) Decrease in ventilatory function; (b) Aggravation of asthmatic symptoms; (c) Aggravation of cardio-pulmonary disease; (d) Vegetation damage; (e) Degradation of visibility; and (f) Property damage |
| Lead[1] | 1.5 μg/m$^3$, 30-day avg. | 1.5 μg/m$^3$, calendar quarterly average | (a) Increased body burden; and (b) Impairment of blood formation and nerve conduction |

| Air Pollutant | State Standard | Federal Primary Standard | Most Relevant Health Effects |
|---|---|---|---|
| Visibility-Reducing Particles | In sufficient amount to produce extinction of 0.23 per kilometer due to particles when relative humidity less than 70%, 8-hr. average (10 AM–6 PM) | None | Visibility impairment on days when relative humidity is less than 70 percent |
| Hydrogen Sulfide | 0.03 ppm, 1-hr. avg. | None | Odor annoyance |
| Vinyl Chloride[1] | 0.01 ppm, 24-hr. avg. | None | Known carcinogen |

*Source: BAAQMD. Air Pollutants Regulated by the District. [September 19, 2007]; http://www.baaqmd.gov/dst/pollutants.htm.*
*$\mu g/m^3$ = microgram per cubic meter.*
*ppm = parts per million by volume.*
[1] *CARB has identified lead and vinyl chloride as "toxic air contaminants" with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.*

The project site is located within the SFBAAB, which includes all of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara counties as well as the southern half of Sonoma County and the southwestern portion of Solano County. The region is named as such because its geographical formation surrounding the San Francisco Bay. The Basin is affected by the pollutants generated within dense population centers, heavy vehicular traffic, and industry. However, as mentioned above, coastal sea breezes tend to transport pollutants generated within the SFBAAB to inland locations such as the Central Valley.

The air pollutants within the Basin are generated by two categories of sources: stationary and mobile. Stationary sources are known as "point sources," which have one or more emission sources at a single facility, or "area sources," which are widely distributed and produce many small emissions. Point sources are usually associated with manufacturing and industrial uses and include sources such as refinery boilers or combustion equipment that produce electricity or process heat. Examples of area sources include residential water heaters, painting operations, lawn mowers, agricultural fields, landfills, and consumer products, such as barbecue lighter fluid or hair spray. "Mobile sources" refer to operational and evaporative emissions from on- and off-road motor vehicles.

## Local Air Quality

To identify ambient concentrations of the criteria pollutants, the BAAQMD operates more than 30 air quality monitoring stations throughout the Basin. The nearest monitoring station to the project site is located at 822 Alice Street in Oakland, approximately 5 miles southwest of the project site. This monitoring station measures CO and $O_3$.

**Table 4.2-2, Ambient Pollutant Concentrations Measured at Oakland-Alice Street Station by Year**, lists the concentrations registered and the exceedances of California Ambient Air Quality Standards (CAAQS) and the National Ambient Air Quality Standards (NAAQS) that have occurred at this monitoring station from 2001 through 2005. Although limited 2006 data are available from other air monitoring stations, 2001 through 2005 data were used in order to provide complete coverage of air pollutants monitored at the Alice Street station. In addition, 2006 air quality data from the Alice Street monitoring station have not yet been fully reviewed and compiled for public access. During this period (i.e., 2001 through 2005), the station did not register any days above the state 1-hour or federal 8-hour ozone standard. At the closest monitoring station that monitors for $PM_{10}$ (Arkansas Street station in San Francisco), the state 24-hour $PM_{10}$ standard was exceeded each year except for 2005. At the same Arkansas Street station, the federal 24-hour $PM_{2.5}$ standard was exceeded in 2001 and 2002, but no exceedances were registered between 2003 and 2005. No other exceedances of the state or federal standards for $NO_2$, CO, $SO_2$, or Pb were registered at this station between 2001 and 2005.

## Sensitive Receptors

Land uses such as schools, hospitals, and convalescent homes are considered relatively sensitive to poor air quality because infants and children, the elderly, and people with health afflictions, especially respiratory ailments, are more susceptible to respiratory infections and other air-quality-related health problems than the general public. Residential areas are also considered sensitive to air pollution because residents (including children and the elderly) tend to be at home for extended periods of time, resulting in sustained exposure to any pollutants present. Recreational areas are also considered sensitive locations due to vigorous exercise associated with these types of land uses (exercise causes an increased breathing rate that will lead to greater exposure to ambient air pollutants).

**Table 4.2-2**
**Ambient Pollutant Concentrations Measured at Oakland-Alice Street Station by Year**

| Pollutant | Standards[1] | Year | | | | |
|---|---|---|---|---|---|---|
| | | 2001 | 2002 | 2003 | 2004 | 2005 |
| **OZONE ($O_3$)** | | | | | | |
| Maximum 1-hour concentration (ppm) | | 0.069 | 0.053 | 0.081 | 0.080 | 0.068 |
| Maximum 8-hour concentration (ppm) | | 0.043 | 0.043 | 0.054 | 0.057 | 0.045 |
| Number of days exceeding state 1-hour standard | 0.09 ppm | 0 | 0 | 0 | 0 | 0 |
| Number of days exceeding federal 8-hour standard | 0.08 ppm | 0 | 0 | 0 | 0 | 0 |
| **CARBON MONOXIDE (CO)** | | | | | | |
| Maximum 1-hour concentration (ppm) | | 5.0 | 4.4 | 3.9 | 3.5 | 3.4 |
| Maximum 8-hour concentration (ppm) | | 3.98 | 3.34 | 2.78 | 2.64 | 2.44 |
| Number of days exceeding state 8-hour standard | 9 ppm | 0 | 0 | 0 | 0 | 0 |
| Number of days exceeding federal 8-hour standard | 9.0 ppm | 0 | 0 | 0 | 0 | 0 |
| **NITROGEN DIOXIDE ($NO_2$)[2]** | | | | | | |
| Maximum 1-hour concentration (ppm) | | 0.062 | 0.080 | 0.056 | 0.063 | 0.066 |
| Annual Average (ppm) | | NA | 0.019 | NA | 0.017 | 0.016 |
| Number of days exceeding state 1-hour standard | 0.25 ppm | 0 | 0 | 0 | 0 | 0 |
| **SULFUR DIOXIDE ($SO_2$)[2]** | | | | | | |
| Maximum 1-hour concentration in ppm | | 0.010 | 0.020 | 0.021 | 0.044 | 0.019 |
| Maximum 24-hour concentration in ppm | | 0.004 | 0.006 | 0.009 | 0.008 | 0.007 |
| Annual arithmetic mean concentration (ppm) | | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 |
| Number of days exceeding state 1-hour standard | 0.25 ppm | 0 | 0 | 0 | 0 | 0 |
| Number of days exceeding state 24-hour standard | 0.04 ppm | 0 | 0 | 0 | 0 | 0 |
| Number of days exceeding federal 24-hour standard | 0.14 ppm | 0 | 0 | 0 | 0 | 0 |
| **PARTICULATE MATTER ($PM_{10}$)[3]** | | | | | | |
| Maximum 24-hour concentration ($\mu g/m^3$)[4] | | 69.8 | 78.6 | 51.7 | 51.8 | 46.4 |
| Maximum 24-hour concentration ($\mu g/m^3$)[5] | | 67.4 | 74.1 | 50.8 | 48.6 | 44.6 |
| Annual arithmetic mean concentration ($\mu g/m^3$)[5] | | 26 | 25 | 22 | 22 | 19 |
| Number of samples exceeding state 24-hour standard | 50 $\mu g/m^3$ | 8 | 4 | 1 | 1 | 0 |
| Number of samples exceeding federal 24-hour standard | 150 $\mu g/m^3$ | 0 | 0 | 0 | 0 | 0 |
| **PARTICULATE MATTER ($PM_{2.5}$)[3]** | | | | | | |
| Maximum 24-hour concentration ($\mu g/m^3$) | | 77 | 70 | 41.6 | 45.8 | 43.6 |
| Annual arithmetic mean concentration using federal methods ($\mu g/m^3$) | | 11.5 | 13.1 | 10.2 | 9.9 | 9.5 |
| Number of samples exceeding federal 24-hour standard[6] | 65 $\mu g/m^3$ | 2 | 4 | 0 | 0 | 0 |

| Pollutant | Standards[1] | Year 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|
| **LEAD[7]** | | | | | | |
| Maximum 30-day average concentration (μg/m³) | | 0.02 | 0.02 | 0.01 | — | — |
| Maximum quarterly average concentration (μg/m³) | | 0.01 | 0.01 | 0.01 | — | — |
| Number of months exceeding state standard | 1.5 μg/m³ | 0 | 0 | 0 | — | — |

*Sources: (i) California Air Resources Board Air Quality Database http://www.arb.ca.gov/adam/welcome.html*
*(ii) U.S. Environmental Protection Agency Air Quality Database http://www.epa.gov/air/data/*

[1] *Parts by volume per million of air (ppm), micrograms per cubic meter of air (μg/m³) or annual arithmetic mean (aam).*

[2] *Sulfur dioxide and nitrogen dioxide are not monitored at the Alice Street monitoring station. Data for 2001 to 2003 were obtained from the 6701 International Boulevard monitoring station in Oakland, which is located approximately 8.5 miles southeast of the project site. The 6701 International Boulevard station is the closest monitoring station that monitors for these pollutants. Monitoring for $NO_2$ and $SO_2$ was discontinued at the 6701 International station in 2003. Data for 2004 and 2005 were obtained from the Arkansas Street station in San Francisco, the next closest monitoring station located 11 miles west of the project site.*

[3] *Data is from monitoring station in San Francisco at Arkansas Street, the closest monitoring that that monitors that particulate pollutant.*

[4] *Using state methods for sampling.*

[5] *Using federal methods for sampling.*

[6] *The federal $PM_{2.5}$ standard was revised from 65 to 35 μg/m³ in September 2006. Statistics shown are based on the 65 μg/m³ standard.*

[7] *Pollutant concentrations were obtained from the Arkansas Street station, the closest monitoring station that monitors for lead.*

*NOTES:*
*Sulfates are monitored at Arkansas Street Station, San Francisco. Sulfates have not exceeded the state standard of 25 μg/m³ for more than 20 years.*

Sensitive land uses in the vicinity of the proposed project include residential neighborhoods, open space recreational areas, university student dormitories, and day care centers. Residential neighborhoods are located along the western and northern boundary of the proposed project. The nearest residences are approximately 2,100 feet away.

The UC Berkeley campus lies west of the project site. Sensitive land uses on the campus, which are in proximity of the project site, include a dormitory, Foothill Student Housing facility, and a day care facility, which is located in Girton Hall. The open space areas of Strawberry Canyon (owned by University of California) are located southeast of the project site. Other open space areas include University of California's Ecological Study Area and the Botanical Garden, the 2,000-acre Tilden Regional Park to the northeast, and the 208-acre Claremont Canyon Regional Preserve, which is located to the southeast of the project site.

## *Localized Carbon Monoxide Concentrations*

Traffic congestion along roadways and at intersections has the potential to generate localized high levels of CO. The BAAQMD monitoring stations have not recorded any exceedances of the state or federal CO standards since 1991. However, because elevated CO concentrations are generally localized, heavy traffic volumes and congestion at specific intersections or roadway segments can lead to high levels of CO, or

hotspots, while concentrations at the nearest air quality monitoring station may be below state and federal standards.

## *Surrounding Land Uses*

The proposed project site is surrounded by residential neighborhoods, UC Berkeley campus, recreational areas, university dormitories, and daycare centers, although relatively little development is found within 0.5 mile of the site, other than Berkeley Lab facilities. Major sources of air pollutants associated with these uses include motor vehicle emissions, natural gas combustion for water and space heating, and periodic landscape maintenance. It is not anticipated that surrounding land uses would result in emissions that would have a significant impact on the employees of the proposed project.

## *Global Climate Change*

### Description of Greenhouse Effect

Heat retention within the atmosphere is an essential process to sustain life on Earth. An important natural process through which heat is retained in the troposphere[1] is called the "greenhouse effect." The greenhouse effect traps heat in the troposphere through a three-fold process as follows: Short-wave radiation emitted by the Sun is absorbed by the Earth; the Earth emits a portion of this energy in the form of long-wave radiation; and greenhouse gases (GHGs) in the upper atmosphere absorb this long-wave radiation and emit this long-wave radiation into space and toward the Earth. This "trapping" of the long-wave (thermal) radiation emitted back toward the Earth is the underlying process of the greenhouse effect. Without the greenhouse effect, it is estimated that the Earth's average temperature would be approximately 18 degrees Celsius (°C) (0° Fahrenheit [°F]) instead of its present 14°C (57°F) (National Climatic Data Center 2006). The most abundant GHGs are water vapor and carbon dioxide ($CO_2$). Many other trace gases have greater ability to absorb and re-radiate long-wave radiation; however, these gases are not as plentiful. For this reason, and to gauge the potency of GHGs, scientists have established a Global Warming Potential (GWP) for each GHG based on its ability to absorb and re-radiate long-wave radiation. The GWP of a gas is determined using $CO_2$ as the reference gas with a GWP of 1.

1 The troposphere is the bottom layer of the atmosphere, which varies in height from the Earth's surface to 10 to 12 kilometers).

**Greenhouse Gases**

***Primary Greenhouse Gases***

Greenhouse gases include, but are not limited to, the following (IPCC 1996):[2]

- Carbon dioxide ($CO_2$). $CO_2$ associated with human activity is primarily generated by fossil fuel combustion in stationary and mobile sources. Due to the emergence of industrial facilities and mobile sources in the past 250 years, the concentration of $CO_2$ in the atmosphere has increased 35 percent (U.S. EPA 2006). $CO_2$ is the most widely-emitted anthropogenic GHG and is the reference gas (GWP of 1) for determining GWPs for other GHGs. In 2004, 83.8 percent of California's GHG emissions were $CO_2$ (CEC 2006).

- Methane (CH4). Methane is emitted from biogenic sources, incomplete combustion in forest fires, landfills, manure management, and leaks in natural gas pipelines. In the United States, the top three sources of methane come from landfills, natural gas systems, and enteric fermentation (U.S. EPA 2006). Methane is the primary component of natural gas, which is used for space and water heating, steam production, and power generation. The GWP of methane is 21.

- Nitrous oxide ($N_2O$). Nitrous oxide is produced by both natural and human-related sources. Primary human-related sources include agricultural soil management, animal manure management, sewage treatment, mobile and stationary combustion of fossil fuel, adipic acid production, and nitric acid production. The GWP of nitrous oxide is 310.

- Hydrofluorocarbons (HFCs). HFCs are typically used as refrigerants for both stationary refrigeration and mobile air conditioning. The use of HFCs for cooling and foam blowing is growing as the continued phase-out of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) gains momentum. The GWP of HFCs range from 140 for HFC-152a to 6,300 for HFC-236fa.

- Perfluorocarbons (PFCs). Perfluorocarbons are compounds consisting of carbon and fluorine. They are primarily created as a byproduct of aluminum production and semiconductor manufacturing. Perfluorocarbons are potent GHGs with a GWP several thousand times that of $CO_2$, depending on the specific PFC. Another area of concern regarding PFCs is their long atmospheric lifetime (up to 50,000 years) (Energy Information Administration 2001). The GWPs of PFCs range from 5,700 to 11,900.

- Sulfur hexafluoride. Sulfur hexafluoride is a colorless, odorless, nontoxic, nonflammable gas. It is most commonly used as an electrical insulator in high voltage equipment that transmits and distributes electricity. Sulfur hexafluoride is the most potent GHG that has been evaluated by the IPCC with a GWP of 23,900. However, its global warming contribution is not as high as the GWP would indicate due to its low mixing ratio compared to $CO_2$ (4 parts per trillion [ppt] in 1990 versus 365 parts per million [ppm]) (U.S. EPA 2006).

- Water vapor ($H_2O$). Although water vapor has not received the scrutiny of other GHGs, it is the primary contributor to the greenhouse effect. Water vapor and clouds contribute 66 to 85 percent of the greenhouse effect (water vapor alone contributes 36 to 66 percent) (Real Climate 2005). Natural

[2] All Global Warming Potentials (GWPs) are given as 100-year GWP. Unless noted otherwise, all GWPs were obtained from the Intergovernmental Panel on Climate Change (Intergovernmental Panel on Climate Change 1996).

processes such as evaporation from oceans and rivers and transpiration from plants contribute 90 percent and 10 percent of the water vapor in our atmosphere, respectively (United States Geological Survey 2006). The primary human-related source of water vapor comes from fuel combustion in motor vehicles; however, this is not believed to contribute a significant amount (less than 1 percent) to atmospheric concentrations of water vapor (Energy Information Administration 2002). Therefore, the control and reduction of water vapor emissions is not within reach of human actions. The Intergovernmental Panel on Climate Change (IPCC) has not determined a GWP for water vapor.

***Other Greenhouse Gases***

In addition to the six major GHGs discussed above (excluding water vapor), many other compounds have the potential to contribute to the greenhouse effect. Some of these substances were previously identified as stratospheric ozone depletors; therefore, their gradual phase-out is currently in effect. A few of these compounds are discussed below:

- Hydrochlorofluorocarbons (HCFCs). HCFCs are solvents, similar in use and chemical composition to CFCs. The main uses of HCFCs are for refrigerant products and air conditioning systems. As part of the Montreal Protocol, all developed countries that adhere to the Protocol are subject to a consumption cap and gradual phase-out of HCFCs. The United States is scheduled to achieve a 100 percent reduction to the cap by 2030. The GWPs of HCFCs range from 93 for HCFC-123 to 2,000 for HCFC-142b (U.S. EPA 1996).

- 1,1,1-trichloroethane. 1,1,1-trichloroethane or methyl chloroform is a solvent and degreasing agent commonly used by manufacturers. In 1992, the U.S. EPA issued Final Rule 57 FR 33754 scheduling the phase-out of methyl chloroform by 2002 (U.S. EPA 2006). Therefore, the threat posed by methyl chloroform as a GHG continues to diminish. Nevertheless, the GWP of methyl chloroform is 110 times that of $CO_2$ (U.S. EPA 1996).

- Chlorofluorocarbons (CFCs). CFCs are used as refrigerants, cleaning solvents, and aerosol spray propellants. CFCs were also part of the U.S. EPA's Final Rule 57 FR 3374 for the phase-out of ozone depleting substances. Currently, CFCs have been replaced by HFCs in cooling systems and a variety of alternatives for cleaning solvents. Nevertheless, CFCs remain suspended in the atmosphere, contributing to the greenhouse effect. CFCs are potent GHGs with GWPs ranging from 4,600 for CFC-11 to 14,000 for CFC-13 (U.S. EPA 2006).

- Ozone ($O_3$). Ozone occurs naturally in the stratosphere where it is largely responsible for filtering harmful ultraviolet (UV) radiation. In the troposphere, ozone acts as a GHG by absorbing and re-radiating the infrared energy emitted by the Earth. As a result of the industrial revolution and rising emissions of oxides of nitrogen (NOX) and volatile organic compounds (VOCs) (ozone precursors), the concentrations of ozone in the troposphere have increased (IPCC 2006). Due to the short life span of ozone in the troposphere, its concentration and contribution as a GHG is not well established.

However, the greenhouse effect of tropospheric ozone is considered small, as the radiative forcing of ozone is 25 percent of that of $CO_2$ (IPCC 2007).[3]

**Contributions to Greenhouse Gas Emissions**

*Global*

Anthropogenic GHG emissions worldwide as of 2004 (the last year for which data are available for Annex 1 countries [i.e., industrialized countries]) total approximately 29,900 $CO_2$ equivalent million metric tons ($MMTCO_2E$)[4] with five countries and the European Community (includes Germany) accounting for 72 percent of the total (See **Table 4.2-3, Six Top GHG Producer Countries and the European Community**). It should be noted that inventory data are not all from the same year and may vary depending on the source of the emissions inventory. Furthermore, the GHG emissions in more recent years may be substantially different than those shown in **Table 4.2-3**.

**Table 4.2-3**
**Six Top GHG Producer Countries and the European Community**

| Emitting Countries | 2004 GHG Emissions ($MMTCO_2E$)* |
|---|---|
| United States | 7,067.6[1] |
| China | 4,963.1[2] |
| European Community | 4,228.0[1] |
| Russian Federation | 2,086.4[1] |
| India | 1,889.1[2] |
| Japan | 1,355.2[1] |
| Germany[3] | 1,015.3[1] |
| **Total:** | **21,589.4** |

*Sources:*

[1] *United Nations Framework Convention on Climate Change 2006.*

[2] *GHG emissions for China and India (Calendar Year 2000) were obtained from the World Resources Institute's Climate Analysis Indicators Tool (CAIT) <http://www.cait.wri.org/cait.php>*

[3] *Germany's GHG emissions are included in the European Community.*

* *Excludes emissions/removals from land use, land-use change and forestry (LULUCF)*

3 Radiative forcing, measured in Watts/$m^2$, is an externally imposed perturbation (e.g., stimulated by greenhouse gases) in the radiative energy budget of the Earth's climate system (i.e., energy and heat retained in the troposphere minus energy passed to the stratosphere).

4 The $CO_2$ equivalent emissions are commonly expressed as "million metric tons of carbon dioxide equivalent ($MMTCO_2E$)" The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP, such that $MMTCO_2E$ = (million metric tons of a GHG) x (GWP of the GHG). For example, the GWP for methane is 21. This means that emissions of one million metric tons of methane are equivalent to emissions of 21 million metric tons of $CO_2$.

***United States***

As noted in **Table 4.2-3**, the United States was the top producer of greenhouse gas emissions, as of 2004. At that time, six of the states—Texas, California, Pennsylvania, Ohio, Illinois, and Florida, in ranked order—would each rank among the top 30 GHG emitters internationally (World Resources Institute 2006). The primary greenhouse gas emitted by human activities in the United States was $CO_2$, representing approximately 84 percent of total greenhouse gas emissions (U.S. EPA 2006). $CO_2$ from fossil fuel combustion, the largest source of U.S. greenhouse gas emissions, accounts for approximately 80 percent of U.S. GHG emissions (U.S. EPA 2006).

***State of California***

Based upon the 2004 GHG inventory data (the latest year available) compiled by the California Energy Commission (CEC) for California and GHG inventories for countries contributing to the worldwide GHG emissions inventory compiled by the United Nations Framework Convention on Climate Change (UNFCCC) for 2004, California's GHG emissions rank second in the United States with emissions of 431 $MMTCO_2E$ (excluding emissions related to imported power) and internationally between Spain (427.9 $MMTCO_2E$) and Australia (529.2 $MMTCO_2E$). However, in terms of the United States, the CEC report ranks California as the fourth lowest per capita emitter of $CO_2$ from fossil fuel combustion based on 2001 data.

The CEC report placed $CO_2$ produced by fossil fuel combustion in California as the largest source of GHG emissions, accounting for 81 percent of the total GHG emissions. $CO_2$ emissions from other sources contributed 2.8 percent of the total GHG emissions, methane emissions 5.7 percent, nitrous oxide emissions 6.8 percent, and high-GWP gases 2.9 percent (CEC 2006). These high GWP gases are largely composed of refrigerants and a small contribution of sulfur hexafluoride ($SF_6$) used as insulating materials in electricity transmission and distribution.

The primary contributors to GHG emissions in California are transportation, electric power production from both in-state and out-of-state sources, industry, agriculture and forestry, and other sources, which include commercial and residential activities. These primary contributors to California's GHG emissions and their relative contributions are presented in **Table 4.2-4, GHG Sources in California**.

It should be noted that emissions from each of these economic sectors are not confined to emissions from a single process, since there is crossover with other sectors. For example, the GHG emissions from cement production places clinker (nodules formed by the heat processing of cement elements in a kiln) manufacturing in its own category and the fuel used to heat the cement production process within the industrial fuel category. In the case of landfills, methane emissions and $CO_2$ emissions and sinks are

reported in their respective portions of the inventory. Taken together, the $CO_2$ sinks approximately offset the landfill methane emissions. Additionally, fuel-related GHG emissions from transporting wastes to landfills are included in transportation fuels.

**Table 4.2-4**
**GHG Sources in California[1]**

| Source Category | Annual GHG Emissions ($MMTCO_2E$)[a] | Percent of Total | Annual GHG Emissions ($MMTCO_2E$)[b] | Percent of Total |
|---|---|---|---|---|
| Transportation | 200.1 | 40.7% | 200.1 | 46.4% |
| Electric Power Production | 109.2 | 22.2% | 48.4 | 11.2% |
| Industry | 100.9 | 20.5% | 100.9 | 23.4% |
| Agriculture and Forestry | 40.9 | 8.3% | 40.9 | 9.5% |
| Other | 40.9 | 8.3% | 40.9 | 9.5% |
| **Total** | **492.0** | **100.0%** | **431.2** | **100.0%** |

*Sources:*
[1] *CEC 2006.*
[a] *Includes emissions associated with imported electricity, which account for 60.8 $MMTCO_2E$ annually.*
[b] *Excludes emissions associated with imported electricity.*

**Global Climate Change**

Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer) (U.S. EPA 2006). Climate change may result from:

- Natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- Natural processes within the climate system (e.g., changes in ocean circulation, reduction in sunlight from the addition of GHG and other gases to the atmosphere from volcanic eruptions); and
- Human activities that change the atmosphere's composition (e.g., through burning fossil fuels) and the land surface (e.g., deforestation, reforestation, urbanization, desertification).

*Effects of Global Climate Change*

The primary effect of global climate change has been a rise in average global tropospheric temperature of 0.2° Celsius per decade, determined from meteorological measurements worldwide between 1990 and 2005 (IPCC 2007). Climate change modeling using 2000 emission rates shows that further warming would occur, which would induce further changes in the global climate system during the current

century (IPCC 2007). According to the Intergovernmental Panel on Climate Change (IPCC) and the California Environmental Protection Agency, changes to the global climate system and ecosystems and to California could include, but would not be limited to:

- the loss of sea ice and mountain snowpack resulting in higher sea levels and higher sea surface evaporation rates with a corresponding increase in tropospheric water vapor due to the atmosphere's ability to hold more water vapor at higher temperatures (IPCC 2007);
- a rise in global average sea level primarily due to thermal expansion and melting of glaciers and ice caps, and the Greenland and Antarctic ice sheets (IPCC 2007);
- changes in weather that include widespread changes in precipitation, ocean salinity, and wind patterns, and more energetic aspects of extreme weather including droughts, heavy precipitation, heat waves, extreme cold, and the intensity of tropical cyclones (IPCC 2007);
- the decline of Sierra snowpack, which accounts for approximately half of the surface water storage in California, by 70 percent to as much as 90 percent over the next 100 years (CalEPA 2006);
- an increase in the number of days conducive to ozone formation by 25 to 85 percent (depending on the future temperature scenario) in high ozone areas of Los Angeles and the San Joaquin Valley by the end of the 21st century (CalEPA 2006); and
- high potential for erosion of California's coastlines and sea water intrusion into the Delta and associated levee systems due to the rise in sea level (CalEPA 2006).

### 4.2.3 Regulatory Considerations

Air quality within the San Francisco Bay Area Air Basin is addressed through the efforts of various federal, state, regional and local government agencies. These agencies work jointly as well as individually to improve air quality through legislation, regulations, planning, policymaking, education, and a variety of programs. With respect to the proposed project, the BAAQMD would administer most of the air quality requirements affecting the Helios Facility. Regulatory considerations regarding potential radioactive materials, which are administered by the California Department of Public Health, are discussed in **Section 4.6, Hazards and Hazardous Materials**. The agencies primarily responsible for improving the air quality within the Basin are discussed below along with their individual responsibilities.

#### *United States Environmental Protection Agency*

**Criteria Pollutants**

The U.S. EPA is responsible for enforcing the federal Clean Air Act (CAA) and the NAAQS. The NAAQS identify levels of air quality for seven criteria pollutants that are considered the maximum levels of

ambient (background) air pollutants considered safe, with an adequate margin of safety, to protect the public health and welfare. The seven criteria pollutants are $O_3$, CO, $NO_2$, $SO_2$, respirable particulate matter ($PM_{10}$), fine particulate matter ($PM_{2.5}$), and lead. Particulate matter is the general term used for a mixture of solid particles and liquid droplets found in the air. For air quality purposes, these particles are classified by size: fine particulates ($PM_{2.5}$) have a diameter less than or equal to 2.5 micrometers, and respirable or coarse particulates ($PM_{10}$) have a diameter less than or equal to 10 micrometers. The federal ambient air quality standards and the relevant health effects of the criteria pollutants are summarized in **Table 4.2-1, Ambient Air Quality Standards**.

The Basin is currently classified by the U.S. EPA as a nonattainment/marginal area for the 8-hour standard for $O_3$. Additionally, it has been designated as an attainment/unclassifiable area for the 1-hour and 8-hour standards for CO; the 24-hour and annual $PM_{2.5}$ standards; the annual standard for $NO_2$; and as an attainment area for the quarterly lead standard and 24-hour and annual $SO_2$ standards. The Basin is currently designated as unclassifiable for the 24-hour $PM_{10}$ standard. In response to its enforcement responsibilities, the U.S. EPA requires each state to prepare and submit a State Implementation Plan (SIP) describing how the state will achieve the federal standards by specified dates, depending on the severity of the air quality within the state or air basin. The BAAQMD has been delegated the responsibility for implementing many of the CAA requirements for the region, which includes the Berkeley Lab.

The status of the SFBAAB with respect to attainment with the NAAQS is summarized in **Table 4.2-5, National Ambient Air Quality Standards and Status – San Francisco Bay Area Air Basin**.

**Table 4.2-5**
**National Ambient Air Quality Standards and Status**
**San Francisco Bay Area Air Basin**

| Pollutant | Averaging Time | Designation/Classification |
|---|---|---|
| Ozone ($O_3$) | 8 Hour | Nonattainment/Marginal |
| Carbon Monoxide (CO) | 1 Hour, 8 Hour | Attainment/Unclassifiable |
| Nitrogen Dioxide ($NO_2$) | Annual Arithmetic Mean | Attainment/Unclassifiable |
| Sulfur Dioxide ($SO_2$) | 24 Hour, Annual Arithmetic Mean | Attainment |
| Respirable Particulate Matter ($PM_{10}$) | 24 Hour | Unclassifiable |
| Fine Particulate Matter ($PM_{2.5}$) | 24 Hour, Annual Arithmetic Mean | Attainment/Unclassifiable |
| Lead (Pb) | Calendar Quarter | Attainment |

*Source: Environmental Protection Agency. "Region 9: Air Programs, Air Quality Maps." [Online] [July 19, 2007]. http://www.epa.gov/region9/air/maps/maps_top.html*

**Hazardous Air Pollutants**

Regulation of hazardous air pollutants (HAPs) under federal regulations is achieved through federal and state controls on individual sources. Federal law defines HAPs as noncriteria air pollutants with short-

term (acute) and/or long-term (chronic or carcinogenic) adverse human health effects. The 1990 federal CAA Amendments offer a comprehensive plan for achieving significant reductions in both mobile and stationary source emissions of HAPs. Under the 1990 CAA Amendments, a total of 189 chemicals or chemical families were designated HAPs because of their adverse human health effects. Title III of the 1990 federal CAA Amendments amended Section 112 of the CAA to replace the former program with an entirely new technology-based program. Under Title III, the U.S. EPA must establish maximum achievable control technology emission standards for all new and existing "major" stationary sources through promulgation of National Emission Standards for Hazardous Air Pollutants (NESHAP). Major stationary sources of HAPs are required to obtain an operating permit from the BAAQMD pursuant to Title V of the 1990 CAA Amendments. A major source is defined as one that emits at least 10 tons per year of any HAP or at least 25 tons per year of all HAPs. Neither LBNL nor UC Berkeley is considered a major source.

Radiochemical and radiobiological studies that may be performed at the proposed Helios Facility are expected to use small millicurie quantities of a variety of radionuclides, but not result in emissions to the atmosphere. All use of radioactive material at Helios Facility will be managed in accordance with a California Department of Public Health-issued radioactive materials license, the UCB Radiation Safety Program, and applicable radioactive materials regulations.

**Nanomaterials**

The Helios project would include nanomaterial research. Nanoscience is an emerging area of research aimed at the development of structures and devices at the atomic, molecular, or macromolecular levels to produce materials with novel properties and perform functions at the molecular level. The U.S. EPA has listed nanotechnology as an area for future study under its "Future Analysis" program, and only recently has U.S. EPA begun funding research in this area. No regulatory standards have yet been developed. The U.S. Food and Drug Administration (FDA) has not established a formal definition for nanomaterials.

The FDA has created the Nanotechnology Interest Group (NTIG) that is designed to facilitate the regulation of the nanotechnology. In addition, the National Nanotechnology Initiative (NNI), which is managed by the National Science and Technology Council, is a federal research and development program established to coordinate multi agency efforts in nanoscale science, engineering, and technology. The NNI acts as a cross-disciplinary network for all sectors that would potentially have an interest in nanotechnology. The three main goals in terms of environmental, health, and safety research conducted by the NNI are (1) to understand how nanomaterials behave in the environment and within the human

body, (2) to develop instrumentation and measuring methods to characterize, test, and monitor nanomaterials, and (3) to conduct research to assess safety of nanomaterials in chemicals, foods, drug, and devices. As further toxicity and epidemiological research is conducted, regulatory standards for environmental health and safety will be established. Standard laboratory practices and protocol and engineered controls that would be used in the Helios Facility laboratories to control routine and accidental releases of all scientific materials, including nanomaterials, are discussed in **Section 4.6, Hazards and Hazardous Materials**.

### *California Air Resources Board*

CARB, a branch of the California Environmental Protection Agency (Cal/EPA), oversees air quality planning and control throughout California. It is primarily responsible for ensuring implementation of the 1988 California Clean Air Act (CCAA), for responding to the federal CAA requirements and for regulating emissions from motor vehicles and consumer products within the state. CARB has established emission standards for vehicles sold in California and for various types of equipment available commercially. It also sets fuel specifications to further reduce vehicular emissions. The CCAA and other California air quality statutes designate local air districts, such as the BAAQMD, with the responsibility for regulating most stationary sources, and to a certain extent, area sources. CARB is responsible for the regulation of motor vehicles and fuels and some area sources such as consumer products.

Like the U.S. EPA, CARB has established ambient air quality standards for the state (i.e., CAAQS). These standards apply to the same seven criteria pollutants as the federal CAA and also address sulfates ($SO_4$), visibility-reducing particles, hydrogen sulfide ($H_2S$) and vinyl chloride ($C_2H_3Cl$). The CCAA standards are more stringent than the federal standards and, in the case of $PM_{10}$ and $SO_2$, far more stringent. The CCAA requires air pollution control districts to achieve the state standards by the earliest practicable date. Based on monitored pollutant levels, the CCAA divides $O_3$ nonattainment areas into four categories—moderate, serious, severe, and extreme—to which progressively more stringent planning and emission control requirements apply.

The Basin is a nonattainment area for the California 1-hour and 8-hour ozone standard. The Basin is designated as nonattainment for the California 24-hour and annual $PM_{10}$ standards, as well as the California annual $PM_{2.5}$ standard. The Basin is designated as attainment or unclassifiable for all other CAAQS. The ozone precursors, reactive organic gases (ROG) and oxides of nitrogen ($NO_X$), in addition to $PM_{10}$, are the pollutants of concern for projects located in the Basin. The status of the Basin with respect

to attainment with the CAAQS is summarized in **Table 4.2-6, California Ambient Air Quality Standards and Status – San Francisco Bay Area Air Basin**.

**Table 4.2-6**
**California Ambient Air Quality Standards and Status**
**San Francisco Bay Area Air Basin**

| Pollutant | Averaging Time | Designation/Classification |
|---|---|---|
| Ozone ($O_3$) | 1 Hour, 8 Hour | Nonattainment[1] |
| Carbon Monoxide (CO) | 1 Hour, 8 Hour | Attainment |
| Nitrogen Dioxide ($NO_2$) | 1 Hour | Attainment |
| Sulfur Dioxide ($SO_2$) | 1 Hour, 24 Hour | Attainment |
| Respirable Particulate Matter ($PM_{10}$) | 24 Hour, Annual Arithmetic Mean | Nonattainment |
| Fine Particulate Matter ($PM_{2.5}$) | Annual Arithmetic Mean | Nonattainment |
| Lead (Pb)[2] | 30 Day Average | Attainment |
| Sulfates ($SO_4$) | 24 Hour | Attainment |
| Hydrogen Sulfide ($H_2S$) | 1 Hour | Unclassified |
| Vinyl Chloride[2] | 24 Hour | Unclassified |
| Visibility Reducing Particles | 8 Hour (10 AM–6 PM) | Unclassified |

*Source: California Air Resources Board. "Area Designations Maps/State and National." [Online] [July 26, 2007]. http://www.arb.ca.gov/desig/adm/adm.htm*

*[1] CARB has not issued area classifications based on the new state 8-hour standard. The previous classification for the 1-hour ozone standard was Serious.*

*[2] CARB has identified lead and vinyl chloride as "toxic air contaminants" with no threshold level of exposure for adverse health effects determined.*

**Toxic Air Contaminants**

California law defines TACs as air pollutants having carcinogenic or other health effects. Assembly Bill (AB) 1807 (the Tanner Bill, passed in 1983) established the State Air Toxics Program and the methods for designating certain chemicals as TACs. A total of 245 substances have been designated TACs under California law; they include the federal HAPs adopted as TACs in accordance with AB 2728. The Air Toxics Hot Spots Information and Assessment Act of 1987 (AB 2588) seeks to identify and evaluate risk from air toxics sources; AB 2588 does not regulate air toxics emissions directly. Under AB 2588, sources emitting more than 10 tons per year of any criteria air pollutant must estimate and report their toxic air emissions to the local air districts. Local air districts then prioritize facilities on the basis of emissions, and high priority facilities are required to submit a health risk assessment and communicate the results to the affected public. Depending on risk levels, emitting facilities are required to implement varying levels of risk reduction measures. The BAAQMD is responsible for implementing AB 2588 in the Basin.

The BAAQMD is currently working to control TAC impacts from local hot spots and from ambient background concentrations. The control strategy involves reviewing new sources to ensure compliance

with required emission controls and limits, maintaining an inventory of existing sources to identify major TAC emissions and developing measures to reduce TAC emissions. The BAAQMD publishes the results of the various control programs in an annual report, which provides information on the current TAC inventory, AB 2588 risk assessments, TAC monitoring programs, and TAC control measures and plans.

One of the TACs being controlled by the BAAQMD is particulate matter (PM) from diesel-fueled engines, also known as diesel exhaust particulate. In 1998, CARB identified diesel exhaust particulate as a TAC. Compared to other TACs, diesel exhaust particulate emissions are estimated to be responsible for about 70 percent of the total ambient air toxics risk in the Basin. On a statewide basis, the average potential cancer risk associated with these emissions is over 500 potential cancer cases per million exposed people. In addition to these general risks, diesel exhaust particulate can also present elevated localized or near-source exposures. Depending on the activity and nearness to receptors, these potential risks can range from a low number to 1,500 cancer cases per million exposed people (CARB 2000).

## *Greenhouse Gas Regulatory Programs*

### Kyoto Protocol

The original Kyoto Protocol was negotiated in December 1997 and came into force on February 16, 2005. As of June 2007, 174 countries and the European Economic Community have ratified the agreement; however, notably, the U.S. and Australia have not ratified the Protocol. Participating nations are separated into Annex 1 and Non-Annex 1 (i.e., developing countries) countries that have differing requirements for GHG reductions. The goal of the Protocol is to achieve overall emissions reduction targets for six GHGs by the period from 2008 through 2012. The six GHGs regulated under the Protocol are $CO_2$, methane, nitrous oxide, sulfur hexafluoride, HFCs, and PFCs. Each nation has an emissions reduction target under which they must reduce GHG emissions a certain percentage below 1990 levels (e.g., 8 percent reduction for the European Union, 6 percent reduction for Japan). The average reduction target for nations participating in the Kyoto Protocol is approximately 5 percent below 1990 levels (Pew Center on Global Climate Change No date). Although the United States has not ratified the Protocol, it has established a target of 18 percent reduction in GHG emissions intensity by 2012 (The White House. *Addressing Global Climate Change* 2007). Greenhouse gas intensity is the ratio of GHG emissions to economic output (i.e., gross domestic product).

### Federal Activities

In *Massachusetts vs. EPA,* the Supreme Court held that U.S. EPA has the statutory authority under Section 202 of the CAA to regulate GHGs from new motor vehicles. The court did not hold that the U.S. EPA was required to regulate GHG emissions; however, it indicated that the agency must decide

whether GHGs from motor vehicles cause or contribute to air pollution that is reasonably anticipated to endanger public health or welfare. Upon the final decision, President Bush signed Executive Order 13432 on May 14, 2007, directing the U.S. EPA, along with the Departments of Transportation, Energy, and Agriculture, to initiate a regulatory process that responds to the Supreme Court's decision. The order requires the U.S. EPA to coordinate closely with other federal agencies and to consider the president's Twenty-in-Ten plan in this process. The Twenty-in-Ten plan would establish a new alternative fuel standard that would require the use of 35 billion gallons of alternative and renewable fuels by 2017. The U.S. EPA will be working closely with the Department of Transportation in developing new automotive efficiency standards.

**California Activities**

***AB 1493***

In a response to the transportation sector accounting for more than half of California's $CO_2$ emissions, Assembly Bill 1493 (AB 1493, Pavley) was enacted on July 22, 2002. AB 1493 required CARB to set GHG emission standards for passenger vehicles, light-duty trucks, and other vehicles determined by the state board to be vehicles whose primary use is noncommercial personal transportation in the state. The bill required that CARB set the GHG emission standards for motor vehicles manufactured in 2009 and all subsequent model years. In setting these standards, CARB must consider cost-effectiveness, technological feasibility, economic impacts, and provide maximum flexibility to manufacturers. CARB adopted the standards in September 2004. These standards are intended to reduce emissions of $CO_2$ and other greenhouse gases (e.g., nitrous oxide, methane). The new standards would phase in during the 2009 through 2016 model years. When fully phased in, the near-term (2009 to 2012) standards will result in about a 22 percent reduction in greenhouse gas emissions compared to the emissions from the 2002 fleet, while the mid-term (2013 to 2016) standards will result in a reduction of about 30 percent. Some currently used technologies that achieve GHG reductions include small engines with superchargers, continuously variable transmissions, and hybrid electric drive.

In December 2004, these regulations were challenged in federal court by the Alliance of Automobile Manufacturers, who claimed that the law regulated vehicle fuel economy, a duty assigned to the federal government. The case had been put on hold by a federal judge in Fresno pending the U.S. Supreme Court's decision in *Massachusetts vs. EPA*. There has not yet been a decision regarding the challenge to AB 1493 regulations. Before these regulations may go into effect, the U.S. EPA must grant California a waiver under the federal Clean Air Act, which ordinarily preempts state regulation of motor vehicle emission standards. Following the issuance of the *Massachusetts vs. EPA* decision, the U.S. EPA announced that it will decide whether to grant California a waiver by December 2007.

***Executive Order S-3-05***

In June 2005, Governor Schwarzenegger established California's GHG emissions reduction targets in Executive Order S-3-05. The Executive Order established the following goals: GHG emissions should be reduced to 2000 levels by 2010; GHG emissions should be reduced to 1990 levels by 2020; and GHG emissions should be reduced to 80 percent below 1990 levels by 2050. The Secretary of CalEPA (the Secretary) is required to coordinate efforts of various agencies in order to collectively and efficiently reduce GHGs. Some of the agency representatives involved in the GHG reduction plan include the Secretary of the Business, Transportation and Housing Agency, the Secretary of the Department of Food and Agriculture, the Secretary of the Resources Agency, the Chairperson of CARB, the Chairperson of the Energy Commission, and the President of the Public Utilities Commission. The Secretary is required to submit a biannual progress report to the Governor and State Legislature disclosing the progress made toward GHG emission reduction targets. In addition, another biannual report must be submitted illustrating the impacts of global warming on California's water supply, public health, agriculture, the coastline, and forestry, and reporting possible mitigation and adaptation plans to combat these impacts.

***AB 32***

In furtherance of the goals established in Executive Order S-3-05, the Legislature enacted Assembly Bill 32 (AB 32, Nuñez and Pavley), the California Global Warming Solutions Act of 2006, which Governor Schwarzenegger signed on September 27, 2006. AB 32 represents the first enforceable statewide program to limit GHG emissions from all major industries with penalties for noncompliance. CARB has been assigned to carry out and develop the programs and requirements necessary to achieve the goals of AB 32. The foremost objective of CARB is to adopt regulations that require the reporting and verification of statewide GHG emissions. This program will be used to monitor and enforce compliance with the established standards. The first GHG emissions limit is equivalent to the 1990 levels, which are to be achieved by 2020. CARB is also required to adopt rules and regulations to achieve the maximum technologically feasible and cost-effective GHG emission reductions. AB 32 allows CARB to adopt market-based compliance mechanisms to meet the specified requirements. Finally, CARB is ultimately responsible for monitoring compliance and enforcing any rule, regulation, order, emission limitation, emission reduction measure, or market-based compliance mechanism adopted. In order to advise CARB, it must convene an Environmental Justice Advisory Committee and an Economic and Technology Advancement Advisory Committee. By January 2008, the first deadline for AB 32, a statewide cap for 2020 emissions based on 1990 levels must be adopted. The following year (January 2009), CARB must adopt mandatory reporting rules for significant sources of GHGs and also a plan indicating how reductions in significant GHG sources will be achieved through regulations, market mechanisms, and other actions.

The first action under AB 32 resulted in the adoption of a report listing early action greenhouse gas emission reduction measures on June 21, 2007. The early actions include three specific GHG control rules. On October 25, 2007, CARB approved an additional six early action GHG reduction measures under AB 32. These early action GHG reduction measures are to be adopted and enforced before January 1, 2010, along with 32 other climate-protecting measures CARB is developing between now and 2011. The report divides early actions into three categories:

- Group 1 – GHG rules for immediate adoption and implementation
- Group 2 – Several additional GHG measures under development
- Group 3 – Air pollution controls with potential climate co-benefits

The original three adopted early action regulations include:

- a low-carbon fuel standard to reduce the "carbon intensity" of California fuels;
- reduction of refrigerant losses from motor vehicle air conditioning system maintenance to restrict the sale of "do-it-yourself" automotive refrigerants; and
- increased methane capture from landfills to require broader use of state-of-the-art methane-capture technologies.

The additional six early action regulations adopted on October 25, 2007 include:

- reduction of aerodynamic drag, and thereby fuel consumption, from existing trucks and trailers through retrofit technology;
- reduction of auxiliary engine emissions of docked ships by requiring port electrification;
- reduction of perfluorocarbons from the semiconductor industry;
- reduction of propellants in consumer products (e.g., aerosols, tire inflators and dust removal products);
- requirement that all tune-up, smog check and oil change mechanics ensure proper tire inflation as part of overall service in order to maintain fuel efficiency; and
- restriction on the use of sulfur hexafluoride ($SF_6$) from non-electricity sectors if viable alternatives are available.

***SB 1368***

Governor Schwarzenegger, just two days after signing AB 32, reiterated California's commitment to reducing GHGs by signing SB 1368. SB 1368 requires the California Energy Commission to develop and

adopt regulations for GHG emissions performance standards for the long-term procurement of electricity by local publicly owned utilities. The California Energy Commission must adopt the standards on or before June 30, 2007. These standards must be consistent with the standards adopted by the California Public Utilities Commission. This effort will help to protect energy customers from financial risks associated with investments in carbon-intensive generation by allowing new capital investments in power plants whose GHG emissions are as low or lower than new combined-cycle natural gas plants, by requiring imported electricity to meet GHG performance standards in California and requiring that the standards be developed and adopted in a public process.

***Executive Order S-1-07***

On January 18, 2007, California further solidified its dedication to reducing GHGs by setting a new Low Carbon Fuel Standard (LCFS) for transportation fuels sold within the state. Executive Order S-1-07 sets a declining standard for GHG emissions measured in $CO_2$-equivalent gram per unit of fuel energy sold in California. The target of the LCFS is to reduce the carbon intensity of California passenger vehicle fuels by at least 10 percent by 2020. The LCFS will apply to refiners, blenders, producers, and importers of transportation fuels and will use market-based mechanisms to allow these providers to choose how they reduce emissions during the "fuel cycle" using the most economically feasible methods. The Executive Order requires the Secretary of CalEPA to coordinate with actions of the California Energy Commission, CARB, the University of California, and other agencies to develop a protocol to measure the "life-cycle carbon intensity" of transportation fuels. CARB is anticipated to complete its review of the LCFS protocols no later than June 2007 and implement the regulatory process for the new standard by December 2008.

***SB 97***

In August 2007, as part of the legislation accompanying the state budget negotiations, the Legislature enacted SB 97 (Dutton), which directs the Governor's Office of Planning and Research (OPR) to develop guidelines under CEQA for the mitigation of greenhouse gas emissions. OPR is to develop proposed guidelines by July 1, 2009, and the Resources Agency is directed to adopt guidelines by January 1, 2010. Until such guidelines are promulgated, there is no guidance from OPR or other agencies regarding the analysis of greenhouse gas emissions in EIRs.

## *Bay Area Air Quality Management District*

Management of air quality in the Basin is the responsibility of the BAAQMD. The BAAQMD is responsible for bringing and/or maintaining air quality in the Basin within federal and air quality standards. Specifically, the BAAQMD has responsibility for monitoring ambient air pollutant levels

throughout the Basin and developing and implementing attainment strategies to ensure that future emissions will be within federal and state standards. The following plans have been developed by the BAAQMD to achieve attainment of the federal and state ozone standards. The Clean Air Plan (CAP) and Ozone Strategy fulfill the planning requirements of the CCAA, while the Ozone Attainment Plan fulfills the federal CAA requirements.

**Clean Air Plans**

As discussed previously, the federal and California Clean Air Acts require preparation of plans to reduce air pollution to healthful levels. The CCAA requires the air districts within nonattainment areas to prepare a triennial assessments and revisions to their CAPs. The BAAQMD has responded to this requirement by preparing a series of CAPs, the most recent and rigorous of which was approved in December 2000 (BAAQMD 2000) (see also the discussion of the 2005 Ozone Strategy, which continues the series of CCAA attainment plans). The 2000 CAP continues the air pollution reduction strategy established by the 1991 CAP and represents the third triennial update to the 1991 CAP, following previous updates in 1994 and 1997. The 2000 CAP is designed to address attainment of the state standard for $O_3$. CAPs are intended to focus on the near-term actions through amendments of existing regulations and promulgation of new District regulations.

The 1997 CAP contained stationary and mobile source control measures, which included developing rules to reduce vehicle trips to and from major residential developments, shopping centers and other indirect sources; encouraging cities and counties to plan for high-density development; and clustering development with mixed uses in the vicinity of mass transit stations (BAAQMD 1997). The 2000 CAP includes changes in the organization and scheduling of some existing control measures, some new stationary source control measures, revisions to previous stationary source measures and deletion of some control measures deemed no longer feasible by BAAQMD staff (BAAQMD 2000). The transportation control measures (TCMs) in the 2000 CAP are unchanged from the 1997 CAP. The 2000 CAP continues to discourage urban sprawl while strongly endorsing high-density mixed-use developments near transit centers that reduce the need for commuting by personal vehicles.

**2001 Ozone Attainment Plan**

The BAAQMD developed the 2001 Ozone Attainment Plan as a guideline to achieve the then federal 1-hour ozone standard (BAAQMD 2001). The 2001 Attainment Plan was approved by CARB in 2001 and by the U.S. EPA in 2003. In April 2004, the U.S. EPA determined the SFBAAB had attained the federal 1-hour ozone standard. Due to the attainment status of the Basin, the 1-hour ozone requirements set forth in the 2001 Ozone Attainment Plan were not required anymore. A year later, in 2005, the federal

1-hour ozone standard was revoked by the U.S. EPA for a new and more health-protective 8-hour standard. The SFBAAB was designated as marginal nonattainment for the federal 8-hour ozone standard. Although designated as nonattainment, areas designated as marginal nonattainment or less were not required to submit new attainment plans. Nonetheless, the control measures and strategies described in the 2001 Ozone Attainment Plan for the 1-hour standard will also help achieve attainment with the 8-hour standard.

**2005 Ozone Strategy**

The 2005 Ozone Strategy is a comprehensive document mapping how the SFBAAB will achieve attainment of the state 1-hour ozone standard as expeditiously as possible and how the Basin will reduce transport of ozone and ozone precursors to neighboring air basins (BAAQMD 2006). The 2005 Ozone Strategy was prepared by the BAAQMD in cooperation with the Metropolitan Transportation Commission (MTC) and the Association of Bay Area Governments (ABAG). The document outlines how the Basin will meet the CCAA planning requirements and transport mitigation requirements through implementation of control measures and strategies. The 2005 Ozone Strategy describes its plans to implement stationary source control measures through District regulations, mobile source control measures through incentive programs; and transportation control measures through transportation programs in cooperation with MTC, transit agencies, and local governments.

Currently, the BAAQMD is developing a 2007 Ozone Strategy that will address achieving attainment for both the state 1-hour and 8-hour ozone standard. The 2007 Ozone Strategy will continue to focus on reducing transport of ozone and ozone precursors to neighboring air basins. In addition, a review of the progress achieved from 2004 to 2006 will be evaluated and used to establish meaningful and effective control measures for 2007 to 2009.

**BAAQMD Rules and Regulations**

The BAAQMD is responsible for limiting the amount of emissions that can be generated throughout the Basin by stationary sources. Specific rules and regulations have been adopted that limit emissions that can be generated by various uses and/or activities and identify specific pollution reduction measures that must be implemented in association with various uses and activities. These rules regulate not only the emissions of the state and federal criteria pollutants, but also the emissions of toxic air contaminants. The rules are also subject to ongoing refinement by the BAAQMD.

In general, all stationary sources with air emissions are subject to BAAQMD's rules governing their operational emissions. Some emissions sources are further subject to regulation through the BAAQMD's permitting process. Through this permitting process, the BAAQMD also monitors the amount of

stationary emissions being generated and uses this information in developing the CAP. Some of the stationary emission sources that would be constructed as part of the project (e.g., emergency generator) will be subject to the BAAQMD permitting requirements. A few of the primary BAAQMD rules applicable to the project include the following:

**Regulation 2, Rule 1 (General Requirements):** This rule requires new and modified sources of air pollution to acquire permits (e.g., Authority to Construct, Permit to Operate) in order to monitor stationary source emissions within the BAAQMD's jurisdiction. The rule also includes a list of equipment and processes that would be exempt from permitting requirements. Among others, these include cooling towers and boilers with a heat input rating less than 10 million British thermal units (BTU) per hour fired exclusively with natural gas, liquefied petroleum gas, or a combination, and laboratories located in a building where the total number of fume hoods within the building is fewer than 50 or the total laboratory space is less than 25,000 square feet, provided that responsible laboratory management practices are used.

**Regulation 2, Rule 2 (New Source Review):** For new and modified stationary sources subject to permitting requirements (see Regulation 2, Rule 1), this series of rules prescribes the use of Best Available Control Technology and the provision of emission offsets (i.e., mitigation) for equipment whose emissions exceed specified thresholds. The applicability of these requirements would be determined upon submittal of an application for an Authority to Construct under Regulation 2, Rule 1.

**Regulation 2, Rule 5 (New Source Review for Toxic Air Contaminants):** For new and modified stationary sources of toxic air contaminants subject to permitting requirements (see Regulation 2, Rule 1), this rule evaluates potential public exposure and health risk and provides measures for mitigating potentially significant health risks from these exposures, including the use of Maximum Available Control Technology.

**Regulation 8, Rule 3 (Architectural Coatings):** This rule sets limits on the VOC content in architectural coatings sold, supplied, offered for sale, or manufactured within the BAAQMD's jurisdiction. The rule also includes time schedules that specify when more stringent VOC standards are to be enforced. The rule applies during the construction phase of a project. In addition, any periodic architectural coating maintenance operations are required to comply with this rule.

**Regulation 8, Rule 15 (Emulsified and Liquid Asphalts):** This rule sets limits on the VOC content in emulsified and liquid asphalt used for maintenance and paving operations. The rule includes specific VOC content requirements for various types of asphalt (e.g., emulsified asphalt, rapid-cure liquid asphalt, slow-cure liquid asphalt). This rule applies during the construction phase of a project. In addition, any

future asphalt maintenance of a project's roads would be required to comply with the VOC standards set in Rule 15.

**Regulation 9, Rule 6 (Nitrogen Oxide Emission from Natural Gas-Fired Water Heaters):** This rule sets a limit on the $NO_x$ emissions from natural gas-fired water heaters. The rule applies to natural gas-fired water heaters manufactured after July 1, 1992 with a heat input rating of less than 75,000 BTU/hr. Water heaters subject to the rule must not emit more than 40 nanograms of $NO_x$ per joule of heat output.

**Regulation 9, Rule 7 (Nitrogen Oxide and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters):** This rule limits the $NO_x$ and CO emissions from industrial, institutional, and commercial boilers, steam generators, and process heaters. The rule applies to boilers with a heat input rating greater than 10 million BTU/hr fired exclusively with natural gas, liquefied petroleum gas, or a combination or boilers with a heat input rating greater than 1 million BTU/hr fired with other fuels.

**Regulation 9, Rule 8 (Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines):** This rule limits the $NO_x$ and CO emissions from stationary internal combustion engines. The rule applies to engines rated at greater than 50 brake horsepower, but it exempts emergency generators that would not run for more than 100 hours per year.

**BAAQMD CEQA Guidelines**

In April 1996, the BAAQMD prepared its *BAAQMD CEQA Guidelines* as a guidance document to provide lead government agencies, consultants and project proponents with uniform procedures for assessing air quality impacts and preparing the air quality sections of environmental documents for projects subject to CEQA. The *BAAQMD CEQA Guidelines* were last revised by the BAAQMD in December 1999. This document describes the criteria that the BAAQMD uses when reviewing and commenting on the adequacy of environmental documents, such as this EIR. The *BAAQMD CEQA Guidelines* recommend thresholds for use in determining whether projects would have significant adverse environmental impacts, identify methodologies for predicting project emissions and impacts, and identify measures that can be used to avoid or reduce air quality impacts. This EIR section was prepared following these recommendations.

## *Association of Bay Area Governments*

The Association of Bay Area Governments (ABAG) is a council of governments for the Counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano. ABAG is a regional planning agency and serves as a forum for regional issues relating to transportation,

the economy, community development and the environment. ABAG also serves as the regional clearinghouse for projects requiring environmental documentation under federal and state law. In this role, ABAG reviews proposed projects to analyze their impacts on ABAG's regional planning efforts.

Although ABAG is not an air quality management agency, it is responsible for several air quality planning issues. Specifically, as the designated Metropolitan Planning Organization for the nine counties, it is responsible, pursuant to Section 176(c) of the 1990 Amendments to the federal CAA, for providing current population, employment, travel and congestion projections for regional air quality planning efforts. ABAG is required to quantify and document the demographic and employment factors influencing expected transportation demand, including land-use forecasts. ABAG is also responsible for preparing and approving the portions of the Basin's CAP relating to demographic projections and integrated regional land use, housing and employment, as well as transportation programs, measures, and strategies.

## *Local Plans and Policies*

The proposed project would be located at LBNL, which is operated by the University of California and conducts work within the University's mission on land that is owned or controlled by The Regents of the University of California. As a state project, the proposed project is exempted by the state constitution from compliance with local land use regulations, including general plans and zoning. However, the proposed project seeks to cooperate with local jurisdictions to reduce any physical consequences of potential land use conflicts to the extent feasible. LBNL is located in the cities of Berkeley and Oakland. The following sections summarize objectives and policies from 2006 Long-Range Development Plan (LRDP), and the City of Berkeley and City of Oakland General Plans that relate to air quality.

### 2006 LRDP Principles and Strategies[5]

The 2006 LRDP proposed four fundamental principles that form the basis for the development strategies provided for each element of the LRDP. The one principle that is most applicable to air quality is to "Preserve and enhance the environmental qualities of the site as a model of resource conservation and environmental stewardship."

5 While this Environmental Impact Report presents a "stand alone" impact analysis that does not rely upon tiering from any programmatic CEQA document, Berkeley Lab does actively follow the 2006 LRDP as a planning guide for Lab development. Accordingly, relevant 2006 LRDP principles, strategies, and design guidelines are identified in this section.

Development strategies provided by the 2006 LRDP are intended to minimize potential environmental impacts that could result from implementation of the 2006 LRDP. Development strategies set forth in the 2006 LRDP that are applicable to air quality include the following:

- Protect and enhance the site's natural and visual resources, including native habitats, streams and mature tree stands by focusing future development primarily within the already developed areas of the site;
- Increase development densities within areas corresponding to existing cluster of development to preserve open space, enhance operational efficiencies and access;
- Site and design new facilities in accordance with University of California Presidential Policy for Green Building Design to reduce energy, water, and material consumption and provide improved occupant health, comfort and productivity;
- Increase use of alternative modes of transit through improvements to the Laboratory's shuttle bus service;
- Promote transportation demand management strategies such as vanpools and employee ride share programs;
- Maintain or reduce the percentage of parking spaces relative to the adjusted daily population; and
- Consolidate parking into larger lots and/or parking structures, locate these facilities near Laboratory entrances to reduce traffic within the main site.

**City of Berkeley General Plan**

The City of Berkeley General Plan was adopted on April 23, 2002. The following policies and objectives are contained in the Environmental Management Element of the City of Berkeley General Plan.

> Objective 3 Reduce emissions and improve air quality.
>
> Policy EM-18: Regional Air Quality Action: Continue working with the Bay Area Air Quality Management District and other regional agencies to:
>
> 1. Improve air quality through pollution prevention methods.
> 2. Ensure enforcement of air emission standards.
> 3. Reduce local and regional traffic (the single largest source of air pollution in the City) and promote public transit.
> 4. Promote regional air pollution prevention plans for business and industry.

5. Promote strategies to reduce particulate pollution from residential fireplaces and wood-burning stoves.

6. Locate parking appropriately and provide adequate signage to reduce unnecessary "circling" and searching for parking.

Policy EM-19: 15 percent Emission Reduction: Global Warming Plan: Make efforts to reduce local [air pollutants] emissions by 15 percent by the year 2010;

Policy EM-20: City of Berkeley Fleet: The City should exceed Federal and State [air quality] standards for all City fleet vehicles and use all means practical to reduce emissions of criteria pollutants and greenhouse gases;

Policy EM-21: Alternative Fuels: Work with the University of California, the Berkeley Unified School District, and other agencies to establish natural gas fueling and electric vehicle recharging stations accessible to the public; and

Policy EM-22: Public Awareness: Increase public awareness of air quality problems, rules, and solutions through use of City publications and networks.

In addition, the following policies from the Transportation Element of the City of Berkeley General Plan are applicable to air quality:

Policy T-10 Trip Reduction: To reduce automobile traffic and congestion and increase transit use and alternative modes in Berkeley, support, and when appropriate require, programs to encourage Berkeley citizens and commuters to reduce automobile trips. The programs that would apply to the proposed project are:

2. Participation in Commuter Check Program.

3. Carpooling and provision of carpool parking and other necessary facilities.

4. Telecommuting programs.

8. Programs to encourage neighborhood-level initiatives to reduce traffic by encouraging residents to combine trips, carpool, telecommute, reduce the number of cars owned, shop locally, and use alternative modes.

9. Programs to reward Berkeley citizens and neighborhoods that can document reduced car use.

10. Limitations on the supply of long-term commuter parking and elimination of subsidies for commuter parking.

Policy T-12 Education and Enforcement: Support, and when possible require, education and enforcement programs to encourage carpooling and alternatives to single-occupant automobile use, reduce speeding, and increase pedestrian, bicyclist, and automobile safety;

Policy T-13 Major Public Institutions: Work with other agencies and institutions, such as the University of California, the Berkeley Unified School District, Vista Community College, and the Alameda County Court, and neighboring cities to promote Eco-Pass and to pursue other efforts to reduce automobile trips;

Policy T-19 Air Quality Impacts: Continue to encourage innovative technologies and programs such as clean-fuel, electric, and low-emission cars that reduce the air quality impacts of the automobile; and

Policy T-20 Neighborhood Protection and Traffic Calming: Take actions to prevent traffic and parking generated by residential, commercial, industrial, or institutional activities from being detrimental to residential areas.

**City of Oakland General Plan**

The following transportation-related policies from the City of Oakland General Plan Land Use and Transportation Element would relate to air quality. The Land Use and Transportation Element was approved in March 1998.

Policy T2.1 Encouraging Transit-Oriented Development: Transit-oriented development should be encouraged at existing and proposed transit nodes, defined by the convergence of two or more nodes of public transit such as BART, bus, shuttle services, light rail or electric trolley, ferry, and inter-city or commuter rail;

Policy T2.5 Linking Transportation and Activities: Link transportation facilities and infrastructure improvements to recreational uses, job centers, commercial nodes, and social services (i.e., hospitals, parks, or community centers);

Policy T3.2 Promoting Strategies to Address Congestion: The City should promote and participate in both local and regional strategies to manage traffic supply and demand where unacceptable levels of service exist or are forecast to exist;

Policy T3.5 Including Bikeways and Pedestrian Walks: The City should include bikeways and pedestrian walks in the planning of new, reconstructed, or realigned streets, wherever possible;

Policy T3.6 Encouraging Transit: The City should encourage and promote use of public transit in Oakland be expediting the movement of and access to transit vehicles on designated "transit streets" as shown on the Transportation Plan;

Policy T4.2 Creating Transportation Incentives: Through cooperation with other agencies, the City should create incentives to encourage travelers to use alternative transportation options;

Policy D3.2 Incorporating Parking Facilities: New parking facilities for cars and bicycles should be incorporated into the design of any project in a manner that encourages and promotes safe pedestrian activity;

Policy N1.2 Placing Public Transit Stops: The majority of commercial development should be accessible by public transit. Public transit stops should be placed at strategic locations in the Neighborhood Activity Centers and Transit-Oriented Districts to promote browsing and shopping by transit users; and

Policy N5.1: Residential areas should be buffered and reinforced from conflicting uses through the establishment of performance-based regulations, the removal of non-conforming uses, and other tools.

In addition, the Open Space, Conservation, and Recreation (OSCAR) Element of the City of Oakland General Plan includes the following policies that are relevant to air quality. The OSCAR Element of the General Plan was adopted in 1996.

Policy CO-12.1: Promote land use patterns and densities which help improve regional air quality conditions by: (a) minimizing dependence on single passenger autos; (b) promoting projects which minimize quick starts and stops, such as live-work development, and office development with ground-floor retail space; (c) separating land uses which are sensitive to pollution from the sources of air pollution; and (d) supporting telecommuting, flexible work hours, and behavioral changes which reduce the percentage of people in Oakland who must drive to work on a daily basis;

Policy CO-12.3: Expand existing transportation systems management and transportation demand management strategies which reduce congestion, vehicle idling, and travel in single-passenger autos;

Policy CO-12.4: Require that development project be designed in a manner which reduces potential adverse air quality impacts. This may include: (a) the use of vegetation and

landscaping to absorb carbon monoxide and to buffer sensitive receptors; (b) the use of low-polluting energy sources and energy conservation measures; (c) designs which encourage transit use and facilitate bicycle pedestrian travel;

Policy CO-12.5: Require new industry to use best available control technology to remove pollutants, including filtering, washing, or electrostatic treatment of emissions;

Policy CO-12.6: Require construction, demolition, and grading practices which minimize dust emissions. These practices are currently required by the City and include the following:

- Avoid earth moving and other major dust-generating activities on windy days;
- Sprinkling unpaved construction areas with water during excavation, using reclaimed water where feasible. (Watering can reduce construction-related dust by 50 percent.);
- Covering stockpiled sand, soil, and other particulates with a tarp to avoid blowing dust;
- Covering trucks hauling dirt and debris to reduce spills. If spills do occur, they should be swept up promptly before materials become airborne;
- Preparing a comprehensive dust control program for major construction in populated areas or adjacent to sensitive uses like hospitals and schools; and
- Operating construction and earthmoving equipment, including trucks, to minimize exhaust emissions.

Policy CO-12.7: Coordinate local air quality planning efforts with other agencies, including adjoining cities and counties, and the public agencies responsible.

## 4.2.4 Impacts and Mitigation Measures

### *Significance Criteria*

For the purposes of this EIR, air quality impacts would considered significant if they would exceed the following Standards of Significance, which are based on Appendix G of the State *CEQA Guidelines*, the *BAAQMD CEQA Guidelines*, and the UC CEQA Handbook. According to these guidelines, a project would normally have a significant impact on air quality if it would:

- Conflict or obstruct with implementation of the applicable air quality plan;
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation;

- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);
- Expose sensitive receptors to substantial pollution concentrations;
- Create objectionable odors affecting a substantial number of people;
- Exceed the probability of 10 in one million of a maximally exposed individual contracting cancer due to emissions of toxic air contaminants; or
- Have ground level concentrations of non-carcinogenic toxic air contaminants that would result in a Hazard Index greater than 1.0 for the maximally exposed individual.

The UC CEQA Handbook states that, where applicable, the significance criteria established by the applicable air district may be used to make these determinations. The *BAAQMD CEQA Guidelines* recommend analytical methodologies and provide evaluation criteria for determining the level of significance of project impacts under the above-listed general criteria. The BAAQMD's evaluation criteria for determining air quality impacts provide defined screening thresholds for pollutant emissions. Screening thresholds for air quality impacts from the *BAAQMD CEQA Guidelines* are presented below.

**Construction Emissions**

$PM_{10}$ is the pollutant of greatest concern with respect to construction activities. Construction emissions of $PM_{10}$ can vary greatly depending upon the level of activity, construction equipment, local soils and weather conditions, among other factors. As a result, the *BAAQMD CEQA Guidelines* specify that "[t]he District's approach to CEQA analyses of construction impacts is to emphasize implementation of effective and comprehensive control measures rather than detailed quantification of emissions." Therefore, the determination of significance with respect to construction emissions should be based on a consideration of the control measures to be implemented. If all the applicable control measures for $PM_{10}$ indicated in the *BAAQMD CEQA Guidelines* would be implemented, then air pollutant emissions from construction activities would be considered less than significant. If a project would not implement all applicable control measures, construction emissions may be considered to result in a significant impact.

**Operational Emissions**

The *BAAQMD CEQA Guidelines* recommend that individual project impacts involving direct and/or indirect operational emissions that exceed the following thresholds be considered significant:

- 80 pounds per day of ROG;
- 80 pounds per day of NOx; and

- 80 pounds per day of $PM_{10}$.

Direct emissions are those that are emitted on a site and include stationary sources and on-site mobile equipment, if applicable. Examples of land uses and activities that generate direct emissions are industrial operations and sources subject to an operating permit by the BAAQMD. Indirect emissions come from mobile sources that access the project site, but generally are emitted off site. For many types of land development projects, the principal source of air pollutant emissions is the motor vehicle trips generated by the project.

**Local Carbon Monoxide Concentrations**

Indirect CO emissions are considered significant if they will contribute to a violation of the state standards for CO (9.0 ppm averaged over 8 hours and 20 ppm over 1 hour). The BAAQMD recommends CO modeling for projects in which: (1) project vehicle emissions of CO would exceed 550 pounds per day; (2) project traffic would affect intersections or roadway segments operating at level of service (LOS) E or F, or would cause a decline to LOS E or F;[6] or (3) project traffic would increase traffic volumes on nearby roadways by 10 percent or more (unless the increase in traffic volume is less than 100 vehicles per hour). Intersections are determined to operate at a LOS between A and E (LOS A being the best and LOS E being the worst) according to congestion or delay time, demand/capacity ratio, and relative flow of traffic at the intersection. Intersections that are determined to operate at LOS F or E have the potential to cause a CO hotspot (i.e., exceedance of the CAAQS). If necessary, a simplified CO modeling analysis, described in the *BAAQMD CEQA Guidelines*, may be used to determine localized CO concentrations. If modeling demonstrates that the source would not cause a violation of the state standard at existing or reasonably foreseeable receptors, the motor vehicle trips generated by the project would not have a significant impact on local air quality.

**Greenhouse Gas Emissions**

To date, no local or state air quality agency has adopted significance criteria for GHGs emissions or guidance on how GHGs or global climate change should be addressed in CEQA documents. While the Global Warming Solutions Act (AB 32) created a framework for the reduction of GHGs in California, the Act did not address the role of CEQA in achieving the goals of the Act. As noted earlier, in August 2007, the Governor signed SB 97 (Dutton) into law which requires the Governor's Office of Planning and Research (OPR) to prepare *CEQA Guidelines* for the mitigation of GHG emissions or the effects of greenhouse gas emissions. The Resources Agency must certify and adopt the guidelines by January 1,

6 Levels of Service (LOS) range from A (least congested) with a condition of free flow with low volumes and high speeds to F (most congested) with stop and go, low-speed conditions with little or poor maneuverability.

2010. Despite the foregoing, this EIR provides a discussion of the cumulative impacts of the project with respect to global climate change in the absence of an established significance threshold in **Section 5.0, Cumulative Impacts**.

## *Impact Assessment Methodology*

Air quality impacts resulting from the implementation of the proposed project fall into two categories: short-term impacts due to construction activities and long-term impacts from the day-to-day operations of the proposed project. Construction activities would impact air quality on a local level due to fugitive dust $PM_{10}$ and other criteria pollutant emissions associated with heavy-duty construction equipment exhaust. As mentioned above, compliance with standard control measures specified in the *BAAQMD CEQA Guidelines* is considered sufficient to reduce construction impacts to a less than significant level.

Following construction of the proposed project, operational criteria pollutant emissions would be generated primarily due to project-related motor vehicle trips. Emissions from on-site stationary and areas sources such as cooling towers, emergency engines, boilers, natural gas combustion, and landscape maintenance equipment would also be generated. Emissions resulting from all on-site stationary and area sources were quantified and compared with the appropriate significance threshold in the analysis presented below. URBEMIS2007 was used to quantify mobile and area source emissions resulting from the operation of the proposed project. Emissions from on-site stationary sources (i.e., cooling towers, emergency engines, and boilers) were calculated using emission factors contained in U.S. EPA's *Compilation of Air Pollutant Emission Factors* (also referred to as AP 42) and the emissions standards for compression-ignition diesel engines established by CARB and the U.S. EPA. The emission calculations and daily emissions are described in further detail below.

## *Mitigation Measures included in the Proposed Project*

The following mitigation measures, adopted as part of the LBNL 2006 LRDP, are required by the 2006 LRDP for the proposed project and are thus included as part of the proposed project. The analysis presented below evaluates environmental impacts that would result from project implementation following the application of these mitigation measures. These mitigation measures that are included in the project would be monitored pursuant to the Mitigation Monitoring and Reporting Plan that will be adopted for the proposed project.

**LRDP MM AQ-1a**: During construction of the proposed LRDP buildings, the developer must implement all "basic" control measures to minimize the generation of fugitive dust. In addition, for construction sites greater than four acres or projects that would generate large amounts of fugitive dust, "enhanced" and "optional"

control measures should be implemented. The recommended control measures are located in Table 2 of the *BAAQMD CEQA Guidelines*.

**LRDP MM AQ-1b**: During construction of the proposed LRDP buildings, the developer must implement the following mitigation measures to minimize heavy-duty construction equipment exhaust.

- Construction equipment shall be properly tuned and maintained in accordance with manufacturer's specifications.
- Best management construction practices shall be used to avoid unnecessary emissions (e.g., truck and vehicles in loading and unloading queues would turn their engines off when not in use).
- Any stationary motor sources such as generators and compressors located within 100 feet of a sensitive receptor shall be equipped with a supplementary exhaust pollution control system as required by the BAAQMD and CARB.
- Incorporate use of low-$NO_X$ emitting, low-particulate emitting, or alternatively fueled construction equipment into the construction equipment fleet where feasible, especially when operating near sensitive receptors.
- Reduce construction-worker trips with ride-sharing or alternative modes of transportation.

**LRDP MM AQ-4a**: To avoid the single location where implementation of the 2006 LRDP would result in an increase in health risk in excess of the 10-in-1-million threshold, LBNL shall adjust, prior to the construction of parking structure PS-1 (or similarly configured building), the exhaust system of the existing generator near Building 90 to reduce or eliminate the restriction on upward exhaust flow caused by the existing rain cap. For example, modeling indicates that removal of the rain cap would reduce the risk caused by construction of parking structure PS-1 in proximity to the existing generator to a level below 10 in 1 million. The Berkeley Lab could install a hinged rain cap, which would prevent moisture infiltration into the generator but still allow unobstructed exhaust flow and would avoid the significant impact identified in the health risk assessment.[7]

[7] While this measure is not specifically applicable to the proposed project, consistency with its provisions regarding the configuration of the emergency generator stack would help to reduce the potential health impacts associated with the emissions from the proposed emergency generator.

## *Project Impacts and Mitigation Measures*

The following sections describe project-specific impacts. Cumulative air quality impacts are discussed in **Subsection 5.5.2** of **Section 5.0 Cumulative Impacts**.

**Helios Impact AIR-1: Construction of the proposed project would generate short-term emissions of fugitive dust and criteria air pollutants that would not adversely affect local air quality in the vicinity of the construction site. (*Less than Significant*)**

Construction of the proposed project is anticipated to commence in April/May 2008 and continue for approximately 26 to 34 months. The proposed building site is currently vacant and would not require demolition operations. Construction activities would also involve the improvement of the existing access road leading from Centennial Drive. A small wooden shed that is along the proposed access road alignment would be demolished, and under three of the four Helios Road/Centennial Drive intersection options Building 73 would also be demolished. Prior to building construction, the entire site would be graded to prepare for building foundations and asphalt paving activities. Fugitive dust $PM_{10}$ would be generated on the project site as a result of earthmoving and grading activities. In addition, criteria air pollutants, including ROG and $NO_X$ among others, would be generated due to heavy-duty construction equipment. During building construction, emissions would primarily be generated from heavy-duty construction equipment, construction worker trips, and material delivery trips. Although temporary in nature, construction emissions have the potential to cause adverse effects on local air quality in the vicinity of the project site.

The BAAQMD does not require full quantification of construction emissions, but rather emphasizes the implementation of effective and comprehensive control measures to minimize the generation of $PM_{10}$ fugitive dust, ROG, and $NO_X$. If a proposed project implements all appropriate dust-control measures, the BAAQMD considers construction-related emissions to be less than significant. Implementation of the control measures specified in the *BAAQMD CEQA Guidelines*, Table 2, Feasible Control Measures for Construction Emissions of $PM_{10}$, would be sufficient to reduce construction impacts to a less than significant level. LRDP Mitigation Measure AQ-1a is the suite of basic, enhanced and optional control measures recommended in the *BAAQMD CEQA Guidelines* to minimize the generation of fugitive dust. These measures (basic, enhanced and optional control measures) are included in the proposed project and will be required during the construction of the proposed project. As a result, the project's construction-phase impact related to fugitive dust emissions would be less than significant.

In addition, construction activities would generate air emissions of ROG and $NO_X$, which are ozone precursors. The magnitude of emissions would vary on a day-to-day basis depending on the heavy-duty

construction equipment activity level, number of construction workers, and material delivery trucks. The ozone precursors could potentially contribute to the ongoing nonattainment status of the SFBAAB for ozone. The *BAAQMD CEQA Guidelines* recognize that construction activities will generate ROG and $NO_X$; however, these emissions are included in the inventory that is used as the basis for the regional air quality plan. Hence, the emissions have been accounted for and would not be expected to impede attainment or maintenance of ozone in the SFBAAB. Furthermore, LRDP Mitigation Measure AQ-1b to minimize the generation of exhaust emissions during construction is included in the proposed project and will be implemented during the construction of the proposed project. This would ensure that emissions of ozone precursors are minimized during project construction. Project construction activities would also comply with Regulation 8, Rules 3 and 15 related to architectural coatings and emulsified and liquid asphalt. Therefore, the construction emissions would not conflict or obstruct with implementation of the applicable air quality plan and construction-phase project impacts on air quality would be less than significant.

**Mitigation Measure**: No project-level mitigation measure required.

**Helios Impact AIR-2: The proposed project would generate long-term operational emissions of criteria pollutants from increases in traffic and stationary and area sources that would not adversely affect air quality. (*Less than Significant*)**

Operational emissions associated with the proposed project would result from increased vehicular trips to and from the facility (i.e., mobile sources). Other sources of operational emissions associated with the project include area and stationary source emissions, such as the use of natural gas for water heaters, landscape maintenance equipment, and an emergency generator, four boilers, and up to eight cooling towers. As mentioned above, BAAQMD recommends operational thresholds of significance for projects within its jurisdiction. Any project that would generate emissions of ROG, $NO_X$, or $PM_{10}$ that exceed the thresholds would be considered to have significant operational impacts.

The mobile source emissions associated with the proposed project were estimated using URBEMIS2007, a land use and emissions estimation model. URBEMIS2007 estimates vehicle emissions based on the amount of development and trip generation rate of the development. In addition, URBEMIS2007 incorporates trip distances and emission factors specific to counties, air basins, and air district jurisdictions. For the proposed project, parameters specific to Alameda County were used to estimate mobile and area source emissions. Area source emissions estimated using URBEMIS2007 include natural gas combustion, landscape maintenance equipment, and periodic architectural coating maintenance. The

proposed project would be designed consistent with the UC Policy for Sustainable Practices, which requires new buildings to outperform California Code of Regulations Title 24 standards by at least 20 percent. Although the proposed project's design could outperform Title 24 standards by more than 20 percent, the exact percentage is not known at this stage of development. Therefore, area source emissions in URBEMIS2007 were calculated assuming a minimum of 20 percent more efficient than Title 24 would require. Detailed URBEMIS2007 outputs, including parameters and assumptions, are provided in **Appendix 4.2**.

The proposed project would also include stationary sources such as an emergency generator, boilers, and cooling towers. A 750-kilowatt emergency generator would be located on the north side of the project site adjacent to the loading dock. The emergency generator would act as an energy supply in the case of an electricity outage in the area. Criteria pollutant emissions associated with the emergency generator were calculated using emission standards for off-road diesel (compression-ignition) engines established by CARB and the U.S. EPA (California Code of Regulations 2000). Because the engine would have an output rating greater than 50 horsepower, this unit must comply with CARB's Airborne Toxics Control Measure (ATCM) for stationary compression-ignition engines (California Code of Regulations undated). The ATCM requires that new emergency standby engines must comply with hydrocarbon, $NO_x$, and CO limits that are applicable to an off-road engine of the same model year and horsepower rating. The ATCM further limits the PM emissions from an emergency standby engine to either (1) 0.15 gram per horsepower-hour (g/hp-hr) (with a maximum operating limit of 50 hours per year for testing and maintenance) or 0.01 g/hp-hr (with a maximum operating limit of 100 hours per year for testing and maintenance), or (2) the emission limit for an off-road engine with the same maximum rated power, whichever is more stringent. For the ratings of the proposed engine, assuming a 2010 model year or later, the 0.15 g/hp-hr limit is the applicable PM limit under California and federal standards for off-road engines; however, LBNL has proposed to meet the more stringent emission standard of 0.01 g/hp-hr and would restrict the operating hours to 50 hours per year for testing and maintenance. Since June 2006, the sulfur content of available CARB diesel fuel has been 15 ppm (0.0015 percent) by weight, and this concentration was used to estimate the $SO_x$ emissions from the proposed engine. The criteria pollutant emissions associated with the operation of the 750-kilowatt emergency generator are included in the stationary source category in **Table 4.2-7**, **Estimated Operational Emissions**.

The proposed project would include four 1.7-million British thermal units (MMBTU) boilers, which would provide steam and hot water for the proposed facility. Finally, the proposed project would include eight cooling towers with a maximum circulating water flow rate of 1,465 gallons per minute. The emissions associated with daily operation of the cooling towers were calculated using the maximum flow rate to represent a worst-case day scenario. Cooling towers would provide chilled water for space

cooling and for laboratory uses. The emissions associated with the cooling towers and boilers were calculated using emission factors contained in the U.S. EPA's AP 42, a compilation of emission factors for various area and point sources (U.S. EPA 1995; 1998). Stationary source emissions associated with the proposed project were quantified and included as "stationary sources" in **Table 4.2-7**, **Estimated Operational Emissions**. Detailed calculations of each stationary source are included in **Appendix 4.2**.

**Table 4.2-7**
**Estimated Operational Emissions**

| | Emissions in Pounds per Day | | | | |
|---|---|---|---|---|---|
| **Emissions Source** | **ROG** | **$NO_X$** | **CO** | **$SO_X$** | **$PM_{10}$** |
| **Summertime Emissions[1]** | | | | | |
| Stationary Sources | 3.23 | 17.08 | 19.78 | 0.11 | 5.04 |
| Operational (Mobile) Sources | 4.48 | 4.10 | 38.77 | 0.03 | 5.67 |
| Area Sources | 1.12 | 0.87 | 2.27 | 0.00 | 0.01 |
| **Summertime Emission Totals** | **8.83** | **22.05** | **60.82** | **0.14** | **10.72** |
| BAAQMD Thresholds | 80 | 80 | — | — | 80 |
| Exceeds Threshold? | NO | NO | — | — | NO |
| **Wintertime Emissions[2]** | | | | | |
| Stationary Sources | 3.23 | 17.08 | 19.78 | 0.11 | 5.04 |
| Operational (Mobile) Sources | 3.34 | 6.00 | 40.35 | 0.03 | 5.67 |
| Area Sources | 1.00 | 0.85 | 0.72 | 0.00 | 0.00 |
| **Wintertime Emission Totals** | **7.57** | **23.93** | **60.85** | **0.14** | **10.71** |
| BAAQMD Thresholds | 80 | 80 | — | — | 80 |
| Exceeds Threshold? | NO | NO | — | — | NO |

*Source: Impact Sciences, Inc. Detailed URBEMIS2007 and stationary source emissions calculations are provided in **Appendix 4.2**.*
*Totals in table may not appear to add exactly due to rounding in the computer model calculations.*
[1] *"Summertime Emissions" are representative of the conditions that may occur during the ozone season (May 1 to October 31).*
[2] *"Wintertime Emissions" are representative of the conditions that may occur during the balance of the year (November 1 to April 30).*

As shown above, operational emissions associated with the day-to-day activities of the proposed project would not exceed any of the operational thresholds of significance. Projects that generate emissions below the regional thresholds of significance would not be considered to contribute a substantial amount of air pollutants. Therefore, operational emissions would be considered to have a less than significant impact, and the project would not contribute substantially to the existing ozone and $PM_{10}$ nonattainment status for the Basin.

**Mitigation Measure:** No project-level mitigation measure required.

**Helios Impact AIR-3: The proposed project would increase carbon monoxide concentrations at busy intersections and along congested roadways in the project vicinity but would not expose sensitive receptors to substantial pollution concentrations. (*Less than Significant*)**

CO is produced in greatest quantities from vehicle combustion and is usually concentrated at or near ground level under cool, stable (i.e., low or no wind) atmospheric conditions because it does not readily disperse into the atmosphere. As a result, potential air quality impacts to sensitive receptors are assessed through an analysis of localized CO concentrations. Traffic congested roadways and intersections have the potential to generate high localized levels of CO. Congested intersections, roadways, and parking structures where high ambient concentrations of CO accumulate are termed CO "hotspots." These hotspots have the potential to exceed the state ambient air quality 1-hour CO standard of 20 ppm or the 8-hour CO standard of 9.0 ppm. Note that the federal levels are based on 1- and 8-hour standards of 35 and 9 ppm, respectively. Thus, an exceedance condition would occur based on the state standards prior to exceedance of the federal standard. As such, exceedance of the state ambient air quality 1-hour standard of 20 ppm or the 8-hour standard of 9.0 ppm would constitute a significant air quality impact from the creation of substantial concentrations of CO.

The project was evaluated to determine if it would cause a CO hotspot utilizing a simplified CALINE4 screening model developed by the BAAQMD. The simplified model is intended as a screening analysis that identifies a potential CO hotspot. If a hotspot is identified, the complete CALINE4 model is then utilized to determine precisely the CO concentrations predicted at the intersections in question. This methodology assumes worst-case conditions (i.e., wind direction is parallel to the primary roadway and 90 degrees to the secondary road, wind speed of less than one meter per second and extreme atmospheric stability) and provides a screening of maximum, worst-case, CO concentrations. This model was utilized to predict future CO concentrations 0 and 25 feet from the intersections in the study area based on projected traffic volumes for these intersections contained in the project traffic study. These intersections were determined in the project traffic study to operate at a level of service (LOS) D or worse. Intersections operating at LOS E or F are considered to have the potential to create a CO hotspot. However, for the purposes of this analysis, any intersections operating at LOS D or worse (i.e., Centennial Drive and Grizzly Peak Boulevard) were analyzed. Maximum CO concentrations occurring during cumulative plus project conditions were calculated for peak hour traffic volumes. The results of these CO concentration calculations are presented in **Table 4.2-8**, **Cumulative (2025) Plus Helios Project CO Concentrations**, for representative receptors located 0 and 25 feet from the intersection.

**Table 4.2-8**
**Cumulative (2025) Plus Helios Project CO Concentrations**

| Intersection | 0 Feet | | 25 Feet | |
|---|---|---|---|---|
| | 1-Hour[1] | 8-Hour[2] | 1-Hour[1] | 8-Hour[2] |
| Centennial Drive and Grizzly Peak Boulevard | 7.1 | 4.4 | 6.9 | 4.3 |
| Gayley Avenue/La Loma Avenue and Hearst Avenue | 7.3 | 4.6 | 7.1 | 4.4 |
| Gayley Avenue and Stadium Rim Way | 7.3 | 4.6 | 7.1 | 4.4 |
| Piedmont Avenue and Bancroft Way | 7.2 | 4.5 | 7.0 | 4.4 |
| Piedmont Avenue and Durant Avenue | 7.2 | 4.5 | 7.0 | 4.4 |

*Source: Impact Sciences, Inc.*

*Emissions calculations are provided in* ***Appendix 4.2****.*

[1] *State standard is 20 parts per million. Federal standard is 35 parts per million.*

[2] *State standard is 9.0 parts per million. Federal standard is 9 parts per million.*

As shown above, the contribution of traffic from cumulative projects plus the proposed project traffic would not generate CO concentrations near the study intersections that would exceed any of the state CO ambient air quality standards. Therefore, the project's impact would be considered less than significant and the project would not expose sensitive receptors to substantial pollutant concentrations. The day-to-day operations of the proposed project would not violate or contribute substantially to an air quality violation.

**Mitigation Measure:** No project-level mitigation measure required.

**Helios Impact AIR-4: The proposed project would not create objectionable odors affecting a substantial number of people. (*Less than Significant*)**

The proposed project would consist of research and development laboratory space and offices. Although the proposed operations could conduct activities that would generate odors, each laboratory would be equipped with fume hoods and exhaust systems to isolate any odor generated from within the facility. An estimated 75 fume hoods would lead to one common exhaust system. Each fume hood would be equipped with an air flow sensor. All air exhausts would be located on the Helios building roof. Discharge from the fume exhaust would meet applicable vertical velocity and stack height requirements to enhance dispersion of the exhaust, thereby minimizing any odor impact caused by the proposed project.

In addition, LBNL provides an extensive buffer zone around most of the Berkeley Lab's perimeter. This established buffer zone for potential sources of odors is consistent with the *2005 Ozone Strategy*. It should

also be noted that LBNL has no previous history of odor complaints. The project site would be located in the southeast portion of LBNL. The closest sensitive receptors to the proposed project site are located south of the project site at least 2,100 feet away. These receptors are located outside the zone to which the prevailing winds blow (toward the east and southeast), which would further reduce the potential for odor impacts. It should be noted that nighttime winds tend to blow toward the northwest, which could carry any potential odors toward the residents located northwest of LBNL. However, this is not the predominant wind direction and would occur during the evening when receptors tend not to be outdoors. Furthermore, these residences are located at least 2,400 feet from the project site. Due to project features described above, the distance to the nearest receptors, and the prevailing wind direction (which blows toward the east and southeast), the proposed project would not create objectionable odors that would impact a substantial number of people. Therefore, this impact would be less than significant.

**Mitigation Measure:** No project-level mitigation measure required.

**Helios Impact AIR-5: The proposed project would not expose maximally exposed individuals to cancer risks exceeding 10 in one million. (*Less than Significant*)**

A human health risk assessment (HHRA) was prepared to evaluate the emissions of TACs from laboratory exhaust systems, eight cooling towers, four natural-gas-fired boilers, and the diesel emergency generator proposed at the Helios Facility (Golder Associates 2007). The Helios Project HHRA is on file with the Berkeley Lab.

Estimated TAC emissions from the sources associated with the Helios Facility were screened with respect to their relative emission rates and toxicity (i.e., cancer potency) so that the TACs resulting in greater than 90 percent of the total toxicity-weighted cancer-causing emissions were included in the HHRA for the project. These TACs were thus identified as chemicals of potential concern (COPCs) for the HHRA. The sources, specific COPCs evaluated in the HHRA for cancer effects, and annual quantities are shown in **Table 4.2-9, Summary of Annual COPC Emissions (Carcinogens).** The methods used to calculate the emissions of all TACs emitted and the screening of COPCs are described in the Helios Project HHRA.

**Table 4.2-9**
**Summary of Annual COPC Emissions (Carcinogens)**

| Source(s) | Chemical | Annual COPC Emissions (Pounds/Year) |
|---|---|---|
| Boilers | Chromium (VI) | 0.014 |
| Generator | Diesel Particulate Matter | 1.17 |
| Boilers | Cadmium | 0.064 |
| Boilers, Laboratories | Benzene | 6.60 |
| Laboratories | Chloroform | 33.4 |
| Laboratories | Carbon Tetrachloride | 3.89 |
| Laboratories | 1,2-Dichloroethane | 6.43 |

*Source: Golder Associates 2007*

The U.S. Environmental Protection Agency-approved American Meteorological Society/EPA Regulatory Model (AERMOD) model was used to model the air quality impacts of COPC emissions from the proposed Helios operations. The AERMOD model can estimate the air quality impacts of single or multiple sources using actual meteorological conditions. The specific exhaust parameters for the laboratory vents, cooling towers, boilers, and the emergency generator are described in the Helios Project HHRA.

The model was configured with the following control parameters:

- Modeling switches: regulatory defaults
- Averaging periods: annual
- Choice of dispersion coefficients based upon land-use type: rural

Meteorological data from an on-site monitoring station at LBNL for 1998 and 1999 were used in AERMOD. Rural dispersion coefficients were selected because they result in higher ambient concentrations than urban coefficients, and both rural and urban land use types exist within and outside of the LBNL facility site.

Two separate receptor grids were created for this project: One grid containing only receptor locations on, or inside of, the LBNL facility property boundaries (On-Site Grid), and the second grid containing only receptor locations beyond, or outside of, the LBNL facility property boundaries (Off-Site Grid). The receptor grids were created by first overlaying a rectilinear grid of receptor locations extending approximately 200 meters out from the facility property boundary with even 30-meter spacing between

receptor locations. An additional grid of receptors with 180-meter spacing was extended from the edge of the 30-meter grid to a distance of at least 1 kilometer out from the facility property boundary to ensure that all maximum off-site concentrations would be captured in the modeling simulation.

A set of property boundary receptors was also generated by creating receptor locations every 50 meters along the LBNL facility property boundary. A detailed description of the modeling methodology and results is provided in the Helios Project HHRA.

The cancer risk calculations were performed using the exposure and risk equations in the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) guidance manual for health risk assessments prepared under the Air Toxics "Hot Spots" program (OEHHA 2003). The potential exposure pathways assessed included inhalation only. Dermal (skin), soil ingestion, ingestion of homegrown produce, and mother's milk exposure pathways were not assessed as these pathways were not considered to be significant sources of potential human health risk given the emission sources and the location of the proposed project (see the Helios Project HHRA which on file with the Berkeley Lab for further discussion of this issue). The cancer risk calculations for off-site residential exposures were based on COPC concentrations predicted at locations in the Offsite Grid and assumed that a person is exposed continuously for 70 years (9 years as a child and 61 years as an adult). This approach is intended to result in conservative (i.e., health protective) estimates of health impacts. The cancer risk calculations for on-site worker receptors were based on COPC concentrations predicted at locations in the Onsite Grid and used the assumed breathing rates and exposure periods in the OEHHA guidance manual (e.g., 8 hours per day, 245 days per year, 40 years). Cancer risks were evaluated using the inhalation Cancer Potency Factors published by CARB and OEHHA (CARB/OEHHA 2006).

**Table 4.2-10, Summary of Maximum Modeled Cancer Risks**, shows the maximum cancer risk due to COPC emissions from the Helios Facility at any of the on-site and off-site receptors evaluated in the AERMOD modeling.

As shown in **Table 4.2-10**, the maximum potential on-site and off-site cancer risks resulting from the proposed project's TAC emissions would be substantially lower than the BAAQMD significance threshold of 10 in 1 million ($10 \times 10^{-6}$). Accordingly, the project impacts on human health with respect to the cancer risk threshold would be less than significant.

**Table 4.2-10**
**Summary of Maximum Modeled Cancer Risks**

| Receptor | Cancer Risk |
|---|---|
| On-site | |
| Worker | $1 \times 10^{-6}$ |
| Off-site | |
| Child/Adult Resident | $0.5 \times 10^{-6}$ |

*Source: Golder Associates 2007*

**Mitigation Measure:** No project-level mitigation measure required.

**Helios Impact AIR-6: The proposed project would not generate ground level concentrations of noncarcinogenic toxic air contaminants that would result in a Hazard Index greater than 1.0 for the maximally exposed individual. (*Less than Significant*)**

The human health risk assessment described above also evaluated the emissions of TACs from the laboratory exhaust systems, cooling towers, boilers, and the emergency generator proposed at the Helios Facility with respect to their noncancer health effects (Golder Associates 2007). In addition to the potential cancer risk, TACs have acute (i.e., short-term) and chronic (i.e., long-term) noncancer health impacts.

For the chronic noncancer assessment, estimated TAC emissions from the sources associated with the Helios Facility were screened with respect to their relative emission rates and chronic toxicity (i.e., chronic noncancer reference exposure levels) so that the TACs resulting in greater than 90 percent of the total chronic noncancer toxicity-weighted emissions were included in the HHRA for the project. These TACs were thus identified as chemicals of potential concern (COPCs) for the HHRA. The sources, specific COPCs evaluated in the HHRA for chronic noncancer effects, and annual quantities are shown in **Table 4.2-11, Summary of Annual COPC Emissions (Chronic Noncarcinogens).** The methods used to calculate the emissions of all TACs emitted and the screening of COPCs are described in the Helios Project HHRA on file with the Berkeley Lab.

**Table 4.2-11**
**Summary of Annual COPC Emissions**
**(Chronic Noncarcinogens)**

| Source(s) | Chemical | Annual COPC Emissions (Pounds/Year) |
|---|---|---|
| Laboratories | Chlorine | 11.75 |
| Boilers, Laboratories | Formaldehyde | 14.21 |
| Boilers | Cadmium | 0.064 |
| Boilers | Nickel | 0.12 |
| Cooling Towers, Laboratories | Bromine and Compounds | 3.20 |

*Source: Golder Associates 2007*

For the acute hazard assessment, all chemicals estimated to be emitted from the laboratory stacks that had acute Reference Exposure Levels published by CARB/OEHHA (CARB/OEHHA 2006) were evaluated (note that only TACs emitted from laboratory stacks were evaluated, for reasons discussed in the Helios Project HHRA). Therefore, a subset of COPCs were not determined for the acute analysis through a screening process, and all TACs estimated to be emitted from the laboratory stacks that had acute Reference Exposure Levels were evaluated.

The specific TACs associated with the Helios Facility that were evaluated in the HHRA for acute noncancer effects and their associated hourly emission rates are shown in **Table 4.2-12, Summary of Maximum Hourly Laboratory TAC Emissions (Acute Noncarcinogens)**. The methods used to calculate the emissions of all TACs assessed are described in the Helios Project HHRA.

The chronic and acute hazard indices were evaluated using the CARB/OEHHA inhalation Reference Exposure Levels (RELs) (CARB/OEHHA 2006). The REL is the concentration (inhalation) at or below which no adverse health effects are anticipated. The hazard quotient is the ratio of the modeled concentration of a TAC to its REL. The hazard quotients for TACs affecting the same target organ or organ system (e.g., skin, eyes, nervous system, gastrointestinal system) are typically added together to compute a hazard index, although for the chronic assessment all hazard quotients were conservatively added without regard to target organ.

The chronic noncancer hazard quotients for the proposed project were calculated by dividing the maximum annual average concentrations of the COPCs (predicted by the AERMOD model) by their RELs. **Table 4.2-13, Summary of Maximum Modeled Chronic Noncancer Health Impacts**, shows the

maximum chronic hazard indices due to COPC emissions from the Helios Facility at selected on-site and off-site receptors.

**Table 4.2-12**
**Summary of Maximum Hourly Laboratory TAC Emissions**
**(Acute Noncarcinogens)**

| Chemical | Maximum Hourly TAC Emissions (Grams/Hour) |
|---|---|
| Formaldehyde | 0.35 |
| Carbon Tetrachloride | 1.04 |
| Methanol | 57.24 |
| 2-Propanol | 99.69 |
| Chloroform | 8.96 |
| Benzene | 1.70 |
| Carbon Disulfide | 0.21 |
| Propylene Oxide | 0.25 |
| 2-Butanone | 0.63 |
| Styrene | 0.04 |
| Epichlorohydrin | 0.24 |
| Acrolein | 0.01 |
| Toluene | 2.53 |
| Phenol | 0.004 |
| 2-Methoxyethanol | 0.15 |
| Triethylamine | 1.49 |
| 1,4-Dioxane | 0.33 |
| Tetrachloroethylene | 0.14 |
| Carbon Monoxide | 0.23 |
| Carbon Monoxide | 7.09 |
| Xylene | 1.49 |
| Mercury | 0.00004 |
| Hydrogen Chloride | 4.45 |
| Hydrofluoric Acid | 0.20 |
| Ammonia | 0.0005 |
| Sulfuric Acid | 0.07 |
| Nitric Acid | 1.83 |
| Chlorine | 3.15 |
| Nitrogen Dioxide | 6.94 |

*Source: Golder Associates 2007*

**Table 4.2-13**
**Summary of Maximum Modeled Chronic Noncancer Health Impacts**

| Receptor | Chronic Hazard Index |
|---|---|
| On-site | |
| Worker | 0.04 |
| Off-site | |
| Resident | 0.007 |

*Source: Golder Associates 2007*

As shown in **Table 4.2-13**, the maximum potential on-site and off-site chronic impacts resulting from the proposed project's TAC emissions would be substantially lower than the BAAQMD significance threshold of 1.0. Accordingly, the project impacts on human health with respect to acute health impacts would be less than significant.

The hazard quotients for acute health impacts were calculated in a manner similar to the chronic hazard quotients except that the maximum hourly concentrations predicted by the AERMOD model and acute RELs were used. In this case, an acute hazard index was not determined by adding together the separate maximum hazard quotients because the various TACs assessed were not anticipated to be co-emitted at the maximum emission rate during the same one-hour period. **Table 4.2-14, Summary of Maximum Modeled Acute Noncancer Health Impacts**, shows the maximum acute hazard quotients due to TAC emissions from estimated laboratory emissions at the Helios Facility at selected on-site and off-site receptors.

**Table 4.2-14**
**Summary of Maximum Modeled Acute Noncancer Health Impacts**

| Receptor | Acute Hazard Quotient |
|---|---|
| On-site | |
| Worker | 0.006 |
| Off-site | |
| Resident | 0.001 |

*Source: Golder Associates 2007*

As shown in **Table 4.2-14**, the maximum on-site and off-site acute impacts (due to estimated chloroform emissions) resulting from the proposed project's TAC emissions would be less than the BAAQMD

significance threshold of 1.0. Accordingly, the project impacts on human health with respect to acute health impacts would be less than significant.

**Mitigation Measure:** No project-level mitigation measure required.

## 4.2.5 References

Bay Area Air Quality Management District. 1997. '97 Clean Air Plan and Triennial Assessment. December.

Bay Area Air Quality Management District. 1999. *BAAQMD CEQA Guidelines* [for] Assessing the Air Quality Impacts of Projects and Plans. December.

Bay Area Air Quality Management District. 2000. 2000 Clean Air Plan and Triennial Assessment. December.

Bay Area Air Quality Management District. 2001. Revised San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard. October.

Bay Area Air Quality Management District. 2006. Bay Area 2005 Ozone Strategy. January.

BAAQMD. Air Pollutants Regulated by the District. 2007. [Online] [Accessed September 19,]; <http://www.baaqmd.gov/dst/pollutants.htm>

California Air Resources Board and Office of Environmental Health Hazard Assessment. "Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values." 2006. [Online] [October 5,]. <http://www.arb.ca.gov/toxics/healthval/ healthval.htm>

California Code of Regulations, Title 17, Section 93115, Airborne Toxic Control Measure for Stationary Compression Ignition (CI) Engines.

California Energy Commission. Inventory of California Greenhouse Gas Emissions and Sinks 1990 to 2004. Figure 2. December 2006. <http://www.energy.ca.gov/2006publications/CEC-600-2006-013/CEC-600-2006-013-SF.PDF>

California Energy Commission. 2006. Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004. December.

California Environmental Protection Agency. 2006. Climate Action Team. Climate Action Team Report to Governor Schwarzenegger and the Legislature (Executive Summary). March.

California Environmental Quality Act Guidelines. California Code of Regulations, Title 14, Division 6, Chapter 3, Section 15065(a)(3).

California Environmental Quality Act Guidelines. California Code of Regulations, Title 14, Division 6, Chapter 3, Section 15064(h)(4).

Energy Information Administration. 2002. Alternatives to Traditional Transportation Fuels 1994. July. <http://www.eia.doe.gov/cneaf/alternate/page/environment/exec2.html>

Energy Information Administration. 2001. Other Gases: Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride. October. <http://www.eia.doe.gov/oiaf/1605/gg00rpt/other_gases.html>

Golder Associates. 2007. Human Health Risk Assessment in Support of an Environmental Impact Report: Helios Building Project – Lawrence Berkeley National Laboratory. November.

Intergovernmental Panel on Climate Change. Climate Change 1996. 1995: The Science of Climate Change-Contribution of Working Group I to the Second Assessment Report of the IPCC. Cambridge (UK): Cambridge University Press.

Intergovernmental Panel on Climate Change. Climate Change 2001: Tropospheric Ozone. March 2006. <http://www.grida.no/climate/ipcc_tar/wg1/142.htm>

Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: The Physical Science Basis, Summary for Policymakers. February. <http://ipcc-wg1.ucar.edu/wg1/docs/WG1AR4_SPM_PlenaryApproved.pdf>

National Climatic Data Center. Global Warming Frequently Asked Questions. February 2006. <http://www.ncdc.noaa.gov/oa/climate/globalwarming.html>

Office of Environmental Health Hazard Assessment. Air Toxics Hot Spots Program. 2003. Guidance Manual for Preparation of Health Risk Assessments. August.

Pew Center on Global Climate Change. Bush Policy vs. Kyoto. <http://www.pewclimate.org/what_s_being_done/in_the_world/bush_intensity_targe_2.cfm>

Real Climate. Water Vapour: Feedback or Forcing? April 2005. <http://www.realclimate.org/index.php?p=142>

SCAQMD (South Coast Air Quality Management District). 2007. Final Program Environmental Impact Report to the 2003 Draft AQMP, August 2003, Table 3.1-1, p. 3.1-2. Available on-line at: http://www.aqmd.gov/ceqa/documents/2003/aqmd/finalEA/aqmp/AQMP_FEIR.html. Date Accessed: March 21.

United Nations Framework Convention on Climate Change. 2006. National Greenhouse Gas Inventory Data for the Period 1990 – 2004 and Status of Reporting. November.

United States Environmental Protection Agency. 1995. Compilation of Air Pollutant Emission Factors (AP 42), Fifth Edition. Volume I: Chapter 13.4 Wet Cooling Towers. January. <http://www.epa.gov/ttn/chief/ap42/final/c13s04.pdf>

United States Environmental Protection Agency. 1996. Protection of Stratospheric Ozone: Listing of Global Warming Potential for Ozone-Depleting Substances. January. <http://www.epa.gov/fedrgstr/EPA-AIR/1996/January/Day-19/pr-372.html>

United States Environmental Protection Agency. 1996. Compilation of Air Pollutant Emission Factors (AP 42), Fifth Edition. Volume I: Chapter 3.3 Gasoline and Diesel Industrial Engines. October. <http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf>

United States Environmental Protection Agency. 1998. Compilation of Air Pollutant Emission Factors (AP 42), Fifth Edition. Volume I: Chapter 1.4 Natural Gas Combustion. July. <http://www.epa.gov/ttn/chief/ap42/ final/c01s04.pdf>

United States Environmental Protection Agency. 2005. "Greenhouse Gas Emissions from a Typical Passenger Vehicle", Office of Transportation and Air Quality, EPA420-F-05-004. February. p. 4.

United States Environmental Protection Agency. 2006. Class I Ozone Depleting Substances. March. <http://www.epa.gov/ozone/ods.html>

United States Environmental Protection Agency.2006. Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2004. April. <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>

United States Environmental Protection Agency. 2006. The Accelerated Phase-Out of Class 1 Ozone-Depleting Substances. April. <http://www.epa.gov/ozone/title6/phaseout/accfact.html>

United States Environmental Protection Agency. 2006. Methane: Sources and Emissions. October. <http://www.epa.gov/methane/sources.html>

United States Environmental Protection Agency. 2006. High GWP Gases and Climate Change. October. <http://www.epa.gov/highgwp/scientific.html#sf6>

United States Environmental Protection Agency. 2006. Glossary of Climate Change Terms. <http://www.epa.gov/climatechange/glossary.html#Climate_change> [Online] [November 30]

United States Geological Survey. 2006. The Water Cycle: Evaporation. August. <http://ga.water.usgs.gov/edu/watercycleevaporation.html>

University of California, Office of the President. 2001. University of California CEQA Handbook. July.

The White House. Addressing Global Climate Change. March 2007. <http://www.whitehouse.gov/ceq/global-change.html>

World Resources Institute. 2006. How U.S. State GHG Emissions Compare Internationally. [Online] [November 13] <http://earthtrends.wri.org/updates/node/106>

# 4.3 BIOLOGICAL RESOURCES

## 4.3.1 Introduction

This section identifies existing biological resources at and in the vicinity of the project site and analyzes the potential for implementation of the proposed Helios Energy Research Facility project to affect those resources. Information presented in the discussion and analysis that follows was drawn from site visits conducted by Pacific Biology in June and September 2007 and by other biological consultants (ESA 2002a-c; ESA 2003a-c); previous environmental documents prepared by the Berkeley Lab for Lawrence Berkeley National Laboratory (LBNL) projects; biological data contained in the California Natural Diversity Database (CNDDB)[1] and the California Native Plant Society's (CNPS) *Electronic Inventory of Rare and Endangered Vascular Plants of California*; and standard biological references. This biological resources section identifies potential effects of the proposed project on sensitive species and habitats and proposes mitigation measures to reduce those impacts to less than significant levels.

In response to the Notice of Preparation for this Environmental Impact Report (EIR), one commenter expressed concern regarding impacts to biological resources as a result of project development in Strawberry Canyon. Another commenter asked LBNL to consider the effect of tree removal associated with the proposed project on carbon sequestration. These scoping comments are addressed in the impact analysis presented below and are reflected in the analysis of alternatives in **Section 6.0, Alternatives,** in this EIR.

## 4.3.2 Environmental Setting

### *Regional Location*

The project site is located in the San Francisco Bay Area, which is characterized by a Mediterranean climate with moderately warm, dry summers and mild, wet winters. More specifically, LBNL is situated on approximately 200 acres on the western slopes of the Oakland-Berkeley Hills. Roughly one-half of LBNL is within Strawberry Canyon and has a south-facing orientation; the balance is within Blackberry Canyon and has a west-facing orientation. The Main Campus of the University of California, Berkeley, is

1 The CNDDB is a computer database maintained by the California Department of Fish and Game of information on the location and distribution of animals and plants that are rare, threatened, endangered, or candidate species, or habitats considered to be of high biological value or of limited distribution.

located west of LBNL and the Hill Campus[2] is located to the north, east, and south of LBNL. Regional open space, including the 2,000-acre Tilden Regional Park, lies to the northeast.

### *Surrounding Land Uses and Plant Communities*

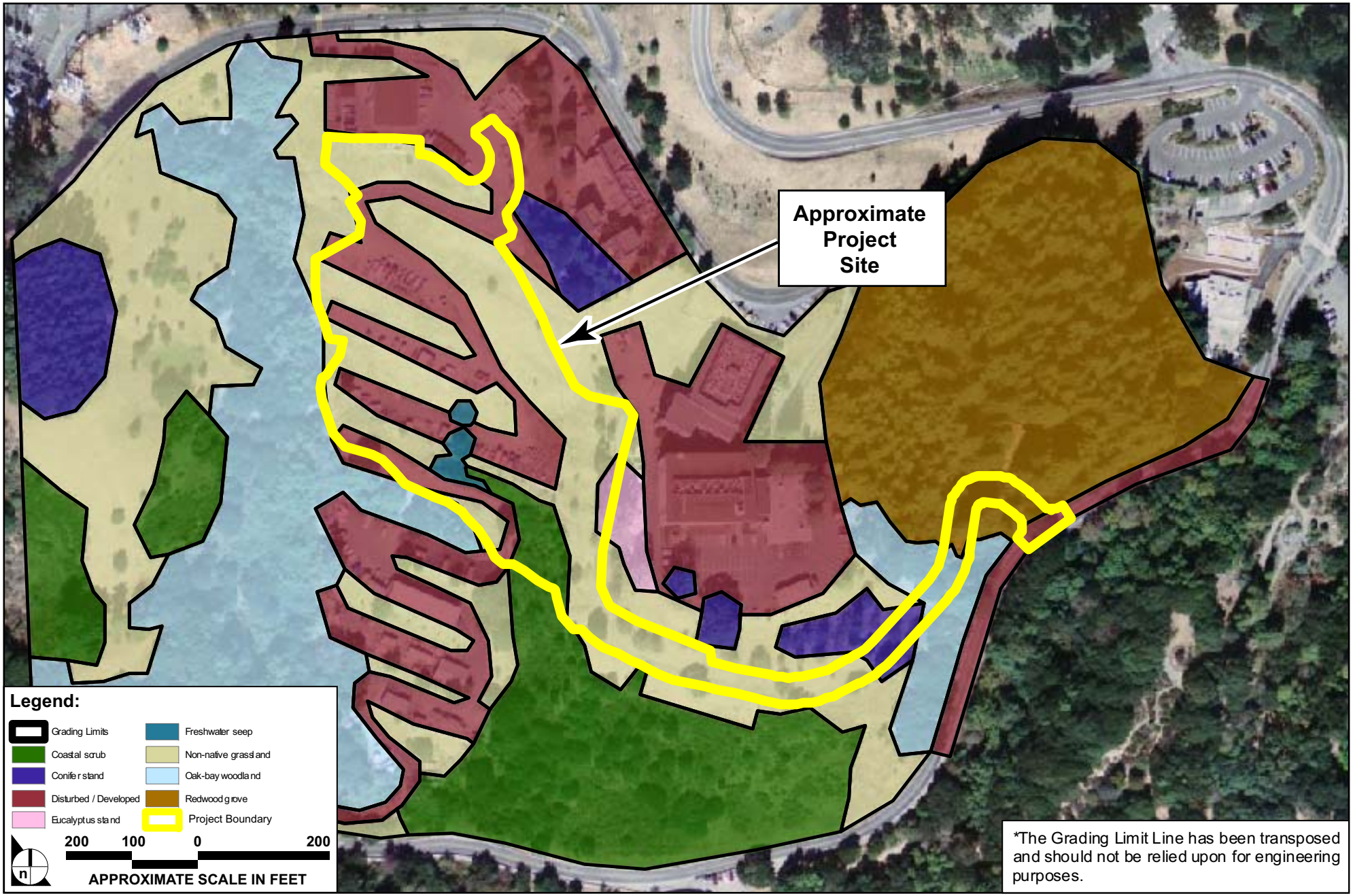
The hills surrounding LBNL contain low-to moderate-density residential neighborhoods mixed with open space containing a mosaic of plant communities and wildlife habitats, including oak and mixed hardwood forests, native and non-native grasslands, chaparral, coastal scrub, marsh and wetland communities, and riparian scrubs and forests. Developed areas of LBNL have been landscaped with a mix of non-native horticultural species and, more recently, California native plants and other drought-tolerant species suitable for landscaping purposes. Open space at LBNL is dominated by annual grassland, with eucalyptus and conifer stands planted throughout the site. Undeveloped areas along the eastern and southern perimeters of the Lab site support a mosaic of coastal scrub and grassland. Woodlands dominated by oak and bay occur along most drainages at LBNL. Open space vegetation on the Berkeley Lab site is managed on an annual basis, either by goats or mechanical means, according to the guidelines set forth in LBNL's *Maintenance Vision for a Fire-Safe Sustainable Landscape* (LBNL 2001).

### *Project Site*

As discussed in **Section 3.0, Project Description**, the proposed project includes the construction of a research building, a new controlled-access road (including four options for its intersection with Centennial Drive), and storm drainage improvements (i.e., grassy swales, a hydromodification cistern, etc.). These project components would be constructed on the main project site (as shown in **Figure 4.3-1 Vegetation Types at Project Site**). The proposed project also includes some associated off-site features. Fill soil would be imported to the project site from a borrow area located in the northeastern portion of LBNL. Additionally, the project includes three wastewater options. Under Wastewater Option 1, a sewer alignment on the LBNL site is proposed to divert wastewater flows to free up capacity in the constrained portion of the city's sewer line to accept project's wastewater flows. Under Wastewater Options 2 and 3, off-site improvements to the sewer lines on the UC Berkeley campus are proposed. The location of the potential sewer alignments are shown on **Figure 3.0-7** and **Figure 3.0-8**.

The project site is located in the southeast portion of LBNL. The project site is located east of Chicken Creek, south of Lawrence Road, west of the Molecular Foundry building, and north of the UC Berkeley

[2] The Hill Campus is an 800-acre portion of the University of California, Berkeley. The Hill Campus extends from Stadium Rim Way to Grizzly Peak Boulevard, is primarily designated as open space, and includes a 300-acre Ecological Study Area and the Botanical Garden.




**SOURCE:** LBNL - 2006; ESA - 2007; Impact Sciences, Inc. - October 2007

FIGURE **4.3-1**

Vegetation Types at Project Site

924-001•11/07

boundary line. The associated access road would be approximately 1,200 feet and descend from the main building site to Centennial Drive. Large portions of the proposed access road would be constructed along and would incorporate an existing access road. The proposed grassy swales would be situated along the downslope side of the access road and turnaround and all storm water from upper portions of the project site would be directed to the grassy swales. From the grassy swales, storm drains would convey the storm water to an on-site underground hydromodification vault.

The project site is approximately 6 acres in size. A large portion of the project site has been heavily disturbed by past grading and by the construction of a paved roadway that traverses the site. There are ungraded slopes on the project site dominated by non-native grasses and ruderal (i.e., weedy) vegetation, as well as native plant communities. Other than small planted redwood trees, trees are absent from the proposed location of the Helios Energy Research Facility, but several species of trees occur within the proposed access road alignment. Specifically, based on a preliminary tree count conducted by LBNL there are a total of 110 trees on the area that would be disturbed for the construction of the access road (under Intersection Option B), including 18 coast redwood (*Sequoia sempervirens*), 44 coast live oak (*Quercus agrifolia*), and 25 bay trees. The number of trees affected under Intersection Option A would be slightly smaller, and the number affected under Intersection Options C and D would be greater. The only on-site structures are an equipment shed (about 400 square feet in size) that is located within the proposed access road alignment and Building 73, which is located within the footprint of three of the four intersection options.

**Plant Communities and Wildlife Habitat**

Plant communities are assemblages of plant species that occur together in the same area and are defined by species composition and relative abundance. The vegetation/habitat classification system for this project is based on Holland (1986) and influenced by the classification system of Sawyer and Keeler-Wolf (1995). Please see **Figure 4.3-1** for the locations of the various plant communities on and near the proposed Helios Energy Research Facility project site.

***Non-Native Grassland***

The slopes on the project site are dominated by non-native grasses and ruderal vegetation characteristic of disturbed habitats. The dominant grass species present include wild oat (*Avena sativa*), a non-native annual species, and Harding grass (*Phalaris aquatica*), a non-native perennial species. Other herbaceous vegetation present includes Italian thistle (*Carduus pycnocephalus*), black mustard (*Brassica nigra*), and bristly ox-tongue (*Picris echioides*). The entire area had recently been grazed by goats to reduce fire hazard. Native and non-native tree species occur throughout portions of the grassland, including coast

live oak and pine. The occurrence of oak trees in the grassland is highest in the eastern portion of the project site within the footprint of the proposed access road.

Grasslands in the project area generally provide habitat for reptiles and amphibians, such as western fence lizard (*Sceloporus occidentalis*), northern alligator lizard (*Elgaria coerulea*), and California slender salamander (*Batrachoseps attenuatus*), as well as numerous birds, including mourning dove (*Zenaida macroura*) and golden-crowned sparrow (*Zonotrichia atricapilla*). Mammals such as Botta's pocket gopher (*Thomomys bottae*) and striped skunk (*Mephitis mephitis*) may browse and forage within the grassland and thrive when varied natural habitats are available nearby (e.g., Chicken Creek). Small rodents attract raptors including red-tailed hawk (*Buteo jamaicensis*) and red-shouldered hawk (*Buteo lineatus*).

***Oak-Bay Woodland***

The eastern portion of the proposed access road would pass through approximately 100 linear feet of oak-bay woodland. An existing service road currently passes through this portion of the woodland. The woodland is dominated by a dense canopy of coast live oak and California bay (*Umbellularia californica*) and contains a sparse understory. In general, undisturbed oak woodland communities in a natural condition may support an abundant assortment of common reptiles, amphibians, and small mammals such as western skink *(Eumeces skiltonianus)*, Pacific treefrog (*Hyla regilla*), northern alligator lizard (*Elgaria coerulea)*, gopher snake (*Pituophis melanoleucus)*, arboreal salamander (*Aneides lugubris*), and deer mouse *(Peromyscus maniculatus).* Resident and migratory bird species found in oak woodlands include spotted towhee (*Pipilo maculates*), brown creeper (*Certhia americana*), oak titmouse *(Parus inornatus),* Hutton's vireo *(Vireo huttoni),* western scrub jay (*Aphelocoma californica*), northern flicker (*Colaptes auratus*), dark-eyed junco *(Junco hyemalis),* downy woodpecker *(Picoides pubescens),* and orange-crowned warbler *(Vermivora celata).* Raptors that breed and nest in local woodland communities include red-tailed hawk, red-shouldered hawk, Cooper's hawk *(Accipiter cooperii)*, and others. Oak woodland can also provide breeding and roosting habitat for bats, including pallid bat (*Antrozous pallidus*), fringed myotis (*Myotis thysanodes*) and long-eared myotis (*Myotis evotis*).

***Redwood Grove***

A grove of redwood trees occurs at the terminus of the proposed access road (just prior to the road's proposed intersection with Centennial Drive). Redwood trees are not native to the Strawberry Canyon area and the redwood grove was planted in the 1940s as part of an effort to introduce redwoods to the area. The grove includes some development, including a small amphitheater, an access road, and Building 73. In the vicinity of the access road intersection alignments, the grove contains redwood trees with diameters (at breast height) ranging from approximately 2 inches to 48 inches. The trees form a

dense canopy and understory vegetation is generally absent. Wildlife use of the redwood grove is expected to be similar to that of the nearby oak-bay woodland (as described above). The redwood trees on the project site are contiguous to, but separated by a fence from, the area known as the Mather Grove.

***Coastal Scrub***

Coastal scrub habitat extends onto the southern portion of the project site and borders portions of the proposed access road to the south. This plant community is dominated by coyote brush (*Baccharis pilularis*) with California honeysuckle (*Lonicera hispidula* var. *vacillans*), bedstraw (*Galium* sp.), hedge nettle (*Stachys ajugoides* ssp. *ajugoides*), and French broom (*Genista monspessulana*) also occurring. Coastal scrub, especially coyote brush scrub, is often the successional phase between grassland and oak woodland. As such, oak trees occur throughout the plant community. Coastal scrub provides nesting and foraging habitat for various birds, including spotted towhee, California towhee, common bushtit (*Psaltriparus minimus*), western scrub jay, and California quail (*Callipepla californica*). Raptors may forage over such areas and prey on small birds, small mammals, and reptiles. The relatively dry conditions within coastal scrub habitat provides suitable habitat for reptiles.

***Freshwater Seep***

A freshwater seep (approximately 0.11 acre in size) is located in the south-central portion of the project site. The seep was created by the outlet pipes of two hydraugers that drain the upslope hillside. According to the LBNL utility maps, the two hydraugers, 700A and 700B extend approximately 850 feet and 1,000 feet, respectively, north through the hillside. There is a large willow at the discharge point of the outlet pipes and an associated herbaceous wetland area has formed along the toe of the slope. The wetland area contains wetland-associated plants such as curly dock (*Rumex crispus*), rabbit's-foot grass (*Polypogon monspeliensis*), water cress (*Rorippa nasturtium-aquaticum*), and umbrella nutsedge (*Cyperus eragrostis*). A second associated wetland area has formed approximately 10 feet downslope of the discharge point of the hydrauger outlet pipes. This area receives surface and subsurface flow from the hydraugers and supports several willow trees, cattails (*Typha latifolia*), and water cress. The presence of flowing water has created a small channel beneath the willow trees containing standing water approximately 1 to 5 inches in depth. The water then passes through a culvert (under the fence line) and discharges further downslope forming a third small wetland area, which also contains several willow trees and an associated herbaceous wetland. Water from this area flows downslope (through a small channel and wetland) prior to entering a storm drain. Seep habitat with perennial water can provide an important source of water for animals during the dry season, including amphibians such as slender

salamander and Pacific treefrog, California mule deer, raccoon, and a wide variety of birds. A red-eared slider (T*rachemys scripta elegans*) turtle was observed within the seep.[3]

***Eucalyptus and Conifer Stands***

Several small stands of eucalyptus and pine trees occur to the north of the proposed access road. These trees appear to have been planted as landscaping and contain understory vegetation similar in composition to the surrounding annual grassland (as described above).

***Disturbed/Developed***

All portions of the project site not containing annual grassland vegetation, oak-bay woodland, coastal scrub, redwoods, eucalyptus, or pines have been graded and/or developed with an existing paved access road. The site was heavily graded in conjunction with the recent construction of the Molecular Foundry building. Additionally, grading occurred in the past to establish the paved roadway that traverses the project site. The graded area contains minimal vegetation and is characterized by compacted dirt and gravel. These unpaved disturbed areas provide habitat values similar (but reduced) to the grasslands discussed above.

***Nearby Plant Communities***

Chicken Creek, a tributary to the South Fork of Strawberry Creek, is located to the west of the project site. The creek is perennial and has been culverted though the developed areas of LBNL. The above ground portions of the creek are steeply incised and support dense and well-developed oak-bay woodland. As the woodland is associated with the creek and associated hydrologic conditions, it is considered to be a riparian woodland. The creek occurs entirely outside of the project boundaries.

**Special Status Species**

For the purposes of this EIR, the term "special-status species" includes species that are listed and receive specific protection defined in federal or state endangered species legislation, as well as species not formally listed as threatened or endangered but designated as species "of concern," or as "rare" or "sensitive" on the basis of adopted policies and expertise of federal or state resource agencies or organizations with acknowledged expertise, including the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), National Marine Fisheries Service (now known as

[3] A red-eared slider was observed in the seep by Christopher Bailey of Bates and Bailey Land Surveyors, on September 14 and 18, 2007. The turtle was positively identified based on the characteristic red stripe behind the eye. This is a non-native turtle species that is commonly kept as a pet. The observed turtle is likely an abandoned pet.

"NOAA Fisheries"), and the California Native Plant Society. Specifically, the following categories are included: federally listed endangered and threatened species; species proposed for listing as endangered or threatened; candidates for such listing; federally identified Birds of Conservation Concern; species of local concern; state-listed endangered and threatened species, and rare (plants only) species; California Species of Special Concern; species designated "special animals" by the state; and "fully protected" species. Additionally, for the purposes of this report, raptors (birds of prey) are also considered to be of special status, as they are specifically protected by Fish & Game Code Section 3503.5, which prohibits the take, possession, or killing of raptors and owls, their nests, and their eggs.[4]

A list of special-status plant and animal species reported to occur in the vicinity of the project site was compiled on the basis of data in the California Natural Diversity Database (CDFG 2005; 2007), the California Native Plant Society Electronic Inventory (CNPS 2005; 2007), special-status species information from the U.S. Fish and Wildlife Service (USFWS 2005a), and biological literature of the region. **Table 4.3-1, Special-Status Species Documented in the Project Area**, (presented at the end of this section) is intended to be comprehensive and includes species for which potential habitat (i.e., general habitat types) occurs within or in the vicinity of the project site. The table reflects the most recent designation of special-status plant and wildlife species based on the current Special Vascular Plants, Bryophytes, and Lichens List (CDFG 2007) and Special Animals List (CDFG 2006).

No special-status plant or wildlife species have been identified on the project site during the field surveys conducted by Pacific Biology or by other biological consultants (ESA 2002a-c; ESA 2003a-c). However, for the reasons discussed in **Table 4.3-1**, several special-status wildlife species are judged to have at least a moderate potential to occur on or adjacent to the project site.

**Special-Status Wildlife Species**

Of the special-status wildlife species presented in **Table 4.3-1**, only the following species, which were determined to have at least a moderate potential to occur within the project vicinity, are fully considered in the impact analysis: Alameda whipsnake, San Francisco lacewing, Cooper's hawk, great horned owl, red-tail hawk, red-shouldered hawk, Olive-sided flycatcher, American kestrel, Allen's hummingbird, California thrasher, pallid bat, long-eared myotis, and fringed myotis. These species are further discussed below.

---

4 The inclusion of birds protected by Fish & Game Code Section 3503.5 is in recognition of the fact that these birds are substantially less common in California than most other birds, having lost much of their habitat to development, and the recognition that the populations of these species are therefore substantially more vulnerable to further loss of habitat and to interference with nesting and breeding than are most other birds. It is noted that a number of raptors and owls are already specifically listed as threatened or endangered by state and federal wildlife authorities.

***Alameda Whipsnake***

Alameda whipsnake (*Masticophis lateralis euryxanthus*) is listed as threatened under both federal and state law and is generally found in open-canopied shrub communities, including coastal scrub and chaparral, and adjacent habitats including oak woodland/savanna and grassland areas (Swaim 1994). There has never been a reported sighting of Alameda whipsnake on the LBNL hill site or in its vicinity (LBNL 2007). However, recent surveys and studies have shown that Alameda whipsnake can be found in a wider variety of habitats than previously thought. For example, whipsnakes have been found in grasslands with very little scrub present, in coastal scrub with dense canopy cover, and in patches of scrub less than one-half acre in size (Swaim 2003). Therefore, habitat associations for this subspecies should include those that co-occur in the general chaparral/scrub habitat mosaic (Alvarez 2005). These recent findings suggest the possibility that whipsnakes could inhabit, or disperse through, areas of the LBNL site where coastal scrub habitat occurs in a mosaic with other habitat types such as grassland or woodland. Though habitat types and features used by Alameda whipsnakes may vary, home ranges typically are centered on areas of scrub habitats with open to partially open canopy, on south-, southeast-, east-, and southwest-facing slopes. Rock outcrops are important for protection from predators and as habitat for western fence lizards and other prey species (Swaim 1994).

A recent whipsnake habitat assessment of LBNL (Swaim 2006) found that potential whipsnake occurrence would be most likely in the easternmost portion LBNL that is contiguous with open space to the north and east and along the south-facing slopes of Strawberry Canyon. Both of these areas are primarily open space with a mosaic of grassland, coastal scrub, riparian woodland, and stands of non-native trees and provide a potential dispersal corridor from areas identified as critical habitat for the species (USFWS 2006) to areas of coastal scrub with potential suitability for the whipsnake. The 2006 LBNL habitat assessment identified and mapped potential for Alameda whipsnake occurrence based on habitat types present and other factors, including habitat fragmentation and existing land uses. Areas designated as having "highly suitable potential whipsnake habitat" (which include the Helios project site) were those that included relatively large patches of coastal scrub in a mosaic of other habitat types and that were contiguous with larger open space areas and known occupied habitat and/or proposed critical habitat (Swaim 2006; McGinnis 1996). Areas designated as having "potential habitat" were those that contained smaller patches of scrub in a mosaic with other habitat types but where there was also a fairly significant degree of fragmentation and habitat degradation and a lesser degree of contiguity with larger areas of less disturbed potential habitat.

After conducting site visits during the summer of 2000, the USFWS determined that most of the LBNL site, including areas with existing facilities, should be excluded from its final critical habitat listing (USFWS 2000).[5] The 2000 designation of critical habitat was rescinded in 2003 but a new critical habitat designation was proposed in 2005 and adopted in October 2006 that, similar to the 2000 designation, includes the easternmost portion of the LBNL site.[6] This area is designated under the 2006 LRDP as a protected area where no development would be permitted.

The project site is within an area identified as having highly suitable potential habitat for Alameda whipsnake (see **Figure 4.3-2, Sensitive Habitat at LBNL**). A qualified biologist evaluated the suitability of the project site for Alameda whipsnake on June 28, 2007. Some core habitat (i.e., coastal scrub) of the Alameda whipsnake occurs in the southern portion of the project site; this scrub habitat is contiguous with a larger area of coastal scrub that borders large portions of the proposed access road. While large portions of the habitat within the project boundaries are heavily disturbed and do not contain scrub communities often associated with Alameda whipsnake, when considered with nearby habitats, the project site is part of a mosaic of habitats (including coastal scrub, grassland, and woodland) commonly associated with the species. Wastewater Option 1 would occur entirely within paved areas and would not traverse areas that have suitable habitat for Alameda whipsnake. The other two wastewater options would be located within city or campus streets.

***San Francisco Lacewing***

The San Francisco lacewing (*Nothochrysa californica*) is included on the most recent Special Animals List (CDFG 2006). This insect was formerly known throughout the Coast Ranges from Mendocino to Los Angeles but its geographic range is shrinking. This lacewing is known to inhabit coastal scrub and woodland habitat and is known to occur in Strawberry Canyon. The species is active from January through July, but little else is known about the species' biology or habitat preferences (Arnold 1997). Potentially suitable habitat for this species occurs on site within coastal scrub and oak-bay woodland habitats.

---

5 Critical habitat for the Alameda whipsnake was rescinded by court order on May 9, 2003. For the purposes of this analysis, the concept is still relevant in that the designation of critical habitat implies a high likelihood of species' presence where critical habitat elements are found. Even though critical habitat has been rescinded, the species is still fully protected under the FESA. In addition, the USFWS (2002) published a draft recovery plan that includes the species, and areas that were formerly designated as critical habitat units are now designated as recovery units under the plan. Finally, critical habitat for the species was re-proposed in October 2005 (USFWS 2005d) and, as adopted in October 2006 (USFWS 2006), includes the easternmost portion of the Lab site.

6 The adopted critical habitat, while smaller than that proposed in 2005 (155,000 acres adopted, compared to 203,000 acres proposed), includes the same part of the Lab main site as included in the proposed critical habitat. Most of the 48,000 acres excluded from the adopted critical habitat are in eastern Contra Costa County, although smaller areas were excluded in the Easy Bay hills in western Contra Costa and southern Alameda counties.

***Cooper's Hawk***

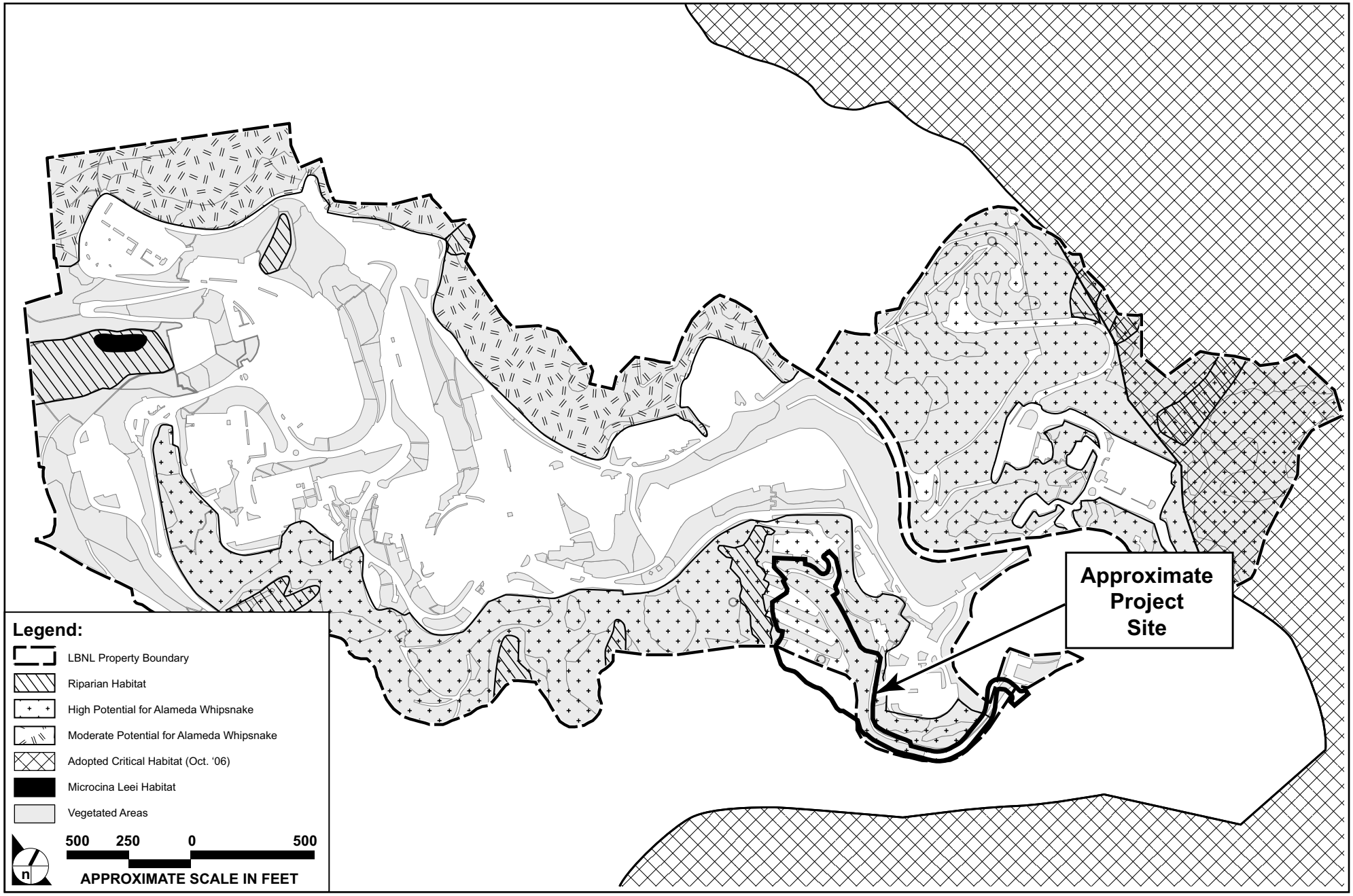
Cooper's hawk (*Accipiter cooperi*) is a California Species of Special Concern. The species ranges over most of North America and may be seen throughout California, most commonly as a winter migrant. Nesting pairs have declined throughout the lower-elevation, more populated parts of the state. Cooper's hawk forages in open woodlands and wooded margins and nests in tall trees, often in riparian areas (Ehrlich et al. 1988; Baicich 1997). This species has been observed foraging at LBNL (ESA 2003b). Coast live oak as well as conifers and eucalyptus on and bordering the project site may provide nesting habitat for the species.

***Great Horned Owl***

Great horned (*Bubo virginianus*) owl does not have any state or federal designation for rarity. However, for the purposes of this report, raptors are considered to be of special-status as they are specifically protected by Fish & Game Code Section 3503.5. Great horned owls occur throughout North America and are found in a variety of wooded habitats. These relatively common large raptors prey on small to medium-sized mammals such as voles, rabbits, skunks, and squirrels. They roost and nest in large trees such as pines or eucalyptus. They often use the abandoned nests of crows, ravens, or sometimes squirrels (Erlich et al. 1988; Sibley 2000). Great horned owls may use large eucalyptus and conifers located on and adjacent to the project site for roosting or nesting and may forage over the grasslands on site for voles and other small mammals.

***Red-Tailed Hawk***

Red-tailed hawk (*Buteo jamaicensis*) does not have any state or federal designation for rarity. However, for the purposes of this report, raptors are considered to be of special-status as they are specifically protected by Fish & Game Code Section 3503.5. Red-tailed hawks are commonly found in woodlands and open country with scattered trees. These large hawks feed primarily on small mammals, but will also prey on other small vertebrates, such as snakes and lizards, as well as on small birds and invertebrates. Red-tailed hawks nest in a variety of trees in woodland and agricultural habitats. Large trees on and adjacent to the project site, including coast live oak, eucalyptus, redwood, and pine, may be used by red-tailed hawks for nesting. This species has been observed foraging at LBNL (ESA 2002a-c; ESA 2003a-c).




**SOURCE:** LBNL - 2006; ESA - 2007; Impact Sciences, Inc. - October 2007

FIGURE **4.3-2**

Sensitive Habitat at LBNL

***Red-Shouldered Hawk***

Red-shouldered hawk (*Buteo lineatus*) does not have any state or federal designation for rarity. However, for the purposes of this report, raptors are considered to be of special-status as they are specifically protected by Fish & Game Code Section 3503.5. Red-shouldered hawks are commonly found in a variety of woodland habitats. These small hawks feed primarily on small mammals and some reptiles and amphibians. Large trees on and adjacent to the project site, including coast live oak, eucalyptus, redwood, and pine, may be used by red-shouldered hawks for nesting.

***Olive-Sided Flycatcher***

Olive-sided flycatcher (*Contopus cooperi*) is a federal Bird of Conservation Concern. The species frequents a variety of forest and woodland habitats throughout most of California. Preferred nesting habitat includes coniferous and mixed hardwood-conifer forests. The species forages for insects over the forest canopy or adjacent grasslands and prefers tall conifers for both nesting and roosting. These flycatchers will often use the tallest trees in a locale for singing posts and hunting perches. Olive-sided flycatcher may make use the tall conifers and grasslands on and adjacent to the project site for nesting and foraging.

***American Kestrel***

American kestrel (*Falco sparverius*) does not have any state or federal designation for rarity. However, for the purposes of this report, raptors are considered to be of special-status as they are specifically protected by Fish & Game Code Section 3503.5. This small member of the falcon family preys on small birds, small mammals, lizards, and insects. The kestrel is most common in open habitats, such as grasslands or pastures. This relatively common species has been observed foraging in grassland habitat at LBNL (ESA 2003b). American kestrels usually nest in tree cavities (Sibley 2001; Erlich et al. 1988) and the coast live oak and other trees on and adjacent to the project site may provide this species with nesting habitat.

***Allen's Hummingbird***

Allen's hummingbird (*Salasphorus sasin*) is included on the most recent Special Animals List (CDFG 2006). This species inhabits chaparral, scrub, riparian, and woodland habitats that support nectar-producing plants. Insects and spiders are consumed as well. Potentially suitable nesting habitat for this species is present on and adjacent to the project site.

***California Thrasher***

California thrasher (*Toxostoma redivivum*) is included on the most recent Special Animals List (CDFG 2006). This species is a resident of moderate to dense chaparral and scrub habitats throughout California. Riparian thickets also may provide nesting habitat. This species rarely strays far from dense shrub cover during forays for terrestrial invertebrates and seeds. Shrub cover is also important for protection of the nest from predators such as domestic cats, skunks, and scrub jays. Potentially suitable nesting habitat for this species is present on and adjacent to the project site.

***Pallid Bat***

Pallid bat (*Antrozous pallidus*) is a California Species of Special Concern. This species is found from Mexico north through Oregon and Washington into Canada, in a variety of habitats. Roosting occurs in deep crevices on rock faces, buildings, bridges and tree hollows (especially oaks). Pallid bat prey both aerially and terrestrially, on species such as Jerusalem crickets, moths, grasshoppers, June beetles and scorpions. Oak and other trees species trees occurring on or adjacent to the project site, as well as the equipment storage shed and Building 73, provide potentially suitable roosting habitat for this species.

***Long-eared Myotis***

Long-eared myotis (*Myotis evotis*) is included on the most recent Special Animals List (CDFG 2006). This species inhabits nearly all types of brushlands, woodlands, and forests, but may show a preference for coniferous forests and woodlands. Roosts include caves, buildings, snags, and crevices in tree bark. Caves provide night roosts. This species is highly maneuverable in its forays for arthropods over water, open terrain, and in habitat edges. The redwood grove, eucalyptus trees, and oak-bay woodland habitat on and adjacent to the project site, as well as the equipment storage shed and Building 73 may provide potential roosting habitat for long-eared myotis.

***Fringed Myotis***

Fringed myotis (*Myotis thysanodes*) is included on the most recent Special Animals List (CDFG 2006). This species occurs throughout California and is most frequent in coastal and montane forests and near mountain meadows (Jameson and Peeters 1988). This species uses echolocation to find moths, beetles, and other prey and forms nursery colonies in caves and old buildings (Jameson and Peeters 1988). Fringed myotis often use separate day and night roosts. The redwood grove, eucalyptus trees, and oak-bay woodland habitat on and adjacent to the project site, as well as the equipment storage shed and Building 73 may provide potential roosting habitat for fringed myotis.

**Special-Status Plant Species**

A thorough review and analysis of special-status plant species, listed by the USFWS (2005), CDFG (2005; 2007), and CNPS (2005; 2007) databases as occurring in the project vicinity, indicate that the likelihood of adverse project impacts for most of the species listed is extremely low for the following reasons:

- Suitable habitat for the species either never existed on the project site or no longer exists due to historical and ongoing disturbance of soils and vegetation.
- The species is not documented within the general vicinity of the project site (i.e., the western side of the Oakland-Berkeley hills).
- Only historical occurrences for the species are documented from the area; or
- The species has been extirpated from the quadrangle or county.

Generally, the potential for special-status plant species to occur at LBNL is low; none have been observed in past environmental studies for LBNL, and none were observed during recent general biological resource surveys (ESA 2002a-c; 2003a-c). LBNL has been subject to ongoing disturbance, first in the form of grazing and then in the form of development, for the past 200 years. These types of disturbance, combined with the introduction of highly competitive non-native plant species, have resulted in the extirpation of a number of plant species that were documented in the Berkeley area in the late 1800s and early 1900s. LBNL aggressively manages vegetation on virtually the entire hill site for fire protection. Therefore, both coastal scrub habitat and stands of eucalyptus and French broom have converted to grassland in recent years. Although small areas of patchily distributed native grasses remain scattered throughout LBNL, the native herbaceous species observed in these areas are those that are commonly found throughout the Oakland-Berkeley hills (ESA 2002a-c; 2003a-c). Generally, rarer species in the hills tend to be found on serpentine or other ultramafic soils or on thin soils, such as occur in road cuts, where non-native species do not compete as readily. These types of soils were not observed at LBNL during ESA's field surveys.

However, the following grassland, coastal scrub, and woodland species were determined to have some potential to occur to occur on the LBNL site given the presence of some suitable habitat: (1) big-scale balsamroot, (2) Diablo helianthella, (3) large-flowered leptosiphon, (4) Oregon meconella, and (5) robust monardella. The listing status, habitat requirements, and blooming period of these species are summarized in **Table 4.3-1**.

Focused surveys during the peak blooming period (i.e., spring, early summer) for special-status plant species have not been conducted on the Helios Energy Research Facility project site. However, a floristic inventory was conducted by Pacific Biology on June 28, 2007, which included a site-specific evaluation of

the suitability of on-site habitats on the main project site for special-status plant species. No special-status plant species were observed and a list of all common plant species identified is included in **Appendix 4.3**. It was concluded that it is highly unlikely that any special-status plant species occur on the main project site based on the generally disturbed condition and types of habitats present (see **Plant Communities**). In addition, many of the target special-status plant species (i.e., big-scale balsamroot, Diablo helianthella, and robust monardella) would have been visible and identifiable at the time of the survey if present, due to their large size and persistence after flowering. The two remaining species – large-flowered leptosiphon and Oregon meconella – are smaller annual species. Large flowered leptosiphon is associated with sandy soils. In general, the soils on the site are loamy and it is highly unlikely the species would occur. Oregon meconella is typically associated with openings in shaded or wooded canyons. There were no such habitats on the site so it is also highly unlikely the species would occur. Wastewater Option 1 would occur entirely in paved areas and would not affect plant species, and the other two wastewater options would be located within city or UC Berkeley streets where such habitats are not present.

**Sensitive Plant Communities**

The California Department of Fish and Game (CDFG) Wildlife and Habitat Data Analysis Branch has developed a *List of California Terrestrial Natural Communities* (CDFG 2003). The most recent version of this list, dated September 2003, is derived from the CNDDB and is intended to supersede all other lists developed from the CNDDB. It is based on the detailed classification put forth in *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995). It is also structured to be compatible with previous CNDDB lists (e.g., Holland 1986).

The primary purpose of the CNDDB classification is to assist in the characterization of the rarity of various vegetation types. For the purposes of this analysis, plant communities denoted on the list as "high priority for inventory in CNDDB" in the September 2003 version are considered to be "sensitive." Based on this classification, the freshwater seep may be considered a sensitive plant community as it supports willow scrub vegetation. This plant community was discussed in detail earlier in this section (see ***Plant Communities and Wildlife Habitat***) and its location on the project site is shown in **Figure 4.3-1** and **Figure 4.3-2**.

**Sensitive Habitat**

The following habitats on the LBNL site are considered to be sensitive: (1) known habitat of Lee's micro-blind harvestman (*Microcina leei*); (2) potential Alameda whipsnake habitat; (3) Critical Alameda

whipsnake habitat, as adopted by USFWS in October 2006; and (4) riparian and wetland habitat that is potentially jurisdictional under federal or state law.

The location of the project site relative to these sensitive habitats is shown in **Figure 4.3-2**. As shown, the project site and borrow area are located entirely within a sensitive habitat area identified as having "highly suitable potential habitat for Alameda whipsnake." Please see ***Special-Status Wildlife***, above, for further discussion of the potential use of the project site by Alameda whipsnake. Additionally, the freshwater seep is potentially jurisdictional under federal and state law and is therefore considered to be a sensitive habitat. The project site is also located near riparian habitat associated with Chicken Creek. Please see ***Nearby Plant Communities*** for further discussion of Chicken Creek and associated riparian habitat.

**Waters of the United States and Waters of the State**

Wetlands, creeks, streams, and permanent and intermittent drainages are generally subject to the jurisdiction of the Army Corps of Engineers (ACOE) under Section 404 of the Federal Clean Water Act. The CDFG generally has jurisdiction over these resources, as well as other aquatic features that provide an existing fish and wildlife resource pursuant to Sections 1602-1603 of the California Fish and Game Code. The CDFG asserts jurisdiction to the edge of any riparian-associated vegetation.

Given the presence of wetland associated vegetation and standing water, the freshwater seep may be under the jurisdiction of ACOE pursuant to Section 404 of the Clean Water Act. However, the ACOE may consider the seep to be a "man-made" wetland and not to be jurisdictional as it would not likely exist in the absence of the installed hydraugers. A formal wetland delineation and its verification by the ACOE would be required to determine the extent of ACOE jurisdiction over the seep. Nonetheless, for the purposes of this EIR, the seep is considered as being potentially under the jurisdiction of the ACOE. The freshwater seep may also be under the jurisdiction of the CDFG pursuant to Section 1602 of the California Fish and Game Code as it supports wetland and riparian associated vegetation and water flow from the hydrauger outlet pipes has created a narrow channel within portions of the seep.

Chicken Creek, which is located near the project site, but outside of the project boundaries, is expected to be under ACOE and CDFG jurisdiction pursuant to Section 404 of the Federal Clean Water Act and Section 1602 of the California Fish and Game Code.

## 4.3.3 Regulatory Considerations

### *Federal and State Laws and Regulations*

**Federal Endangered Species Act**

Under the Federal Endangered Species Act (FESA), the Secretary of the Interior and the Secretary of Commerce have joint authority to list a species as threatened or endangered (16 United States Code [USC] 1533[c]). Pursuant to the requirements of the FESA, an agency reviewing a proposed project within its jurisdiction must determine whether any federally listed or proposed species may be present in the project region, and whether the proposed project would result in a "take"[7] of such species. The "take" provision of the FESA applies to actions that would result in injury, death, or harassment of a single member of a species protected under the Act. In addition, the agency is required to determine whether the project is likely to jeopardize the continued existence of any species proposed to be listed under the FESA, or result in the destruction or adverse modification of critical habitat for such species (16 USC 1536[3][4]). If it is determined that a project may result in the "take" of a federally-listed species, a permit from the USFWS would be required under Section 7 or Section 10 of the federal Endangered Species Act. Section 7 applies if there is a federal nexus (e.g., the project is on federal land, the lead agency is a federal entity, a permit is required from a federal agency, or federal funds are being used). Section 10 applies if there is no federal nexus.

Substantial, adverse project-related impacts to FESA-listed species or their habitats would be considered significant in this EIR. Proposed species are granted limited protection under the Act and must be addressed in Biological Assessments (under Section 7 of the Act); proposed species otherwise have no protection from "take" under federal law, unless they are emergency-listed species. Candidate species are afforded no protection under the Act. However, the USFWS recommends that candidate species and species proposed for listing also be considered in informal consultation during a project's environmental review.

7 "Take," as applied in Section 9 of the FESA, means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect or to attempt to engage in any such conduct." "Harass" is further defined by the USFWS (50 C.F.R. § 17.3) as an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, and sheltering. "Harm" is defined as "an act which actually kills or injures wildlife." This may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

**Clean Water Act**

The Federal Water Pollution Control Act of 1972, often referred to as the Clean Water Act, is the nation's primary law for regulating discharges of pollutants into waters of the United States. The objective of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The regulations adopted pursuant to the Act deal extensively with the permitting of actions in waters of the United States, including wetlands. The Act's statutory sections and implementing regulations provide more specific protection for riparian and wetland habitats than any other federal law. The U.S. Environmental Protection Agency (EPA) has primary authority under the Clean Water Act to set standards for water quality and for effluents, but the ACOE has primary responsibility for permitting the discharge of dredge or fill materials into streams, rivers, and wetlands.

**Migratory Bird Treaty Act**

The federal Migratory Bird Treaty Act (16 USC, Section 703, Supplement I, 1989) prohibits killing, possessing, or trading in migratory birds, except in accordance with regulations prescribed by the Secretary of the Interior. The Act encompasses whole birds, parts of birds, and bird nests and eggs.[8]

**California Endangered Species Act**

Under the California Endangered Species Act (CESA), the CDFG has the responsibility for maintaining a list of threatened and endangered species (California Fish and Game Code Section 2070). The CDFG also maintains a list of "candidate species," which are species formally under review for addition to either the list of endangered species or the list of threatened species. In addition, the CDFG maintains lists of "species of special concern," which serve as watch lists. Pursuant to the requirements of the CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any state-listed endangered or threatened species could be present on the project site and determine whether the proposed project could have a potentially significant impact on such species. In addition, the CDFG encourages informal consultation on any proposed project that may affect a candidate species. Project-related impacts to species on the CESA endangered or threatened lists would be considered significant in this EIR. Impacts to "species of concern" would be considered significant if the species met the criteria set forth under *CEQA Guidelines* Section 15380, or if the species were also protected under any of the other statutes or policies discussed in this section.

8 The act covers hundreds of birds, including varieties of loon, grebe, albatross, booby. pelican, cormorant, heron, stork, swan, goose, duck, vulture, eagle, hawk, falcon, fail, plover, avocet, sandpiper, phalarope, gull, tern, murre, puffin, dove, cuckoo, roadrunner, owl, swift, hummingbird, kingfisher, woodpecker, swallow, jay, magpie, crow, wren, thrush, mockingbird, vireo, warbler, cardinal, sparrow, blackbird, finch, and many others.

**California Native Plant Protection Act**

State listing of plant species began in 1977 with the passage of the California Native Plant Protection Act (NPPA), which directed the CDFG to carry out the legislature's intent to "preserve, protect, and enhance endangered plants in this state." The NPPA gave the California Fish and Game Commission the power to designate native plants as endangered or rare and to require permits for collecting, transporting, or selling such plants. The CESA expanded upon the original NPPA and enhanced legal protection for plants. The CESA established threatened and endangered species categories, and grandfathered all rare animals—but not rare plants—into the Act as threatened species. Thus, there are three listing categories for plants in California: rare, threatened, and endangered.

**California Fish and Game Code**

The California Fish and Game Code provides a variety of protections for species that are not federally or state-listed as threatened, endangered, or of special concern.

- Section 3503 protects all breeding native bird species in California by prohibiting the take,9 possession, or needless destruction of nests and eggs of any bird, with the exception of non-native English sparrows and European starlings (Section 3801).
- Section 3503.5 protects all birds of prey (in the orders Falconiformes and Strigiformes) by prohibiting the take, possession, or killing of raptors and owls, their nests, and their eggs.
- Section 3513 of the code prohibits the take or possession of migratory nongame birds as designated in the Migratory Bird Treaty Act or any parts of such birds except in accordance with regulations prescribed by the Secretary of the Interior.
- Section 3800 of the code prohibits the taking of nongame birds, which are defined as birds occurring naturally in California that are not game birds or fully protected species.
- Section 3511 (birds), Section 5050 (reptiles and amphibians), and Section 4700 (mammals) designate certain wildlife species as fully protected in California.

## *Local Plans and Policies*

The proposed project would be located at LBNL, which is operated by the University of California and conducts work within the University's mission on land that is owned or controlled by The Regents of the University of California. As a state entity, the University is exempted by the state constitution from compliance with local land use regulations, including general plans and zoning. However, the University seeks to cooperate with local jurisdictions to reduce any physical consequences of potential land use

9 "Take" in this context is defined in Section 86 of the California Fish and Game Code as to "hunt, pursue, catch, capture, or kill, or to attempt to hunt, pursue, catch, capture, or kill."

conflicts to the extent feasible. LBNL is located in both the city of Berkeley and the city of Oakland. The following sections summarize objectives and policies from the LBNL 2006 LRDP and LBNL Design Guidelines, and other local plans that relate to biological resources. Policies in the City of Berkeley and City of Oakland General Plans related to biological resources are listed in **Appendix 4.3**.

**2006 LRDP Principles and Strategies**[10]

The 2006 LRDP proposes four fundamental principles that form the basis for the Plan's development strategies provided for each element of the Plan. The one principle most applicable to the biological aspect of new development is to "Preserve and enhance the environmental qualities of the site as a model of resource conservation and environmental stewardship."

Development strategies provided by the 2006 LRDP are intended to minimize potential environmental impacts that could result from implementation of the 2006 LRDP. Development strategies set forth in the 2006 LRDP applicable to biological resources include the following:

- Protect and enhance the site's natural and visual resources, including native habitats, riparian areas, and mature tree stands by focusing future development primarily within the already developed areas of the site.
- Continue to use sustainable practices in selection of plant materials and maintenance procedures.
- Develop all new landscape improvements in accordance with the Laboratory's vegetation management program to minimize the threat of wildland fire damage to facilities and personnel.
- Utilize native, drought-tolerant plant materials to reduce water consumption; focus shade trees and ornamental plantings at special outdoor use areas.

**LBNL Design Guidelines**

The LBNL Design Guidelines were developed in parallel with the 2006 LRDP and were adopted by the Lab following The Regents' approval of the 2006 LRDP. The LBNL Design Guidelines provide specific guidelines for site planning, landscape and building design as a means to implement the 2006 LRDP's development principles as each new project is developed. The LBNL Design Guidelines provide the following specific planning and design guidance relevant to the biological resources related aspects of new development to achieve these design objectives:

10 While this Environmental Impact Report presents a "stand alone" impact analysis that does not rely upon tiering from any programmatic CEQA document, Berkeley Lab does actively follow the 2006 Long Range Development Plan (LRDP) as a planning guide for Lab development. Accordingly, relevant 2006 LRDP principles, strategies, and design guidelines are identified in this section.

- Projects or portions of projects which fall within the Rustic Landscape zones identified on the LRDP Landscape Framework Map shall provide new plantings consistent with this zone.
- Projects or portions of projects which fall within the Rustic Riparian Landscape zones identified on the LRDP Landscape Framework Map shall provide new plantings consistent with this zone.
- Projects or portions of projects which fall within the Ornamental Landscape zones identified on the LRDP Landscape Framework Map shall provide new plantings consistent with this zone.
- Minimize impacts of disturbed slopes.
- Create a cohesive identity across the Lab as a whole by following established precedents for new landscape elements.
- Minimize further increases in impermeable surfaces at the Lab.

**UC Berkeley Strawberry Creek Management Plan**

The Strawberry Creek Management Plan was originally prepared in 1987. The streams that dissect LBNL's slopes represent a significant portion of the upper Strawberry Creek watershed. The plan contains recommendations on best management practices for the Strawberry Creek watershed to control nonpoint-source pollution and reduce degradation of water quality. LBNL's has its own best management practices related to non-point-source pollution and reduction of degradation of water quality.

**UC Berkeley Management Plan for Strawberry and Claremont Canyons**

As outlined in the UC Berkeley 2020 LRDP policy, "Manage the Hill Campus Landscape to Reduce Fire and Flood Risk and Restore Native Vegetation and Hydrology Patterns," UC Berkeley maintains an ongoing program of fire fuel management in the hill area adjacent to LBNL. While the treatment used in a given area is customized to address its specific conditions, including vegetation type, access, and proximity to roads and structures, in general the treatments are designed to meet one or more of the following goals:

- Reducing fuel load by removing dead material, reducing plant density, and favoring species with lower fuel content,
- Reducing horizontal spread by reducing fine fuel material and by separating dense clusters of vegetation with areas of lower fuel load, and
- Reducing vertical fire spread by increasing separation of understory and crown fuels.

Whenever feasible, campus fuel management projects include the selective replacement of high-hazard introduced species with native species: for example, the restoration of native grassland and oak-bay

woodland through the eradication of invasive exotics (broom, acacia, pampas grass) and the replacement of aged Monterey pines and second growth eucalyptus.

## 4.3.4 Impacts and Mitigation Measures

### *Significance Criteria*

The impact of the proposed project on biological resources would be considered significant if it would exceed the following Standards of Significance, in accordance with Appendix G of the *CEQA Guidelines* and the UC CEQA Handbook:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFG or USFWS;
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by CDFG or USFWS;
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan; or
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

### *Issues Not Discussed Further*

The Helios project Initial Study found less than significant impacts to the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites. The project site is located near developed areas and is not part of an established wildlife movement corridor or a native wildlife nursery site. Additionally, the Initial Study found no impacts related to conflicts with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan because No Habitat Conservation Plans or Natural Community Conservations Plans have been adopted that encompass the project area. These issues are not discussed further in this section.

## *Mitigation Measures included in the Proposed Project*

The following mitigation measures, adopted as part of the 2006 LRDP, are required by the LRDP for the proposed project and are thus included as part of the proposed project. The analysis presented below evaluates environmental impacts that would result from project implementation following the application of these mitigation measures. These mitigation measures that are included in the project would be monitored pursuant to the Mitigation Monitoring and Reporting Plan that will be adopted for the proposed project.

**LRDP MM BIO-2a:** Future development under the 2006 LRDP shall avoid, to the extent feasible, the fill of potentially jurisdictional waters. Therefore, during the design phase of any future development project that may affect potentially jurisdictional waters, a preliminary evaluation of the project site shall be made by a qualified biologist to determine if the site is proximate to potentially jurisdictional waters and, if deemed necessary by the biologist, a wetlands delineation shall be prepared and submitted to the Corps for verification. Most development projected under the 2006 LRDP would have no potential for impacts on jurisdictional waters. However, development in specific locations including Buildings S-2 and S-0, as well as Parking Structures and Lots PS-1 and PL-9 and Roads R-2 and R-5, could require fill of or create the potential for accidental discharges to jurisdictional waters. It should be noted that the preferable form of mitigation recommended by the Corps is avoidance of jurisdictional waters. To the extent practicable, new development under the 2006 LRDP shall be located so as to avoid the fill of jurisdictional waters.

**LRDP MM BIO-2b:** Any unavoidable loss of jurisdictional waters shall be compensated for through the development and implementation of a project-specific Wetlands Mitigation Plan. In the event that potential impacts to streams resulting from a 2006 LRDP development project are identified, compensation for loss of jurisdictional waters would be based on the Corps-verified wetlands delineation identified in Mitigation Measure BIO-2a. During the permit application process for specific development project(s) with identified impacts on jurisdictional drainages or wetlands, LBNL would consult with the Corps, CDFG, and Regional Water Quality Control Board regarding the most appropriate assessment and mitigation methods to adequately address losses to wetland function that could occur as a result of the development project(s). A project-specific wetland mitigation plan would be developed prior to project implementation and submitted to permitting agencies for their approval. The plan may include one or more of the following mitigation options: restoration, rehabilitation, or enhancement of drainages and wetlands in on-site areas that remain unaffected by grading and project development or off-site at one or more suitable locations within the project region; creation of on-site or off-site drainages or wetlands at a minimum of a 1:1 functional equivalency or acreage ratio (as verified by the Corps); purchase of credits in an authorized mitigation bank acceptable to the Corps and CDFG; contributions in support of restoration and enhancement programs located within the project region (such as those operated by local non-

profit organizations including the Friends of Strawberry Creek, the Urban Creeks Council, or the Waterways Restoration Institute); or other options approved by the appropriate regulatory agency at the time of the specific project approval.

All mitigation work proposed in existing wetlands or drainages on- or off-site shall be authorized by applicable permits.

**LRDP MM BIO-2c:** To the extent feasible, construction projects that might affect jurisdictional drainages and/or wetlands could be scheduled for dry-weather months.

Avoiding ground-disturbing activities during the rainy season would further decrease the potential risk of construction-related discharges to jurisdictional waters.

**LRDP MM BIO-3:** Direct disturbance, including tree and shrub removal or nest destruction by any other means, or indirect disturbance (e.g., noise, increased human activity in area) of active nests of raptors and other special-status bird species (as listed in Table IV.C-1)[11] within or in the vicinity of the proposed footprint of a future development project shall be avoided in accordance with the following procedures for Pre-Construction Special-Status Avian Surveys and Subsequent Actions. No more than two weeks in advance of any tree or shrub removal or demolition or construction activity involving particularly noisy or intrusive activities (such as concrete breaking) that will commence during the breeding season (February 1 through July 31), a qualified wildlife biologist shall conduct pre-construction surveys of all potential special-status bird nesting habitat in the vicinity of the planned activity and, depending on the survey findings, the following actions shall be taken to avoid potential adverse effects on special-status nesting birds:

1. Pre-construction surveys are not required for demolition or construction activities scheduled to occur during the non-breeding season (August 1 through January 31).

2. If pre-construction surveys indicate that no nests of special-status birds are present or that nests are inactive or potential habitat is unoccupied, no further mitigation is required.

3. If active nests of special-status birds are found during the surveys, a no-disturbance buffer zone will be created around active nests during the breeding season or until a qualified biologist determines that all young have fledged. The size of the buffer zones and types of construction activities restricted within them will be determined through consultation with the CDFG, taking into account factors such as the following:

[11] Refers to 2006 LRDP EIR.

a. Noise and human disturbance levels at the project site and the nesting site at the time of the survey and the noise and disturbance expected during the construction activity;

b. Distance and amount of vegetation or other screening between the project site and the nest; and

c. Sensitivity of individual nesting species and behaviors of the nesting birds.

4. Noisy demolition or construction activities as described above (or activities producing similar substantial increases in noise and activity levels in the vicinity) commencing during the non-breeding season and continuing into the breeding season do not require surveys (as it is assumed that any breeding birds taking up nests would be acclimated to project-related activities already under way). However, if trees and shrubs are to be removed during the breeding season, the trees and shrubs will be surveyed for nests prior to their removal, according to the survey and protective action guidelines 3a through 3c, above.

5. Nests initiated during demolition or construction activities would be presumed to be unaffected by the activity, and a buffer zone around such nests would not be necessary.

6. Destruction of active nests of special-status birds and overt interference with nesting activities of special-status birds shall be prohibited.

7. The noise control procedures for maximum noise, equipment, and operations identified in **Section 4.9, Noise**, of this EIR[12] shall be implemented.

**LRDP MM BIO-4:** Project implementation under the 2006 LRDP shall avoid disturbance to the maternity roosts of special-status bats during the breeding season in accordance with the following procedures for Pre-Construction Special-Status Bat Surveys and Subsequent Actions. No more than two weeks in advance of any demolition or construction activity involving concrete breaking or similarly noisy or intrusive activities, that would commence during the breeding season (March 1 through August 31), a qualified bat biologist, acceptable to the CDFG, shall conduct pre-demolition surveys of all potential special-status bat breeding habitat in the vicinity of the planned activity. Depending on the survey findings, the following actions shall be taken to avoid potential adverse effects on breeding special-status bats:

1. If active roosts are identified during pre-construction surveys, a no-disturbance buffer will be created by the qualified bat biologist, in consultation with the CDFG, around active roosts during the breeding

12 Refers to 2006 LRDP EIR.

season. The size of the buffer will take into account factors such as the following:

a. Noise and human disturbance levels at the project site and the roost site at the time of the survey and the noise and disturbance expected during the construction activity;

b. Distance and amount of vegetation or other screening between the project site and the roost; and

c. Sensitivity of individual nesting species and the behaviors of the bats.

2. If pre-construction surveys indicate that no roosts of special-status bats are present, or that roosts are inactive or potential habitat is unoccupied, no further mitigation is required.

3. Pre-construction surveys are not required for demolition or construction activities scheduled to occur during the non-breeding season (September 1 through February 28).

4. Noisy demolition or construction activities as described above (or activities producing similar substantial increases in noise and activity levels in the vicinity) commencing during the non-breeding season and continuing into the breeding season do not require surveys (as it is assumed that any bats taking up roosts would be acclimated to project-related activities already under way). However, if trees are to be removed during the breeding season, the trees would be surveyed for roosts prior to their removal, according to the survey and protective action guidelines 1a through 1c, above.

5. Bat roosts initiated during demolition or construction activities are presumed to be unaffected by the activity, and a buffer is not necessary.

6. Destruction of roosts of special-status bats and overt interference with roosting activities of special-status bats shall be prohibited.

7. The noise control procedures for maximum noise, equipment, and operations identified in **Section 4.9, Noise**, of this EIR[13] shall be implemented.

**LRDP MM BIO-5a:** With the approval of the USFWS on a case-by-case basis, relocate any snake encountered during construction that is at risk of harassment; cease construction activity until the snake is moved to suitable refugium. Alternatively, submit a general protocol for relocation to the USFWS for approval prior to project implementation.

13 Refers to 2006 LRDP EIR.

**LRDP MM BIO-5b:** Conduct focused pre-construction surveys for the Alameda whipsnake at all project sites within or directly adjacent to areas mapped as having high potential for whipsnake occurrence. Project sites within high potential areas shall be fenced to exclude snakes prior to project implementation. This would not include ongoing and non-site specific activities such as fuel management.

Methods for pre-construction surveys, burrow excavation, and site fencing shall be developed prior to implementation of any project located within or adjacent to areas mapped as having high potential for whipsnake occurrence. Such methods would be developed in consultation or with approval of USFWS for any development taking place in USFWS officially designated Alameda whipsnake critical habitat. Pre-construction surveys of such project sites shall be carried out by a permitted biologist familiar with whipsnake identification and ecology (Swaim 2002). These are not intended to be protocol-level surveys but designed to clear an area so that individual whipsnakes are not present within a given area prior to initiation of construction.At sites where the project footprint would not be contained entirely within an existing developed area footprint and natural vegetated areas would be disturbed, any existing animal burrows shall be carefully hand-excavated to ensure that there are no whipsnakes within the project footprint.Any whipsnakes found during these surveys shall be relocated according to the Alameda Whipsnake Relocation Plan. Snakes of any other species found during these surveys shall also be relocated out of the project area. Once the site is cleared it shall then be fenced in such a way as to exclude snakes for the duration of the project. Fencing shall be maintained intact throughout the duration of the project.

**LRDP MM BIO-5c:** A full-time designated monitor shall be employed at project sites that are within or directly adjacent to areas designated as having high potential for whipsnake occurrence, or (2) Daily site surveys for Alameda whipsnake shall be carried out by a designated monitor at construction sites within or adjacent to areas designated as having moderate potential for whipsnake occurrence.

Each morning, prior to initiating excavation, construction, or vehicle operation at sites identified as having moderate or high potential for whipsnake occurrence, the project area of applicable construction sites shall be surveyed by a designated monitor trained in Alameda whipsnake identification to ensure that no Alameda whipsnakes are present. This survey is not intended to be a protocol-level survey. All laydown and deposition areas, as well as other areas that might conceal or shelter snakes or other animals, shall be inspected each morning by the designated monitor to ensure that Alameda whipsnakes are not present. At sites in high potential areas the monitor shall remain on-site during construction hours. At sites in moderate potential areas the monitor shall remain on-call during construction hours in the event that a snake is found on-site. The designated monitor shall have the authority to halt construction activities in the event that a whipsnake is found within the construction footprint until such time as threatening activities can be eliminated in the vicinity of the snake and it can be removed from the site by a biologist permitted to handle Alameda whipsnakes. The USFWS shall be notified within 24 hours of any such event.

**LRDP MM BIO-5d:** Alameda whipsnake awareness and relevant environmental sensitivity training for each worker shall be conducted by the designated monitor prior to commencement of on-site activities. All on-site workers at applicable construction sites shall attend an Alameda whipsnake information session conducted by the designated monitor prior to beginning work. This session shall cover identification of the species and procedures to be followed if an individual is found on-site, as well as basic site rules meant to protect biological resources, such as speed limits and daily trash pickup.

**LRDP MM BIO-5e:** Hours of operation and speed limits shall be instituted and posted. All construction activities that take place on the ground (as opposed to within buildings) at applicable construction sites shall be performed during daylight hours, or with suitable lighting so that snakes can be seen. Vehicle speed on the construction site shall not exceed 5 miles per hour.

**LRDP MM BIO-5f:** Site vegetation management shall take place prior to tree removal, grading, excavation, or other construction activities. Construction materials, soil, construction debris, or other material shall be deposited only on areas where vegetation has been mowed.

Areas where development is proposed under the 2006 LRDP are subject to annual vegetation management involving the close-cropping of all grasses and ground covers; this management activity would be performed prior to initiating project-specific construction. Areas would be re-mowed if grass or other vegetation on the project site becomes high enough to conceal whipsnakes during the construction period. In areas not subject to annual vegetation management, dense vegetation would be removed prior to the onset of grading or the use of any heavy machinery, using goats, manual brush cutters, or a combination thereof.

**LRDP MM BIO-6a:** Floristic surveys for special-status plants shall be conducted at specific project sites where suitable habitat is present. Floristic surveys shall also be conducted in designated Perimeter Open Space. All occurrences of special-status plant populations, if any, shall be mapped.

Although no special-status plants have been observed at LBNL during past biological resource surveys, the distribution and size of plant populations often vary from year to year, depending on climatic conditions. Therefore, a baseline survey of all non-developed areas, including the designated Perimeter Open Space areas, where there is potential for future development or vegetation management activities, should be conducted in accordance with USFWS and CDFG guidelines by a qualified botanist during the period of identification for all special-status plants. During this initial survey, any special-status plant populations found, as well as areas with high potential for supporting special-status plants (i.e., less disturbed areas, rock outcrops and other areas of thin soils, areas supporting a relatively high proportion of native plant species) would be identified and mapped. Thereafter, surveys of Perimeter Open Space areas where ongoing vegetation management (i.e., active vegetation removal to

minimize potential wildland fire damage to facilities and personnel) activities would be undertaken, and that are mapped as supporting or having potential to support special-status plant species, would be conducted in April and June every five years.

In those proposed LRDP development sites where suitable habitat is present for special status species identified as having a moderate to high potential for occurrence (see Table IV.C-1, p. IV.C-10),[14] protocol-level rare plant surveys would be conducted prior to construction. Surveys should be conducted during the periods of identification for all species under consideration at each applicable development site, the timing and scope to be directed by a qualified botanist. During the initial survey, any special-status plant populations found, as well as all areas with high potential for supporting special-status plants (i.e., less disturbed areas, rock outcrops and other areas of thin soils, areas supporting a relatively high proportion of native plant species) would be identified and mapped.

**LRDP MM BIO-6b:** Seeds or cuttings shall be collected from sensitive plant species found within developable areas and open space and at risk of being any adversely affected, or sensitive plants found in these areas shall be transplanted.

If special-status plants are found during floristic surveys and are at risk of being adversely affected, a qualified botanist working in conjunction with an expert in native plant horticulture, CNPS, and CDFG, would collect seeds, bulbs, and cuttings for propagation and planting in specific project revegetation efforts as well as restoration of native habitat within designated Open Space. Perennial species could be transplanted, if found in undeveloped locations that have a high likelihood for future development. Due to its unreliability, translocation alone should not be relied upon as a sole means of mitigation; however, healthy individuals of any special-status plant species should be transplanted to areas of suitable habitat that are protected in perpetuity. The relocation sites may be located either on or off the LBNL hill-site. If the areas for transplanting are located off-site, they should be within a 20-mile radius of the project site. Plants should be relocated to areas with ecological conditions (slope, aspect, microclimate, soil moisture, etc.) as similar to those in which they were found as possible. Existing plants could also be held in containers for specific post-project revegetation efforts on-site.

A portion of the project site is on UC Berkeley land. Therefore, for tree removal impacts, LBNL has incorporated the following measure from the UC Berkeley 2020 LRDP EIR pertaining to specimen trees into the proposed project.

**Continuing Best Practice BIO-1-a:** UC Berkeley will continue to implement the Campus Specimen Tree Program to reduce adverse effects to specimen trees and

[14] Refers to 2006 LRDP EIR.

flora. Replacement landscaping will be provided where specimen resources are adversely affected, either through salvage and relocation of existing trees and shrubs or through new plantings of the same genetic strain, as directed by the Campus Landscape Architect.

## *Project Impacts and Mitigation Measures*

**Helios Impact BIO-1: Construction of the proposed project would result in the permanent removal of 4.01 acres of vegetation. (*Potentially Significant; Less than Significant with Mitigation*)**

Project-related excavation, grading, and construction activities would result in the removal of 4.01 acres of vegetation, including 0.12 acre of bay-oak woodland, 0.27 acre of coastal scrub, 3.14 acres of non-native grassland, 0.20 acre of a redwood grove, and 0.17 acre of conifer stands. The proposed would also result in filling of the 0.11-acre freshwater seep; impacts to this potentially jurisdictional resource are analyzed below in Helios Impact BIO-2. All three wastewater options would be constructed within paved road right-of-way areas or in already developed or disturbed areas where sensitive habitats are not present. Therefore, there would be no impacts on vegetation or other biological resources from any of the wastewater options.

As part of the proposed project, Environmentally Sensitive Area (ESA) fencing would be installed along the riparian areas and any other sensitive areas to ensure that construction activities do not inadvertently affect these areas. The root systems of all large oak trees that would not be removed in conjunction with the project but are in close proximity of project construction would also be protected by installing ESA fencing at the drip line. All areas not covered by buildings or pavement would be revegetated using native shrubs, trees, and grasses and in keeping with the Berkeley Lab's vegetation management program. Invasive plant species and other undesirable plants, such as French broom, yellow star-thistle, and Italian thistle, would be controlled as appropriate under the Berkeley Lab's vegetation management program.

Although the permanent loss of vegetation associated with development of the Helios Energy Research Facility could affect common wildlife species locally, the impact to vegetation types that are common throughout the Oakland-Berkeley hills would be less than significant because of the existing abundance of these plant communities and associated common wildlife species. All of the upland plant communities to be removed as part of the proposed project are common on LBNL and the surrounding area. In regard to the woodlands to be affected, large areas of oak-bay woodland would remain and existing woodlands would not be fragmented. (see **Figure 4.3-1**).

Tree removal would occur in association with construction of the proposed access road. A grove of mature redwood and oak trees is present in the area where the proposed access road would connect to Centennial Drive and additional trees are present along some portions of the roadway. As discussed earlier, four potential alignments of the road near the Centennial Drive intersection have been developed that are evaluated in this EIR. As shown below in **Table 4.3-2, Trees Affected by Intersection Options**, the four options would result in the removal of between approximately 104 and 128 trees. For a more detailed description of the type and diameter of each tree, please see **Table 3.0-2**.

**Table 4.3-2[1]**
**Trees Affected by Intersection Options**

| Option A | Option B (base option) | Option C | Option D |
|---|---|---|---|
| 128 | 110 | 104 | 127 |

*Source: Smithgroup 2007*

[1] *The numbers in the table reflect the total number of trees that would be removed. This number does not include 20 small redwood trees that would be transplanted as part of the proposed project.*

Within the redwood grove, the trees would be removed from portions of the grove already subject to some level of disturbance associated with Building 73, the existing access road, and equipment shed, and the remainder of the grove would remain undisturbed by the project. Furthermore, the LBNL Construction Standards and Design Requirements that require that all trees that would be removed for the construction of a proposed project at LBNL must be replaced at a 1:1 ratio, would be implemented as part of the proposed project. Additionally, incorporation of the 2006 LRDP Development Principles and Design Guidelines, as well as the best practices currently undertaken by the Berkeley Lab in connection with development projects and UC Berkeley's Specimen Tree Program, which is included in the project, would further reduce the degree of the impact associated with the removal of trees. However, because of the proximity of the redwood and oak trees to be removed to the UC Berkeley Mather Grove, the removal of mature oak and redwood trees for the construction of the Helios Access Road is considered a potentially significant impact. Additional mitigation measures are proposed below to reduce the impact related to tree removal to a less than significant level.

Note that because with mitigation the project would plant replacement trees at a minimum ratio of 2:1, which exceeds the LBNL tree replacement standard, and would replace non-native trees with native trees, the project would also more than offset the reduction in carbon sequestration as a result of project-related tree removal.

**Helios Mitigation Measure BIO-1a**: All trees removed to construct the proposed project will be replaced at a ratio of 2:1.

**Helios Mitigation Measure BIO-1b**: For trees that would be removed by the project and meet the UC Berkeley specimen tree criteria, LBNL will replace the trees at a ratio of 3:1, consistent with UC Berkeley's specimen tree replacement policy.

**Helios Mitigation Measure BIO-1c**: To ensure the successful replacement of trees, a tree replacement plan shall be implemented within the LBNL boundary and shall meet the following standards: (1) The plan shall identify suitable areas for tree replacement to occur such that existing native woodlands are enhanced and/or expanded. (2) The plan shall provide for replacing trees at a 2:1 ratio (or 3:1 for specimen trees, as appropriate), with native trees replaced in-kind and non-native trees replaced with appropriate native species. (3) The plan shall specify, at a minimum, the following: (a) the location of planting sites; (b) site preparation and planting procedures; (c) a schedule and action plan to maintain and monitor the tree replacement sites; (d) a list of criteria and performance standards by which to measure success of the tree replacement; and (e) contingency measures in the event that tree replacement efforts are not successful.

**Significance after Mitigation:** Less than significant

**Helios Impact BIO-2: The proposed project could result in direct and indirect adverse effects to creeks and seeps subject to ACOE and CDFG jurisdiction and sensitive plant communities and sensitive habitats. (*Less than Significant*)**

Based on the current design of the proposed project, construction of a section of the access road and associated grading would result in the removal of the freshwater seep. While a formal wetland delineation has not been conducted, the seep is estimated to be 0.11 acre in size (see ***Plant Communities and Wildlife Habitat*** for a further discussion of the seep). Given the presence of wetland and riparian vegetation and standing water, the seep may fall under the jurisdiction of the ACOE and the CDFG. The seep is also considered to be a sensitive plant community by CDFG and provides habitat for numerous wildlife species.

As required by LRDP Mitigation Measure BIO-2a, the final design phase shall further evaluate the feasibility of avoiding the freshwater seep. In the event that avoidance is not feasible, a formal wetland delineation shall be conducted and submitted to the ACOE, and as required by LRDP Mitigation Measure BIO-2b, a Wetland Mitigation Plan shall be developed and implemented to compensate for the loss of the freshwater seep. The Plan shall specify the location and methods for creating wetland habitat with a minimum of a 1:1 functional equivalency or acreage ratio. To further ensure the success of the required

Wetland Mitigation Plan, additional actions (including performance criteria and monitoring requirements) are included in Helios Mitigation Measure BIO-2 below. LBNL has completed a preliminary evaluation and determined that compensatory wetlands can be created within the LBNL hill site to mitigate for the wetlands that would be filled by the project. The implementation of LRDP Mitigation Measures BIO-2a and BIO-2b, which are included in the proposed project, as well as Helios Mitigation Measure BIO-2, would reduce the potential direct impact on ACOE jurisdictional waters to a less-than-significant level.

The edge of the woodland associated with Chicken Creek borders portions of the project's disturbance boundary to the west. As described in detail in **Section 4.7, Hydrology and Water Quality,** LBNL currently employs, and would continue to employ, a wide array of construction-period "best management practices" to minimize the potential for accidental discharges of fill or other materials into jurisdictional waters. Active management of construction-related storm water flows from development sites is a standard part of contract specifications on all construction projects undertaken by LBNL and is also required for compliance with the NPDES General Permit for construction activity.[15] Construction projects incorporate control measures and are monitored to manage storm water flows and potential discharge of pollutants. For example, LBNL's standard construction specifications include requirements for installation of erosion control netting and riprap to protect slopes and minimize adverse effects of runoff; protection of existing plant materials; application and maintenance of hydroseeding (sprayed application of seed and reinforcing fiber on graded slopes); no washout of concrete trucks to the storm drain system; and proper disposal of wastewater resulting from vehicle washing. LBNL also implements spill prevention and response programs to minimize pollutants in runoff. Construction sites are replanted as soon as practicable following construction. In addition, the Berkeley Lab's construction specifications require that contractors properly maintain construction vehicles to minimize fluid leaks and contractors not refuel construction equipment in proximity to waterways. These ongoing programs and compliance with the NPDES General Permit for construction activity would reduce the potential for accidental discharge during construction to adversely affect jurisdictional waters. In addition to the employment of LBNL best management practices, implementation of LRDP Mitigation Measure BIO-2c, which is included in the proposed project and requires that to the extent feasible, construction projects that might affect jurisdictional drainages and/or wetlands be scheduled for dry-weather months, would reduce the potential impact on jurisdictional waters from accidental discharges of fill or other deleterious substances during construction to a less-than-significant level.

15 The project would be subject to not only the LBNL contract specifications and construction standards but would also be required to apply for and obtain coverage under the statewide NPDES General Permit for Storm Water Discharges associated with Construction Activity. Pursuant to the permit, the project would develop and implement a construction Storm Water Pollution Prevention Plan to control discharge of pollutants into surface waters during project construction.

**Helios Mitigation Measure BIO-2**: To further ensure the success of the required Wetland Mitigation Plan, the plan shall specify, at a minimum, the following: (1) the goals of the mitigation effort; (2) the location of the mitigation site; (3) the approach, site preparation and planting procedures; (4) a schedule and action plan to maintain and monitor the mitigation site; (5) a list of criteria and performance standards by which to measure success of the wetland mitigation; and (6) contingency measures in the event that mitigation efforts are not successful.

**Helios Impact BIO-3: The proposed project would not adversely affect special-status nesting birds (including raptors) such that nests are destroyed, they abandon their nests or that their reproductive efforts fail. (*Less than Significant*)**

The project-related removal of trees has the potential to affect active special-status bird nests (including raptors). Additionally, any unusually loud noise levels generated by project construction activities have the potential to disturb raptors or other special-status birds nesting on or near the project site and to result in the abandonment of active bird nests. Based on the presence of suitable habitat on and near the project site, a number of raptors and other special-status bird species (see **Table 4.3-1**) should be considered as potentially present and possibly using the area for nesting. The loss of active nests of special-status bird species would be avoided through implementation of LRDP Mitigation Measure BIO-3 which involves pre-construction surveys and implementation of additional measures incase active nests are encountered (see above). With the implementation of this measure, impacts to special-status nesting birds (including raptors) would be less than significant. Furthermore, LBNL would comply with the Migratory Bird Treaty Act and the California Fish and Game Code, Sections 3500-3516, which provide protection to all native nesting birds.

**Mitigation Measure**: No project-level mitigation measure required.

**Helios Impact BIO-4: Removal of trees and structures during the breeding season would not result in direct mortality of special-status bats. In addition, construction noise would not cause maternity roost abandonment and subsequent death of young. (*Less than Significant*)**

Special-status bats that may occur on or near the project site include pallid bat, fringed myotis, and long-eared myotis. These bat species may use crevices in exfoliating tree bark and/or hollow cavities in trees located on and near the project site for roosting. Additionally, the proposed project includes the removal of Buildings 73 and 73A (three of the four access road intersection options would require building removal) that could be used by roosting bats. Therefore, the removal of trees and structures from the project footprint could result in the destruction of special-status bat roosts and any unusually loud noise

levels generated by project construction activities have the potential to result in the abandonment of an active maternity bat roost. The loss of active maternity roosts would be avoided through implementation of LRDP Mitigation Measure BIO-4 (see above) which is included in the proposed project. With the implementation of this measure, impacts to special-status bat species would be less than significant.

**Mitigation Measure**: No project-level mitigation measure required.

**Helios Impact BIO-5: Construction of the proposed project would not result in take or harassment of Alameda whipsnake. (*Less than Significant*)**

Although Alameda whipsnake has not been observed at LBNL, the project site is within an area identified as having "highly suitable potential habitat" for Alameda whipsnake (see **Figure 4.3-2**) (Swaim 2006). Large portions of the habitat within the project boundaries are heavily disturbed and do not contain scrub communities often associated with Alameda whipsnake. However, some core habitat (i.e., coastal scrub) of the Alameda whipsnake occurs in the southern portion of the project site; this scrub habitat is contiguous with a larger area of coastal scrub along the south-facing slopes of Strawberry Canyon that borders large portions of the proposed access road. Furthermore, when considered with nearby habitats, even the disturbed portions of the project site are part of a mosaic of habitats (including coastal scrub, grassland, and woodland) potentially utilized by the species. Alameda whipsnake also has the potential to occur in the borrow area.

The proposed project would result in the loss of 0.27 acre of coastal scrub habitat along the outer western edge of a relatively large coastal scrub community. Given the small acreage of scrub habitat to be developed and that large contiguous areas of suitable habitat (including coastal scrub, oak woodland, and grassland) would be maintained in surrounding areas (see **Figure 4.3-1**), the loss of whipsnake habitat would not be substantial. Additionally, potential movement pathways for Alameda whipsnake would be maintained south of the project site providing connectivity to suitable habitats to the west. However, given the potential for Alameda whipsnake to occur on the project site (as well as the borrow area[16]), in the absence of the implementation of avoidance measures, the proposed project could result in the construction-related loss or harassment of the species. Consistent with the requirements of the 2006 LRDP, LRDP Mitigation Measure BIO-5a through LRDP Mitigation Measure BIO-5f (see above) have been included in the proposed project and would be implemented to ensure that the species is protected during project construction and that no loss of individual whipsnakes occurs. Therefore, the impact from

16 The borrow area was devoid of any vegetative cover at the time of a field visit conducted in September 2007. However, the borrow area is located near suitable habitat for Alameda whipsnake and is in a portion of LBNL identified as having "highly suitable potential habitat for Alameda whipsnake." Accordingly, there is some potential that Alameda whipsnake could temporarily occur on or adjacent to the borrow area.

project construction activities would be less than significant. Additionally, prior to project construction, informal consultation will be conducted with the USFWS to determine if a permit would be required under the federal Endangered Species Act.

Following the completion of construction activities, there is potential that vehicular use of the proposed access road could result in the loss of individual whipsnakes. Specifically, the proposed access road is located to the north of an area of coastal scrub along the south-facing slopes of Strawberry Canyon. Given the proximity of the road to highly suitable whipsnake habitat, there is potential that whipsnakes could disperse onto the road and be struck by automobiles. However, the potential to result in the loss of individual whipsnakes is considered low because the roadway is designed to serve only the project site and will not experience high traffic volumes. Approximately 50 vehicles would access the project site via this road on a daily basis and a shuttle bus would likely run on this route at the frequency of about 20 to 30 trips a day. Furthermore, the roadway will be posted with a speed limit of 15 miles an hour. The impact would therefore be less than significant. Helios Mitigation Measure BIO-5 is proposed to further reduce the impact to all wildlife, including Alameda whipsnake, in the project area.

**Helios Mitigation Measure BIO-5:** Signage shall be posted along the road identifying the potential presence of rare and protected wildlife and the need to proceed with caution for the safety of the species.

**Helios Impact BIO-6: Development of the proposed project would not result in the loss of San Francisco lacewing and suitable habitat for the species. (*Less than Significant*)**

The San Francisco lacewing is known to inhabit coastal scrub and woodland habitat and to occur in Strawberry Canyon. Accordingly, potentially suitable habitat for this species occurs within the on-site coastal scrub, oak-bay woodland and redwood grove. Given the small area of potentially suitable habitat to be removed, the extent of similar scrub and woodlands in immediately surrounding areas, and the relatively low sensitivity status of the species, the proposed project is not expected to have a substantial adverse affect on the species. Therefore, potential impacts to San Francisco lacewing would be less than significant.

**Mitigation Measure**: No project-level mitigation measure required.

## 4.3.5 References

Alvarez, Jeff. A Compilation of Observations of Alameda Whipsnakes Outside of Typical Habitat. Transactions of the Western Section of the Wildlife Society 41:21-25. 2005.

Arnold, R., Bombay Project in Santa Cruz: "Report on San Francisco Lacewing and Unsilvered Fritillary." Letter report from Richard Arnold, President, Entomological Services, Ltd. To Meredith

Marquez, Principal Planner, City of Santa Cruz Department of Planning and Community Development, August 18, 1997.

Baicich, P.J. and C.J.O. Harrison, *A Guide to the Nests, Eggs, and Nestlings of North American Birds, 2nd edition*, San Diego, CA, Academic Press, 1997.

California Department of Fish and Game (CDFG), Wildlife Habitat and Data Analysis Branch, *California Natural Diversity Database,* data request for the Oakland East, Oakland West, Briones Valley, San Leandro, and Richmond 7.5-minute USGS topographic quadrangles, 2005, 2007.

California Department of Fish and Game (CDFG), *Special Animals List,* Available online at: http://www.dfg.ca.gov/whdab/pdfs/SPAnimals.pdf. August 2006.

California Department of Fish and Game (CDFG), *Special Vascular Plants, Biophytes, and Lichen List*. July 2007.

California Native Plant Society (CNPS), *Electronic Inventory of Rare and Endangered Plants of California,* data request for the Oakland East, Oakland West, Briones Valley, and Richmond 7.5-minute USGS topographic quadrangles, 2005, 2007. Available online at: http://www.cnps.org/inventory.

Environmental Science Associates (ESA), Field survey of proposed Molecular Foundry project site, March 13, 2002a.

Environmental Science Associates (ESA), Field survey of proposed Building 49 project site, July 30, 2002b.

Environmental Science Associates (ESA), Field survey of proposed Building 49 and G-4 lot project sites, December 12, 2002c.

Environmental Science Associates (ESA), Field survey of proposed Lot G-4 project site, June 25, 2003a.

Environmental Science Associates (ESA), Field survey of LBNL site, October 30, 2003b.

Environmental Science Associates (ESA), Field survey of LBNL site, November 6, 2003c.

Ehrlich, P.R., D.S. Dobkin, and O. Wheye, *The Birder's Handbook: A Field Guide to the Natural History of North American Birds,* New York, NY, Simon and Schuster, 1988.

Holland, R.F., *Preliminary Descriptions of the Terrestrial Natural Communities of California*, California Department of Fish and Game, Sacramento, CA, 1986.

LBNL (Lawrence Berkeley National Lab). Lawrence Berkeley National Laboratory Long Range Development Plan, Final Environmental Impact Report. July 2007.

LBNL, *Maintenance Vision for a Fire-Sustainable Landscape*, September 2001.

McGinnis, Dr. Samuel M. 1996. An Evaluation of Potential Habitat Sites for the Alameda Whipsnake (*Masticophis lateralis euryxanthus*) within and Immediately Adjacent to the Border of the Lawrence Berkeley National Laboratory, Berkeley, California. Prepared for Elton Beck Associates. May 18.

Sawyer, J.O. and T. Keeler-Wolf, *A Manual of California Vegetation*, California Native Plant Society, Sacramento, CA, 1995.

Sibley, D.A., *The Sibley Guide to Birds*, Alfred A. Knopf, Inc., New York, 2000.

Swaim, K.E., *Aspects of the Ecology of the Alameda Whipsnake (Masticophis lateralis euryxanthus),* Masters Thesis, California State University, Hayward, CA, 140 pp., 1994.

Swaim, K., *Results of surveys for special status reptiles at the Site 300 facilities of Lawrence Livermore National Laboratory*, Swaim Biological, Inc., 2002.

Swaim, K.E., *Principal, Swaim Biological Consulting, personal communication [conversation] with Martha Lowe regarding habitat preferences of the Alameda whipsnake,* December, 2003.

Swaim, K.E., *Alameda Whipsnake Habitat Assessment Lawrence Berkeley National Laboratory City of Berkeley, Alameda County, California, prepared for Environmental Science Associates by Swaim Biological, Inc.,* July 10, 2006.

U.S. Fish and Wildlife Service (USFWS), *Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Alameda Whipsnake (Masticophis lateralis euryxanthus)*, Federal Register Volume 65, Number 192, October 3, 2000.

U.S. Fish and Wildlife Service (USFWS), Official Species List for Lawrence Berkeley National Laboratories Long Range Development Plan, Alameda County, California, January 31, 2005a.

U.S. Fish and Wildlife Service (USFWS), *Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Alameda Whipsnake; Final Rule.* Federal Register Vol. 71, No. 190, October 2, 2006.

**Table 4.3-1**
**Special-Status Species Documented in the Project Area**

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **SPECIES LISTED OR PROPOSED FOR LISTING** | | | | |
| **Invertebrates** | | | | |
| Bay checkerspot butterfly<br>*Euphydryas editha bayensis* | FT/--/-- | Serpentine bunchgrass grassland, larvae feed on *Plantago erecta* | **Unlikely**. Grasslands on the project site and greater LBNL do not occur on serpentinite and are not known to support larval host plants. | March–May |
| Callippe silverspot butterfly<br>*Speyeria callippe callippe* | FE/--/-- | Coastal areas in dunes, prairie, scrub, and grasslands supporting Viola pedunculata | **Unlikely**. Species' host plant is not known to occur in the grasslands on the project site or greater LBNL. | Spring |
| **Fish** | | | | |
| Central California coastal steelhead<br>*Oncorhynchus mykiss* | FT/CSC/-- | Unblocked Bay Area and coastal rivers and streams | **Unlikely**. Strawberry Creek contains downstream barriers to migration of this species. With the exception of the North Fork, drainages at LBNL are not large enough to support the species. | Year-round |
| Winter-run chinook salmon<br>*Oncorhynchus tshawytscha* | FE/CE/-- | Unblocked Bay Area and coastal rivers and streams | **Unlikely**. Strawberry Creek contains downstream barriers to migration of this species. Most on-site drainages are not large enough to support the species. | Winter |

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **Amphibians** | | | | |
| California tiger salamander<br>*Ambystoma californiense* | FT/CSC/-- | Breed in ponds and vernal pools; occupies small mammal burrows in surrounding grassland habitats during most of the year | **Unlikely**. Suitable aquatic habitat for this species is not present within the project area. | November-May |
| California red-legged frog<br>*Rana draytonii* | FT/CSC/-- | Breed in stock ponds, pools, and slow-moving streams with emergent vegetation for escape cover and egg attachment | **Unlikely**. Suitable aquatic habitat does not occur on the project site; Chicken Creek (which is near the project site) has a dense canopy, is steeply incised, and does not provide suitable habitat for the species. No species occurrences are reported within several miles of the project site or in areas accessible to the project site. | May-November |
| **Reptiles** | | | | |
| Alameda whipsnake<br>*Masticophis lateralis euryxanthus* | FT/CT/-- | Inhabits open to partially open scrub communities, including coyote bush scrub and chamise chaparral on primarily south-facing slopes | **High potential**. Some preferred habitat (i.e., coastal scrub) for this species is present within the project boundaries and the entire project site is part of a mosaic of habitats potentially utilized by the species. The site is within an area identified as having "highly suitable potential habitat" for the species (Swaim 2006). | Spring |
| **Birds** | | | | |
| American peregrine falcon<br>*Falco peregrinus* | Delisted/CE/-- | Forages in marshes and grasslands; nesting habitat includes high, protected cliffs and ledges near water | **Unlikely**. Suitable nesting habitat is not present within the project area. May forage in the vicinity of the project area. | Year-round |
| Bald Eagle<br>*Haliaeetus leucocephalus* | FT/CE/-- | Nests and forages on inland lakes, reservoirs, and rivers; winter foraging at lakes and along major rivers | **Unlikely**. No suitable foraging or nesting habitat in project vicinity. | Winter |

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **Plants** | | | | |
| Large-flowered fiddleneck<br>*Amsinckia grandiflora* | FE/CE/1B.1 | Valley grassland, foothill woodland, annual grassland | **Low potential**. Project site contains marginally suitable habitat and only three natural occurrences are known, the nearest in east Alameda County (CNPS 2005). | April-May |
| Pallid manzanita<br>*Arctostaphylos pallida* | FT/CE/1B.1 | Broadleaved upland forest, cismontane woodland, closed-cone coniferous forest, chaparral, and coastal scrub; found in siliceous shale, sandstone, or gravelly substrates | **Unlikely**. The project site does not contain suitable soils for this species. Species is readily recognizable and was not seen during recent or past field surveys. | December-March |
| Robust spineflower<br>*Chorizanthe robusta var. robusta* | FE/--/1B.1 | Sandy or gravelly openings in cismontane woodland; also coastal dunes and coastal scrub | **Unlikely**. Suitable habitat is not present on the project site (i.e., tree and shrub cover is too dense). Not seen in Alameda or adjacent counties since the 1890s; presumed extirpated in Bay Area (CNPS 2005). | April-September |
| Presidio clarkia<br>*Clarkia franciscana* | FE/CE/1B.1 | Serpentine outcrops in coastal scrub and valley and foothill grassland | **Unlikely**. Suitable habitat not present as site does not contain serpentine outcrops. | May-July |
| Santa Cruz tarplant<br>*Holocarpha macradenia* | FT/CE/1B.1 | Light, sandy, or sandy clay soil in coastal prairie and scrub and in valley and foothill grassland; often with non-native associates | **Unlikely**. Marginally suitable habitat is present on the project site, but naturally occurring populations have been extirpated from the Bay Area (CNPS 2005). Not observed during recent field survey conducted during the species' blooming period. | June-October |
| San Francisco popcorn flower<br>*Plagiobothrys diffusus* | FSC/CE/1B.1 | Coastal prairie and valley and foothill grassland | **Low Potential**. The project site provides marginally suitable habitat. Species known from fewer than 10 occurrences. | April-June |

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **FEDERAL BIRDS OF CONSERVATION CONCERN/STATE SPECIES OF SPECIAL CONCERN/ STATE SPECIAL ANIMALS** | | | | |
| **Invertebrates** | | | | |
| Monarch butterfly<br>*Danaus plexippus* | --/*/-- | Winters in eucalyptus groves; winter roosting sites protected by the state | **Low potential**. Suitable habitat exists on-site, but the species has not been documented as wintering within the project area. | Winter |
| Bridges' Coast Range shoulderband snail<br>*Helminthoglypta nickliniana bridgesi* | --/*/-- | Inhabits open hillsides; prefers rock piles but can be found under tall grasses and weeds | **Low potential**. Marginally suitable habitat is present in the project area, but all sightings are historic. | Year-round |
| Ricksecker's water scavenger beetle<br>*Hydrochara rickseckeri* | --/*/-- | Specific habitat requirements are unknown; requires calm, shallow water of ponds and streams | **Unlikely**. Suitable aquatic habitat is not present in the project area. | Unknown |
| Lee's micro-blind harvestman<br>*Microcina leei* | --/*/-- | Requires undisturbed rocks in native grasslands and woodlands | **Unlikely**. Suitable habitat is not present on the project site; Known to be present on LBNL in Blackberry Canyon (which is located well outside the project's disturbance boundaries). | Year-round |
| San Francisco lacewing<br>*Nothochrysa californica* | --/*/-- | Coastal scrub and woodlands | **High potential**. The on-site oak-bay woodland provides potentially suitable habitat. The species is known to occur in woodland and coastal scrub habitat on LBNL and in Strawberry Canyon. | January-July |
| **Birds** | | | | |
| Cooper's hawk (nesting)<br>*Accipiter cooperi* | --/CSC/-- | Nests in riparian growths of deciduous trees and live oak woodlands | **Moderate potential**. Suitable nesting habitat is available on and bordering the project site. | March-July |
| Sharp-shinned hawk (nesting)<br>*Accipiter striatus* | --/CSC/-- | Nests in riparian growths of deciduous trees and live oaks | **Low potential**. The project site is located outside of the species' expected nesting range; could occur as a winter migrant. | March-July |

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **Birds (continued)** | | | | |
| Tricolored blackbird (nesting colony)<br>*Agelaius tricolor* | BCC/CSC/-- | Riparian thickets and emergent vegetation | **Unlikely**. Typical nesting habitat used by this species is not present in large enough amounts in the project area. | Spring |
| Grasshoper sparrow<br>*Ammodramus savannarum* | --/*/-- | Dry, dense grasslands, especially with a variety of grasses and tall forbs and scattered shrubs | **Low potential**. Suitable habitat is present on the project site, but species frequents more arid areas. | April-July |
| Bell's sage sparrow<br>*Amphispiza belli belli* | BCC/CSC/-- | Inhabits arid areas with low, fairly dense stands of shrubs, including chamise chaparral and coastal sage scrub | **Low potential**. Suitable scrub habitat is present adjacent to the project site, but species frequents more arid areas. | Year-round |
| Golden eagle (nesting and wintering)<br>*Aquila chrysaetos* | BCC/CSC/CFP | Generally nests in remote areas in trees, on cliffs, rocky outcrops, and utility towers, mostly in hilly or mountainous terrain; prefers to forage in habitat with dense ground squirrel populations | **Unlikely**. While limited foraging habitat exists, nesting habitat is marginal. | Year-round |
| Burrowing owl (burrow sites)<br>*Athene cunicularia* | BCC/CSC/-- | Nests in mammal burrows in open, lowland grasslands; also uses man-made structures | **Unlikely**. Suitable nesting habitat (i.e., small mammal burrows of adequate size) is not present on the project site. | February-June |
| Oak titmouse (nesting)<br>*Baelophus inornatus* | --/*/-- | Inhabits open oak woodlands and oak savannah | **Low potential**. Species is relatively rare on western slopes of East Bay hills due to generally high density of oak habitat. | Year-round |
| Great horned owl<br>*Bubo virginianus* | --/3503.5/-- | Often uses abandoned nests of corvids or squirrels; nests in large oaks, conifers, eucalyptus | **Moderate potential**. Suitable nesting habitat is present on and adjacent to the project site. | Year-round |

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **Birds (continued)** | | | | |
| Red-tailed hawk<br>*Buteo jamaicensis* | --/3503.5/-- | Usually nests in large trees, often in woodland or riparian deciduous habitats | **Moderate potential**. Suitable nesting habitat is present on and adjacent to the project site. | Year-round |
| Red-shouldered hawk<br>*Buteo lineatus* | --/3503.5/-- | Nest in a variety of woodland or riparian habitats | **Moderate potential**. Suitable nesting habitat is present on and adjacent to the project site. | Year-round |
| Lark sparrow (nesting)<br>*Chondestes grammacus* | --/*/-- | Inhabits sparse valley foothill hardwood, open mixed chaparral and brushy habitats, grasslands with scattered trees or shrubs | **Unlikely**. Suitable nesting habitat is not present in the project area, as the canopy cover is too dense. | Year-round |
| Northern harrier (nesting)<br>*Circus cyaneus* | --/CSC/-- | Most commonly found foraging over marshes and open fields. Nests on slightly elevated ground or in thick vegetation. | **Unlikely.** Suitable nesting habitat is not present on or adjacent to the project site. | Year-round |
| Olive-sided flycatcher (nesting)<br>*Contopus cooperi* | BCC/--/-- | Inhabits open conifer or mixed woodlands; nests in large coniferous trees | **Moderate potential.** Suitable nesting habitat is present on and adjacent to the project site; species is relatively rare in East Bay hills. | May-August |
| White-tailed kite (nesting)<br>*Elanus leucurus* | --/CFP/-- | Nests near wet meadows and open grasslands, in dense oak, willow, or other tree stands | **Low potential.** This species rarely seen in the Oakland-Berkeley hills likely due to the extent of woodland habitats and lack of large, open grasslands. Grassland areas on and bordering the project site are relatively small and fragmented and unlikely to be used by the species. | March-July |
| California horned lark<br>*Eremophila alpestris acita* | --/CSC/-- | Nests and forages in short-grass prairie, mountain meadow, coastal plain, fallow fields, and alkali flats | **Unlikely.** Project site does not provide suitable habitat. | March-July |

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **Birds (continued)** | | | | |
| Merlin (wintering)<br>*Falco columbarius* | BCC/CSC/-- | Breeds outside California, inhabits coastlines, open grasslands, savannahs, and woodlands | **Low potential.** Does not nest in California; could infrequently occur as a winter migrant but available on-site habitat is marginal. | September-May |
| American kestrel<br>*Falco sparverius* | --/3503.5/-- | Frequents generally open grasslands, pastures, and fields; primarily a cavity nester | **Moderate-high potential.** Potential nesting habitat available on and adjacent to the project site in cavities in mature oaks or pines. | Year-round |
| Yellow-breasted chat (nesting)<br>*Icteria virens* | --/CSC/-- | Nests in riparian corridors with willows or other dense foliage | **Low potential.** No riparian habitat present within the project boundaries; limited extent of suitable riparian vegetation present near the project makes nesting unlikely in the project area. | March-September |
| Loggerhead shrike (nesting)<br>*Lanius ludovicianus* | BCC/CSC/-- | Nests in shrublands and forages in open grasslands | **Unlikely.** Suitable open grassland habitat is not present on or adjacent to the project site. | March-September |
| Lewis' woodpecker (nesting)<br>*Melanerpes lewis* | BCC/--/-- | Nests in cavities of dead or burned out trees in open, deciduous, and conifer habitats with brushy understory | **Unlikely.** Project site is located outside of the species' expected nesting range. Rarely occurs on the west side of East Bay hills in oak woodland habitat in winter. Available oak woodland habitat too dense to be suitable for nesting. | Winter |

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **Birds (continued)** | | | | |
| Rufous hummingbird (nesting)<br>*Selasphorus rufus* | BCC/--/-- | Inhabits riparian areas, open woodlands, chaparral, and other habitat with nectar-producing flowers; breeding does not occur in San Francisco Bay Area. | **Unlikely.** Breeding does not occur in the San Francisco Bay Area; could occasionally forage on the project site and in surrounding areas. | February-April |
| Allen's hummingbird (nesting)<br>*Selasphorus sasin* | --/*/-- | Inhabits coastal scrub, valley foothill hardwood, and riparian habitats | **High potential.** Trees and shrubs within and adjacent to the project site provide potential nesting habitat. | January-July |
| Red-breasted sapsucker (nesting)<br>*Sphyrapicus ruber* | --/*/-- | Breeds in coastal forests of Northern California and Oregon | **Unlikely.** May occur occasionally and locally in winter, but does not breed in the area. | November-March |
| California thrasher<br>*Toxostoma redivivum* | --/*/-- | Moderate to dense chaparral and scrub, open valley foothill riparian thickets | **Moderate potential.** Suitable habitat occurs on and adjacent to the project site. | Year-round |
| **Mammals** | | | | |
| Pallid bat<br>*Antrozous pallidus* | CSC/-- | Day roosts include rock outcrops, mines, caves, hollow trees, buildings and bridges. Recent research suggests high reliance on tree roosts | **Moderate potential**. Suitable roost habitat present on and adjacent to the site in trees and buildings. Suitable foraging habitat on the project site. | March-August |
| Townsend's big-eared bat<br>*Corynorhinus townsendii* | --/CSC/-- | Inhabits a variety of habitats, requires caves, mines, or man-made structures for roosting; sensitive to disturbance and generally does not roost near areas of high human activity. | **Low potential.** Suitable roosting habitat is not present on or adjacent to the project site, but the species may forage in the area | March-August |

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **Mammals (continued)** | | | | |
| Berkeley Kangaroo rat<br>*Dipodomys heermanni berkeleyensis* | --/*/-- | Open, grassy hilltops and open spaces in chaparral and blue oak/gray pine woodland | **Low potential.** Marginally suitable habitat is present in the project area; species is presumed extinct. | Year-round |
| Western mastiff bat<br>*Eumops perotis* | --/CSC/-- | Breeds in rugged, rocky canyons and forages in a variety of habitats | **Low potential.** Suitable roosting habitat is not present in the project area, but the species may forage in the area. | March-August |
| Long-eared myotis<br>*Myotis evotis* | --/*/-- | Inhabits woodlands and forests up to approximately 8,200 feet in elevation; roosts in crevices and snags | **Moderate potential.** Suitable foraging and roosting habitat is present on and adjacent to the project site. | March-August |
| Fringed myotis<br>*Myotis thysanodes* | --/*/-- | Inhabits a variety of woodland habitats, roosts in crevices or caves, and forages over water and open habitats | **Moderate potential.** Suitable foraging and roosting habitat is present on and adjacent to the project site. | March-August |
| San Francisco dusky-footed woodrat<br>*Neotoma fuscipes annectens* | --/CSC/-- | Forests with moderate canopy and moderate to dense understory | **Low potential.** No woodrat nests were observed on the project site during recent field survey; marginally suitable habitat present. | Year-round |

| **Common Name**<br>***Scientific Name*** | **Listing Status** | **General Habitat** | **Potential for Occurrence** | **Period of Identification** |
|---|---|---|---|---|
| **Plants** | | | | |
| Bent-flowered fiddleneck<br>*Amsinckia lunaris* | --/--/1B.2 | Coastal bluff scrub, woodland, and valley and foothill grassland | **Low potential.** Marginally suitable habitat is present on the project site, and records from Oakland-Berkeley hills are historic only. A focused search of the project site for the species was conducted on June 28, 2007. The search was conducted after the peak spring bloom (making identification of the species more difficult). However, the species would have been persistent or recognizable to genus or species if present. The species was not observed during the survey. | March-June |
| Big-scale balsamroot<br>*Balsamorhiza macrolepis* var. *macrolepis* | --/--/1B.2 | Woodland and valley and foothill grassland, sometimes on serpentine soils | **Low potential.** Low-quality suitable habitat is present on the project site and serpentine soils are absent. A focused search of the project site for the species was conducted on June 28, 2007. The search was conducted after the peak spring bloom (making identification of the species more difficult). However, the species would have been persistent or recognizable to genus or species if present. The species was not observed during the survey. | March-June |

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **Plants (continued)** | | | | |
| Mt. Diablo fairy-lantern<br>*Calochortus pulchellus* | --/--/1B.2 | Woody and shrubby slopes of chaparral, cismontane, and riparian woodland, and valley and foothill grassland | **Low potential.** Marginally suitable habitat is present on the project site, and the species is not known from Oakland-Berkeley hills. A focused search of the project site for the species was conducted on June 28, 2007. The search was conducted after the peak spring bloom (making identification of the species more difficult). However, the species would have been persistent or recognizable to genus or species if present. The species was not observed during the survey. | April-June |
| Western leatherwood<br>*Dirca occidentalis* | --/--/1B.2 | On brushy slopes and mesic areas of chaparral, riparian woodland and forest, and broadleaf or coniferous forest | **Unlikely.** Marginal habitat present on the project site. This shrub would have been recognizable during the field survey and was not observed. | January-April |
| Round-leaved filaree<br>*California macrophyllum* | --/--/1B.1 | On clay soils in woodland and valley and foothill grasslands | **Low potential.** Marginal habitat is present on the project site; most collections are historical (CNPS 2005). | March-May |

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **Plants (continued)** | | | | |
| Diablo helianthella<br>*Helianthella castanea* | --/--/1B.1 | Broadleaf upland forest, cismontane woodland, chaparral, coastal scrub, riparian woodland, and valley and foothill grassland | **Low potential.** Low-quality suitable habitat is present on the project site.<br><br>A focused search of the project site for the species was conducted on June 28, 2007. The search was conducted after the peak spring bloom (making identification of the species more difficult). However, the species would have been persistent or recognizable to genus or species if present. The species was not observed during the survey. | April-June |
| Fragrant fritillary<br>*Fritillaria liliacea* | --/--/1B.2 | Cismontane woodland, coastal prairie and scrub, valley and foothill grasslands, often on serpentine soils | **Low potential.** Serpentine soils are not present on the project site. The species is unlikely to be found on other soils due to competition with non-native species. | February-April |
| Kellogg's horkelia<br>*Horkelia cuneata* spp. *sericea* | --/--/1B.1 | In sandy or gravelly openings of closed-cone coniferous forest, chaparral and coastal scrub | **Low potential.** Suitable habitat is not present on the project site. Presumed extirpated in Alameda County (USFWS 2005a). | April-September |
| Large-flowered leptosiphon (linanthus)<br>*Leptosiphon grandiflorus* (formerly *Linanthus grandiflorus)* | --/--/4.2 | Cismontane woodlands, valley and foothill grassland, coastal scrub; associated with sandy soils | **Low potential.** Sandy soils (generally associated with the species) do not occur on the project site. | April-August |

| Common Name<br>*Scientific Name* | Listing Status | General Habitat | Potential for Occurrence | Period of Identification |
|---|---|---|---|---|
| **Plants (continued)** | | | | |
| Oregon meconella<br>*Meconella oregana* | --/--/1B.1 | Coastal scrub and prairie | **Low potential.** Low-quality suitable habitat is present at LBNL and is absent from the project site. Known only from five occurrences, including Oakland East, Richmond, and Briones Valley quads. | March-April |
| Robust monardella<br>*Monardella villosa* ssp. *globosa* | --/--/1B.2 | In clay or sandy soils of coastal prairie and scrub, and valley and foothill grassland | **Low potential.** Low-quality suitable habitat is present on the project site.<br><br>A focused search of the project site for the species was conducted on June 28, 2007. The species would have been persistent or recognizable if present. The species was not observed during the survey. | June-July |
| Most beautiful jewel-flower<br>*Streptanthus albidus* ssp. *peramoenus* | --/--/1B.2 | Ridges and slopes with chaparral, valley and foothill grassland, and woodland; on serpentine outcrops | **Low potential.** Although grasslands occur on-site, no serpentine soils or outcrops are present. | April-June |

STATUS CODES:

**High potential** = High to moderate quality habitat present and site within the geographic range; species expected to occur.

**Moderate potential** = Low to moderate quality habitat present, or habitat suitable but not within species' reported geographic range.

**Low potential** = Habitat highly limited or only marginally suitable or species may not be reported within the region.

**Unlikely** = Habitat does not meet species requirements as currently understood in the scientific community, site not within currently known species distribution or range, and/or not identified during focused searches when (plant) species would have been identifiable.

| Federal: (U.S. Fish and Wildlife Service) | State: (California Department of Fish and Game) |
|---|---|
| FE = Listed as endangered (in danger of extinction) by the federal government<br>FT = Listed as threatened (likely to become endangered within the forseeable future) by the federal government<br>PE/PT = Proposed for listing as endangered or threatened<br>FC = Candidate to become a *proposed* species | CE = Listed as endangered by the State of California<br>CT = Listed as threatened by the State of California<br>CR = Listed as rare by the State of California (plants only)<br>CSC = California Species of Special Concern<br>CFP = California Fully Protected<br>* = Species designated as "Special Animals" by the state<br>3503.5= California Fish and Game Code Section 3503.5, Protection for nesting species of Falconiformes (hawks) and Strigiformes (owls)<br>^ = Identified as a special-status species in the LRDP EIR (ESA, 2006), but is not included on the most recent Special Animals List (CDFG, 2006) |

*Sources: CalFlora 2003; CDFG 2004, 2007; CNPS 2006; USFWS 2005a; Zeiner et al.1990.*

California Native Plant Society

List 1A = Plants presumed extinct in California
List 1B = Plants rare, threatened, or endangered in California and elsewhere
List 2 = Plants rare, threatened, or endangered in California but more common elsewhere
List 3 = Plants about which more information is needed
List 4 = Plants of limited distribution

An extension reflecting the level of threat to each species is appended to each rarity category as follows:

.1 -- Seriously endangered in California
.2 -- Fairly endangered in California
.3 -- Not very endangered in California

# 4.4 CULTURAL RESOURCES

## 4.4.1 Introduction

This section evaluates the potential impacts to cultural resources (historical and archaeological) associated with implementation of the proposed Helios project. Information presented in the discussion and subsequent analysis was based on information from technical studies prepared for the project area, including archival research at the California Historical Resources Information System's Northwest Information Center conducted for the entire Lawrence Berkeley National Laboratory (LBNL) site; a cultural resources evaluation and survey completed by Archaeological Research and Services in 1986; an archaeological survey report (Kielusiak 2000); and the first of a series of reports being prepared by D.W. Harvey (Harvey 2003) of the Pacific Northwest National Laboratory as a part of an inventory and evaluation of potential historically significant buildings and structures at LBNL, and the LBNL 2006 Long Range Development Plan (LRDP) Environmental Impact Report (EIR).

In response to the Notice of Preparation for this Environmental Impact Report (EIR), one commenter stated that the Berkeley Lab should evaluate the project's impact on the Strawberry Canyon cultural landscape. A cultural landscape is defined by the National Park Service (NPS) as "a geographic area (including both cultural and natural resources and the wildlife or domestic animals therein), associated with a historic event, activity, or person exhibiting other cultural or aesthetic values. There are four general types of cultural landscapes, not mutually exclusive: historic sites, historic designated landscapes, historic vernacular landscapes, and ethnographic landscapes." Although not necessarily required for California Environmental Quality Act (CEQA) evaluation purposes, cultural landscape information in the standard National Park Service format would typically include a history of the use and development of an important landscape, including a cultural landscape chronology, identification of its potential boundaries, and a description of the character defining features of the landscape. Strawberry Canyon has not been the subject of such a study to date and has not been designated a cultural landscape by the City of Berkeley Landmarks Preservation Commission or the State Historic Preservation Officer, and it is not clear what historic event, activity or person would be the basis for significance of the area as a cultural landscape. Furthermore, at this time the City does not have an ordinance to designate cultural landscapes, the canyon has not been recorded or nominated to the National Register or California Register as a cultural landscape, and it is not clear that it has characteristics that would warrant such nomination or would make it eligible for listing. If the property were nominated to the California Register of Historical Resources (CRHR) or National Register of Historical Places (NRHP), the State Historical Resources Commission (and NPS for federal nominations) would be the agency to determine whether the property meets the criteria. If Strawberry Canyon is designated as a cultural landscape in

future, LBNL will take such designation into account in future planning, as required by CEQA. Note that the Canyon area has been the site of numerous and changing research, recreational, and land management activities of the University of California, as well as residential and other development activities on private properties. The proposed project is consistent with this existing and ongoing pattern of development in the area.

## 4.4.2 Environmental Setting

### *Early Regional and Local History*

Native Americans began to occupy the present-day Northern California (i.e., San Francisco Bay region) around 2,000 B.C. Linguistic evidence suggests that the Native Americans that lived in the area spoke Chochenyo, one of the Costanoan[1] languages. In 1770, the Costanoan-speaking people lived in approximately 50 separate and politically autonomous nations or tribelets. Records from early Spanish diaries document a number of small villages along the foothills of the East Bay area. A settlement named Huchiun may have been situated in the general vicinity of the present city of Berkeley as indicated by ethnographic sources (Kroeber 1925). During the mission period, 1770 through 1835, the Costanoan people experienced cataclysmic changes in almost all areas of their lives, particularly a massive decline in population due to introduced diseases and declining birth rate. Following the secularization of the missions by the Mexican government in the 1830s, most Native Americans gradually left the missions to work as manual laborers on the ranchos that were established in the surrounding areas. In the project region (i.e., Alameda County), Native American archaeological sites tend to be situated along ridgetops, midslope terraces, alluvial flats, near ecotones,[2] and near sources of water including springs (LBNL 2007).

In 1820, Sergeant Luis Peralta obtained Mission San Antonio, the present-day sites of the cities of Oakland, Berkeley, and Alameda. The land was later (in 1842) divided among his four sons. In 1860, the University of California was established as the College of California on 160 acres. Four years later in 1864, a Homestead Association was established in the adjacent areas. These actions led to increased development in the vicinity of the University and incorporation of the town of Berkeley in April 1878. During this time, the present-day LBNL site was largely undeveloped, and remained so until the late 1930s (LBNL 2007).

---

1 "Costanoan" is derived from the Spanish word Costanos meaning "coast people." No native name of the Costanoan people as a whole existed in prehistoric times as the Costanoan were neither a single ethnic group nor a political entity.

2 An "ecotone" is defined as the zone of transition between adjacent ecological systems, having a set of characteristics uniquely defined by space and time scales and by the strength of interactions between them.

**Development of Lawrence Berkeley National Laboratory**

LBNL was founded in 1931 as the University of California Radiation Laboratory on the UC Berkeley main campus. The Radiation Laboratory (the former Civil Engineering Test lab) was established as an accelerator laboratory by UC President Robert Gordon Sproul for physics professor Ernest Orlando Lawrence. A couple of years earlier (in 1929), on the UC Berkeley campus, Lawrence had built the world's first cyclotron, a 4-inch circular-particle accelerator. With the establishment of the Radiation Laboratory, Lawrence and his associates had the opportunity to expand their research. Further expansion of the physical size of the Laboratory's hill site during World War II was partly due to an increase in nuclear fission research, which prompted the need for higher-energy accelerators and more room for locating them. Growth of the hill site is also attributed to the fame and publicity Lawrence received for the Nobel Prize, which helped to attract research funding (LBNL 2007).

## *Previous Site-Wide Studies*

As part of the environmental analysis for the 1987 LRDP EIR, as amended, all undeveloped land and then-proposed building locations were examined for potential historical and archaeological resources. All reasonably accessible parts of the LBNL area were examined with special attention given to areas of relatively flat land or rock outcrops. The steep hillsides were not examined intensively, although transects were made through accessible areas. Based on the findings of the historic and archaeological resources survey, no indications of historic or prehistoric archaeological resources were encountered in any location at the project site. Based on this survey, LBNL was not determined to be eligible for listing on the National Register of Historic Places (LBNL 2007).

## *Current Studies of Historical Resources*

To evaluate the potential for historically significant buildings or structures, LBNL retained the Pacific Northwest National Laboratory team of licensed cultural resource professionals to conduct field surveys and historic research at LBNL. In coordination with LBNL, U.S. Department of Energy (DOE), and the State Office of Historic Preservation, the team is systematically investigating and reporting on all buildings and structures at the Lab. The team is currently in the process of completing a series of reports to identify, survey, and evaluate approximately 245 buildings and structures at the LBNL site for potential eligibility for listing in the National Register. These studies have been undertaken pursuant to Section 110 of the National Historic Preservation Act, which requires that federal agencies, such as DOE, survey the lands under their control and evaluate all historic properties (including buildings and the equipment contained therein) for eligibility for listing in the National Register. When completed, these reports will then be submitted to the State Historic Preservation Officer for concurrence.

### *Current Studies of Archaeological Resources*

Field surveys and archival research at the California Historical Resources Information System's Northwest Information Center have been undertaken to determine whether any archaeological resources have been discovered at LBNL. The Northwest Information Center has indicated there is a "low potential for Native American sites in the project area" and thus "a low possibility of identifying Native American or historic-period archaeological deposits in the project area." Additionally, field studies conducted at various times at LBNL have not encountered any archaeological resources. Native American archaeological sites in this portion of Alameda County tend to be situated on terraces along ridgetops, midslope terraces, alluvial flats, near ecotones, and near sources of water, including springs. LBNL is situated on a steep slope adjacent to Strawberry Creek. Therefore, there is a low-to-moderate potential for Native American sites to be present on the project site (LBNL 2007).

## 4.4.3 Regulatory Considerations

### *National Register of Historic Places*

The NRHP is the nation's central inventory of known historic resources. The National Register is administered by the NPS and includes listings of buildings, structures, sites, objects, and districts that possess historic, architectural, engineering, archaeological, or cultural significance at the national, state, or local level. There are three different officials that can nominate properties into the NRHP; the State Historic Preservation Officer of the state in which the property is located, the Federal Preservation Officer for federally owned or controlled property, or the Tribal Preservation Officer for tribally owned property. In order to be considered eligible for listing in the National Register as a significant historic resource, a structure, site, building, district, or object must be at least 50 years old or "exceptionally important."

### *State Office of Historic Preservation*

The State Office of Historic Preservation maintains the CRHR, an authoritative listing of the state's significant historic resources as well as architectural, archaeological, and cultural resources. The CRHR includes properties listed in or formally determined eligible for the National Register, pursuant to Section 4851(a) of the Public Resources Code, and lists selected California Registered Historical Landmarks. The State Office of Historic Preservation also maintains the *Directory of Properties in the Historic Property Data File*; however, properties on the Property Data File are not protected or regulated.

The State Office of Historic Preservation sponsors the California Historical Resources Information System (CHRIS), a statewide system for managing information on the full range of historical resources identified in California. CHRIS is a cooperative partnership among the citizens of California, historic preservation

professionals, 11 information centers, and various agencies (Office of Historic Preservation 2003). CHRIS provides an integrated database that furnishes site-specific archaeological and historical resources information on known resources and surveys to government, institutions, and individuals. CHRIS also supplies a list of qualified consultants. Information for the project area is available through CHRIS's Northwest Information Center.

## *Local Plans and Policies*

### 2006 LRDP Principles and Strategies[3]

The "Vision" section of the 2006 LRDP proposes fundamental principles that form the basis for the LRDP's development strategies. The main principle most applicable to the cultural resource aspects of new development are to "Preserve and enhance the environmental qualities of the site as a model of resource conservation and environmental stewardship." Development strategies provided by the 2006 LRDP are intended to minimize potential environmental impacts on valued cultural resources that could result from implementation of the 2006 LRDP.

### LBNL Design Guidelines

The LBNL Design Guidelines were developed in parallel with the 2006 LRDP and provide specific guidelines for site planning, landscape and building design as a means to implement the 2006 LRDP's development principles as each new project is developed. Specific design guidelines are organized by a set of design objectives that essentially correspond to the strategies provided in the 2006 LRDP. The LBNL Design Guidelines provide the following specific planning and design guidance for the cultural resource aspects of new development to achieve these design objectives.

The design guidelines would be applied to the proposed project as part of the 2006 LRDP program. As part of the design review and approval process, the proposed project would be evaluated for adherence to the LRDP Land Use Map, the design guidelines, the Building Heights Map, and any other relevant plans and policies. Approvals would be subject to satisfactory compliance with these provisions. Design objectives that are contained within the design guidelines and applicable to the cultural resource analysis include the following:

- Complement building aesthetics and enhance visual value through creation of land form elements that are consistent with design on the Hill. Mass and site buildings to minimize their visibility and to

[3] While this Environmental Impact Report presents a "stand alone" impact analysis that does not rely upon tiering from any programmatic CEQA document, Berkeley Lab does actively follow the 2006 LRDP as a planning guide for Lab development. Accordingly, relevant 2006 LRDP principles, strategies, and design guidelines are identified in this section.

"ensure each building contributes to a cohesive and coherent architectural expression through the Laboratory site."

- Each Research Cluster, because of topography, historic buildings, plant palette, and so on will develop a unique identity.
- Preserve the Hill's rustic landscape through provision of screening landscape elements for large buildings and the integration of buildings into the overall landscape using appropriate materials.
- There are many interesting historic objects scattered around the Lab. These artifacts are important reminders of the Lab's legacy as well as items of interest, which stimulate interaction. Placement of these artifacts at major pedestrian nodes and at prominent locations in each commons is encouraged.
- Designers shall examine the architectural precedents, especially of historic buildings, present in the Research Cluster where their project is to be located. A clear rationale based on precedent for the architectural expression of each project will be developed.

**City of Berkeley General Plan**

The Urban Design and Preservation Element of the City of Berkeley General Plan contains policies relating to the development and preservation of cultural resources in the city. The City of Berkeley does not list as facilities at LBNL as a historical resource (City of Berkeley 2002). The Urban Design and Preservation Element policies relevant to the proposed project are as follows:

> Policy UD-5 Architectural Features: Encourage, and where appropriate require, retention of ornaments and other architecturally interesting features in the course of seismic retrofit and other rehabilitation work.
>
> Policy UD-6 Adaptive Reuse: Encourage adaptive reuse of historically or architecturally interesting buildings in cases where the new use would be compatible with the structure itself and the surrounding area.
>
> Policy UD-10 The University of California: Strongly support actions by the University to maintain and retrofit its historic buildings, and strongly oppose any University projects that would diminish the historic character of the campus or off-campus historic buildings.
>
> Policy UD-36 Information on Heritage: Promote, and encourage others to promote, understanding of Berkeley's built and cultural heritage, the benefits of conserving it, and how to sensitively do that.

**City of Berkeley Landmarks Preservation Ordinance**

The City of Berkeley's Landmarks Preservation Ordinance, adopted in 1974, requires the City to establish a list of potential buildings that should be considered for landmark, historic district, or structure of merit status. The ordinance provides a procedure for designating properties as landmarks and for reviewing proposed physical changes to landmark buildings. The City Council and City staff appoints a Landmarks Preservation Commission that administers the ordinance. In order for buildings to be designated as landmarks or as structures of merit, buildings must meet criteria for consideration set forth in the ordinance. The criteria consist of three levels of designation for historic buildings: properties of exceptional significance (landmarks), structures of merit, and properties that do not meet landmark criteria but are worthy of preservation as part of a neighborhood, block, or street front. In late 2006, the Bevatron site, but not its housing structure (Building 51), was designated as a City of Berkeley landmark. No other structure at the LBNL main site is listed as a City of Berkeley historical resource.

**City of Oakland General Plan**

The Oakland General Plan Historic Preservation Element, adopted in 1994 and revised in 1998, identifies several categories of historical resources. Designated Historic Properties include three classes of City Landmarks (1 through 3, in declining order of importance); two classes of Preservation Districts (Areas of Primary Importance and Areas of Secondary Importance); and Heritage Properties, which are historic resources (designated by the Landmarks Preservation Advisory Board or Planning Commission) that are not Landmarks or Preservation Districts.[4] The Element also defines a category of Potential Designated Historic Properties (PDHPs), which are those properties that have an existing or contingency rating of "A" (highest importance), "B" (major importance), or "C" (secondary importance) in either the Oakland Cultural Heritage Survey (OCHS), a project of the City's Planning Department, or the Reconnaissance Survey, or have been determined by the surveys to contribute (or potentially contribute, based on contingency rating) to an Area of Primary Importance or Area of Secondary Importance. PDHPs are so identified by their survey rating; unlike Designated Historic Properties, PDHPs are not formally designated by any City body. None of the facilities at LBNL or in its vicinity are listed as a City of Oakland historical resource.

4 Eligibility requirements for designation as a Heritage Property include an existing or contingency Oakland Cultural Heritage Survey (OCHS) rating of A, B, or C; an existing or contingency Reconnaissance Survey rating of A or B; or is a contributor (or potential contributor based on contingency rating) to a potentially eligible Preservation District. The Heritage Property category was developed in the Historic Preservation Element to replace the City's Preservation Study List. However, as of 2006, the City has not initiated designation of a list of Heritage Properties.

Historic Preservation Element goals and policies relevant to the proposed project include the following:

> Historic Preservation Goal 2: To preserve, protect, enhance, perpetuate, use, and prevent the unnecessary destruction or impairment of properties or physical features of special character or special historic, cultural, educational, architectural or aesthetic interest or value. Such properties or physical features include buildings, building components, structures, objects, districts, sites, natural features related to human presence, and activities taking place on or within such properties or physical features.
>
> Policy 3.1 Avoid or Minimize Adverse Historic Preservation Impacts Related to Discretionary City Actions: The City will make all reasonable efforts to avoid or minimize adverse effects on the Character-Defining Elements of existing or Potential Designated Historic Properties, which could result from private or public projects requiring discretionary City actions.
>
> Policy 3.5 Historic Preservation and Discretionary Permit Approvals: For additions or alterations to Heritage Properties or Potential Designated Historic Properties requiring discretionary City permits, the City will make a finding that: (1) the design matches or is compatible with, but not necessarily identical, to the property's existing or historical design; or (2) the proposed design comprehensively modifies and is at least equal in quality to the existing design and is compatible with the character of the neighborhood; or (3) the existing design is undistinguished and does not warrant retention and the proposed design is compatible with the character of the neighborhood.
>
> For any project involving complete demolition of Heritage Properties or Potential Designated Historic Properties requiring discretionary City permits, the City will make a finding that: (1) the design quality of the proposed project is at least equal to that of the original structure and is compatible with the character of the neighborhood; or (2) the public benefits of the proposed project outweigh the benefit of retaining the original structure; or (3) the existing design is undistinguished and does not warrant retention and the proposed design is compatible with the character of the neighborhood.
>
> Policy 3.8 Definition of "Local Register of Historical Resources" and Historic Preservation "Significant Effects" for Environmental Review Purposes: For purposes of environmental review under the CEQA, the following properties will constitute the City of Oakland's Local Register of Historic Resources:
>
> 1) All Designated Historic Properties, and
>
> 2) Those Potential Designated Historic Properties that have an existing rating of "A" or "B" or are located within an Area of Primary Importance.

3) Until complete implementation of Action 2.1.2 (Redesignation), the "Local Register" will also include the following designated properties: Oakland Landmarks, S-7 Preservation Combining Zone properties, and Preservation Study List properties.

## 4.4.4 Impacts and Mitigation Measures

### *Significance Criteria*

The impact of the proposed project on cultural resources would be considered significant if it would exceed the following Standards of Significance, in accordance with Appendix G of the *CEQA Guidelines* and the UC CEQA Handbook:

- Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5;
- Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5;
- Directly or indirectly destroy a unique paleontological resource or site or unique geological feature; or
- Disturb any human remains, including those interred outside of formal cemeteries.

### *Issues Not Discussed Further*

The Helios project Initial Study determined that implementation of the proposed project would not directly or indirectly destroy a unique paleontological resource or site or unique geologic feature. This issue is not discussed further in this section.

### *Mitigation Measures included in the Proposed Project*

The following mitigation measures, adopted as part of the 2006 LRDP, are required by the 2006 LRDP for the proposed project and are thus included as part of the proposed project. The analysis presented below evaluates environmental impacts that would result from project implementation following the application of these mitigation measures. The mitigation measures that are included in the proposed project would be monitored pursuant to the Mitigation Monitoring and Reporting Plan that will be adopted for the proposed project.

**LRDP MM CUL-3:** If an archaeological artifact is discovered on site during construction under the proposed LRDP, all activities within a 50-foot radius shall be halted and a qualified archaeologist shall be summoned within 24 hours to inspect the site. If the find is determined to be significant and to merit formal recording or data collection, adequate time and funding shall be devoted to salvage the material.

Any archaeologically important data recovered during monitoring shall be cleaned, catalogued, and analyzed, with the results presented in a report of finding that meets professional standards.

**LRDP MM CUL-4:** In the event that human skeletal remains are uncovered during construction or ground-breaking activities resulting from implementation of the 2006 LRDP at the LBNL site, *CEQA Guidelines* Section 15064.5(e)(1) shall be followed:

- In the event of the accidental discovery or recognition of any human remains in any location other than a dedicated cemetery, the following steps should be taken:

  (1) There shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until:

  (A) The coroner of the county in which the remains are discovered must be contacted to determine that no investigation of the cause of death is required, and

  (B) If the coroner determines the remains to be Native American: (1) The coroner shall contact the Native American Heritage Commission within 24 hours. (2) The Native American Heritage Commission shall identify the person or persons it believes to be the most likely descended from the deceased Native American. (3) The most likely descendent may make recommendations to the landowner or the person responsible for the excavation work, for means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods as provided in Public Resources Code Section 5097.98, or

  (2) Where the following conditions occur, the landowner or his authorized representative shall rebury the Native American human remains and associated grave goods with appropriate dignity on the property in a location not subject to further subsurface disturbance.

  (A) The Native American Heritage Commission is unable to identify a most likely descendent or the most likely descendent failed to make a recommendation within 24 hours after being notified by the commission;

  (B) The descendant identified fails to make a recommendation; or

  (C) The landowner or his authorized representative rejects the recommendation of the descendant, and the mediation by the Native American Heritage Commission fails to provide measures acceptable to the landowner.

## *Project Impacts and Mitigation Measures*

**Helios Impact CUL-1: The proposed project would not cause a substantial adverse change in the significance of a historical resource as defined in §15064.5. (*Less than Significant*)**

Although under all four Helios Access Road intersection options, a small shed (Building 73A) would be demolished, and under three of the four intersection options, a larger building (Building 73) would be demolished, neither structure qualifies as a historic resource based on its age. Therefore, no project-level impact on historic resources would occur and the project would not contribute to the loss of any historic resources.

As discussed earlier, Strawberry Canyon has not been evaluated nor designated a cultural landscape by the City of Berkeley Landmarks Preservation Commission or the State Historic Preservation Officer. Furthermore, at this time the City does not have an ordinance to designate cultural landscapes, the canyon has not been recorded or nominated to the National Register or California Register as a cultural landscape, and it is not clear that it has characteristics that would warrant such nomination or would make it eligible for listing. Therefore, there is currently no basis for determining that the project would result in an impact on Strawberry Canyon as a potential cultural landscape.

**Mitigation Measure:** No project-level mitigation measure required.

**Helios Impact CUL-2: The proposed project would not cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5. (*Less than Significant*)**

Most of the project site has been subject to extensive disturbance in conjunction with the construction of the Molecular Foundry building, Building 31, and access roads. However, based on archival research from the Northwest Information Center and the project's proximity to Chicken Creek, the potential for Native American sites to exist on the project site is considered moderate and undiscovered archaeological resources could be discovered during construction. With respect to Wastewater Options 1 through 3 which would require some limited trenching within existing street right-of-ways, the potential to encounter undisturbed archaeological resources is considered low. However, in the event of the discovery of any archaeological resources during construction, LRDP Mitigation Measure CUL-3 that is included in the proposed project and involves work stoppage and appropriate treatment and Native American involvement, would be implemented. As a result, the proposed project would result in a less than significant impact on archaeological resources.

**Mitigation Measure:** No project-level mitigation measure required.

**Helios Impact CUL-3: The proposed project would not disturb any human remains, including those interred outside of formal cemeteries. (*Less than Significant*)**

As discussed above under the Helios Impact CUL-2, based on archival research from the Northwest Information Center, there is a moderate potential that undiscovered archaeological resources could be discovered during construction activities. These undiscovered archaeological resources include human remains, including those interred outside of a formal cemetery. However, with the implementation of LRDP Mitigation Measure CUL-4, which is included in the proposed project, in the event that human remains are discovered during construction activities, all construction activities would be halted and a qualified archaeologist will be summoned within 24 hours to inspect the site. In addition, the mitigation measure would assure that any human remains, include those interred outside of formal cemeteries, are handled and preserved without further disturbance and maintaining appropriate dignity.

**Mitigation Measure:** No project-level mitigation required.

## 4.4.5 References

City of Berkeley. 2002. City of Berkeley General Plan, Urban Design and Preservation Element, Figure 25: City-Designated Landmarks, Structures of Merit and Districts as of November 2001, adopted April 23.

Dobkin, M. and M. Corbett. 1992. Final Historic Architectural Evaluation of Building 7, Lawrence Berkeley Laboratory, University of California, November.

Harvey, D.W. 2003. Identification and Evaluation of Old Town Buildings, Ernest Orlando Lawrence Berkeley National Laboratory, January.

Kielusiak, C. 2000. Archaeological Survey of 70 Acres of Land and Recordation and Evaluation of Four Historic Resources at the Lawrence Berkeley National Laboratory, February.

Kroeber, A.L. 1925. Handbook of the Indians of California. Bureau of American Ethnology, Bulletin 78, Smithsonian Institution, Washington, DC (Reprint by Dover Publications, Inc., New York, 1976).

Lawrence Berkeley National Laboratory. 2007. 2006 Long Range Development Plan Final Environmental Impact Report, SCH No. 2000102046, July.

Northwest Information Center. 2003. Records Search for Lawrence Berkeley National Laboratory, December.

Office of Historic Preservation, State of California. 2003. Historic Properties Listing, by City (through June 2003). State of California Office of Historic Preservation, Sacramento, CA.

# 4.5 GEOLOGY AND SOILS

## 4.5.1 Introduction

This section identifies existing geologic conditions at the Helios project site and analyzes the potential for the project to affect those resources. Information presented in the discussion and subsequent analysis was drawn from site visits, existing Lawrence Berkeley National Laboratory (LBNL) reports, and environmental documents associated with previous LBNL projects.

In response to the Notice of Preparation for this Environmental Impact Report (EIR), several commenters expressed concern regarding past landslides near the project site. Several commenters expressed concern with respect to the project's proximity to the Hayward Fault and the probability of an earthquake occurring on that fault line. All of these scoping comments are addressed in the impact assessment presented below.

## 4.5.2 Environmental Setting

The sections below present a description of the environmental setting of the LBNL site related to geology and soils, concentrating primarily on aspects that are specific to the Helios project site.

### *Geology*

LBNL is located within the California Coast Ranges geomorphic province that parallels the boundary between two major tectonic plates—the Pacific and North American plates. The predominate rock types within this province are marine sedimentary and volcanic rocks that were originally part of the intact, overriding (North American) plate. The units were uplifted after the plate margin changed from a subduction zone to a transform fault, approximately 25 million years ago (Alt and Hyndman 2000).

The proposed Helios site is located near the contact of two geologic units—an unnamed Cretaceous sandstone/shale unit (Ks) within the Great Valley sequence and the Tertiary-aged Orinda formation (Tor), which is composed predominately of sandstone and siltstone (Graymer 2000). The two units are separated by an old, inactive fault that formed during the uplift of the Berkeley Hills.

Based on geologic mapping by Kleinfelder (Lewis 2003) for the Molecular Foundry building adjacent to the proposed Helios site, the Helios facility will likely lie predominately on sandstone within the Orinda formation. This sandstone unit has a low permeability, but is somewhat more permeable than the surrounding units, as discussed below. At this location, the sandstone beds dip steeply to the northeast, opposite the direction of the ground surface slope (Korbay 2003). The northern portion of the project site

(as well as Building 31) overlies a bedrock landslide block composed primarily of Orinda formation material. This unit has very low permeability (LBNL 2007).

The Great Valley sequence units underlie the southwestern portion of the Helios project. Close to the contact with the Orinda formation, these rocks are sheared due to past movement along the inactive fault that separates the units, and as a result have a very low permeability (LBNL 2007).

Colluvium and artificial fill of varying thickness overlie the bedrock within the Helios project site. Over much of the site this unconsolidated material is relatively thin (less than 10 feet). However, south of Building 31 (in the northern portion of the Helios site) unconsolidated Quaternary colluvial deposits are as much as 75 feet thick.

## *Topographic Setting*

The proposed Helios project is located within the Strawberry Creek watershed, on the side-slopes of Strawberry Canyon at an elevation between about 700 and 800 feet above mean sea level. The land surface at the site slopes to the south-southwest at an average of about 15 percent, though the existing slope varies considerably due to terracing when the roads and parking lots in the area were constructed.

## *Mineral Resources*

LBNL is located in an area where no significant mineral or aggregate deposits are present (Stinson and others 1983).

## *Soils*

The proposed site of the Helios Facility is located in an area of Altamont clay soils (NRCS 1981), though soils classified within the Xerorthents-Millsholm complex are present just to the north of the site, and Maymen-Los Gatos complex soils are present just to the east of the site. The Altamont Clay is a deep, well-drained soil with 30 to 50 percent slopes with high shrink-swell capacity. The Xerorthents-Millsholm and Maymen-Los Gatos complexes are also well-drained soils on 30 to 50 percent slopes and 30 to 75 percent slopes respectively. All soil types present in the project area are highly susceptible to erosion due to potentially rapid runoff rates and relatively high slopes.

Several roadway terraces are present on the Helios site, and the site is adjacent to the recently constructed Molecular Foundry building. The construction of these facilities, along with associated grading and cut-and-fill, has disturbed the soil and altered the native soil properties at the site.

## Groundwater

Due to the high relief and the varying geologic units at the LBNL site, depth to groundwater levels within the LBNL can vary considerably, both spatially and temporally. Depth to water at the Helios site varies from greater than 50 feet below ground surface to less than 10 feet. This variation is due primarily to the complex geology of the site and the low permeability of the units. A complete discussion of the groundwater setting of the Helios site is provided in **Section 4.7, Hydrology and Water Quality**, of this EIR.

## Seismicity and Faults

The proposed Helios project is located approximately 0.5 mile west of the Hayward Fault trace, one of several major fault zones present within the San Francisco Bay Area. The most recent major earthquake on the Hayward Fault occurred in 1868 (on the southern portion of the fault, near Mills College). The USGS Working Group on California Earthquake Probabilities estimates there is a 27 percent chance the Hayward–Rodgers Creek Fault System[1] will experience an earthquake of M 6.7 or greater by 2032 (USGS 2003). A major earthquake on the Hayward Fault is anticipated to produce violent to very violent ground-shaking within the LBNL site and correspondingly at the site of the Helios Facility, with peak bedrock accelerations of up to 0.7 g (Bolt 1992).[2]

Additionally, the San Andreas Fault parallels the Hayward Fault approximately 17 miles west of LBNL, and the Great Valley-Concord-Calaveras Fault zone is located about 13 miles to the east. Taken together, along with other faults in the area, there is a 62 percent probability of at least one magnitude 6.7 or greater earthquake striking the San Francisco Bay Area before 2032 (USGS 2003). The intensity of ground-shaking at LBNL would be less the further away the epicenter of the earthquake is. However, a major earthquake on any of the Bay Area faults could still produce violent shaking at the Helios project site.

While active fault traces have been identified within the LBNL site, these are all located within the western portion of LBNL, near the main trace of the Hayward Fault. No known active fault traces are present at the site of the Helios project.

Another potential seismic hazard is that of earthquake-induced settlement. Buildings constructed on compressible sediment may be subject to differential settlement of soils during an earthquake, depending

1 The Hayward Fault is associated with the Rogers Creek fault, located north of San Pablo Bay, and are often combined into one shear zone when discussed in the context of regional tectonics.

2 Ground-shaking magnitude is typically referenced to gravitational acceleration (g) for engineering purposes.

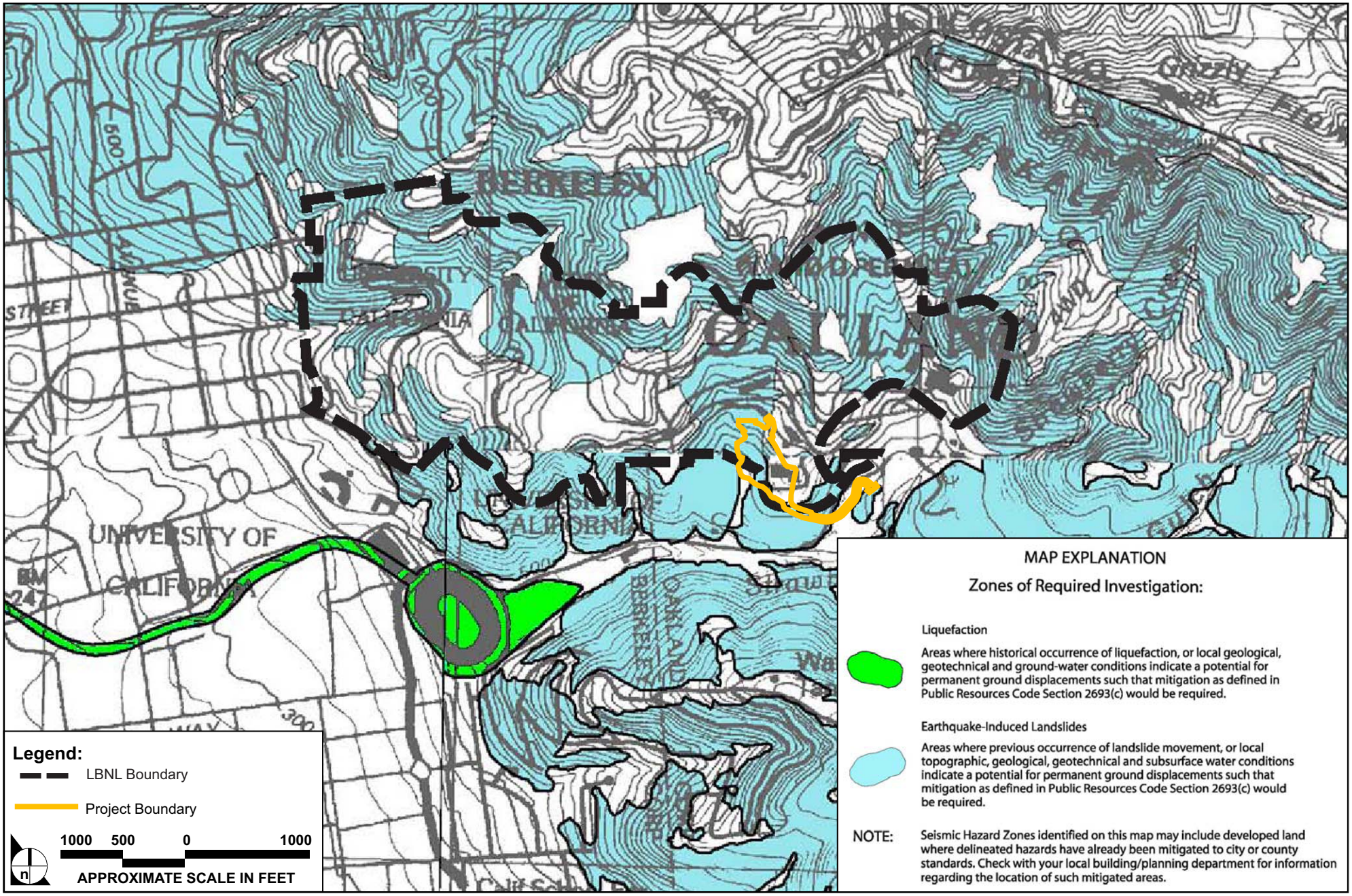
on the distribution of the building weight, the type and condition of the underlying sediment, and the intensity or style of ground-shaking experienced at the site. Primary areas of concern regarding differential settlement include the Bay Mud present near San Francisco Bay and other areas of deep sediment deposits, as well as areas of poorly engineered fill. The Helios site is primarily located on relatively thin soils underlain by bedrock material, except in the northern portion which overlies thick unconsolidated material. The site has undergone several stages of alteration, beginning as early as 1939 with the terracing of the slope adjacent to Chicken Creek, and as recently as 2005 during the construction of the Molecular Foundry building. The roads and parking adjacent to the western side of the proposed facility appear to overlie fill prisms that may not have compacted to current standards.

### *Landslides*

LBNL is located in an area with a high occurrence of landslides and other slope instability. The California Geological Survey Seismic Hazard Zones map (CGS 2003) shows that much of the LNBL site is located within areas of previous landslide movement or conditions that indicate a high probability of ground displacement (**Figure 4.5-1, Seismic Hazard Zone Map**).

Wentworth and others (1997) provided a summary of the distribution of landslides delineated within Alameda County. The Helios project site is located in an area delineated as 'mostly landslides', one of two areas within the LBNL site delineated as having a high concentration of landslides. Aerial photograph inspection of the area shows that the Chicken Creek/No Name Creek drainage basin is formed in a landslide-scarred basin that reaches as far as north as Centennial Drive north of Building 77, and Jordan and others (LBNL 2007) note the presence of a bedrock landslide block underlying Building 31. Two hydraugers were installed in the 1970s to stabilize this area, at least one of which is over 1,000 feet long. The two hydraugers discharge at the head of No Name Creek.

In 1978, work was completed to stabilize the upper end of a slide that was identified to the west of Building 62 parking lot, including the installation of two subdrains and the addition of compacted fill (Korbay 2003). Korbay (2003) also notes that the sandstone units present to the north and west of the Molecular Foundry building (the site of the Helios Facility) dip at a 35 degree angle to the northeast, opposite the ground-surface slope, which is a "generally favorable orientation from the standpoint of slope stability." Based on mapping of landslides at a countywide scale, no major landslides were delineated near the Helios project site during the very wet conditions in the 1997 to 1998 El Nino season (Coe and others 1999). This suggests that landslide stabilization techniques have been at least somewhat effective.




**SOURCE:** California Department of Conservation, California Geologic Survey, 2003; LBNL 2006 Long Range Development Plan

FIGURE **4.5-1**

# Seismic Hazard Zone Map

LBNL has undertaken detailed mapping of slope instability within the LBNL site (LBNL 1999). The map shows that the proposed Helios project lies just north of an identified slide that has been designated a 'low risk' area of landslide movement, and corresponds to the slide that was partially stabilized by the 1978 work near the Building 62 parking lot. This slide may be associated with groundwater discharge along the slide toe, supporting year-round baseflow in Chicken Creek.

Several landslides have been identified along the slope south of Building 62 above Centennial Drive. Several of the slides in this area appear to head at or near the existing access road, and are generally small, shallow-seated slumps less than 100 feet wide. The upper portion of one of these slides (located directly south of Building 62) has been repaired, though recent slumping has been observed near the toe of the slide.

### *Other Hazards*

Several other geologic and seismic hazards are unlikely to affect the LBNL site, including tsunami, seiche, and liquefaction. These hazards, correspondingly, are not likely to affect the proposed Helios project, and are therefore not discussed in this EIR.

## 4.5.3 Regulatory Considerations

This section briefly summarizes regulatory requirements that govern proposed projects within LBNL, expanding where necessary to describe how the regulations specifically affect the proposed Helios project.

### *State Regulations*

#### Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (originally enacted in 1972) is intended to regulate development on or near active fault traces to reduce the hazardous effects of fault rupture. The Act prohibits the construction of most buildings intended for human occupancy across active fault traces, and therefore requires that site-specific fault-trace studies be conducted for projects within delineated fault zones to identify potential active fault traces. The proposed Helios project is not located within an Alquist-Priolo Zone associated with the Hayward Fault, and therefore a fault trace study is not required.

#### Seismic Hazards Mapping Act

The State Geologist has delineated various seismic hazard zones related to ground-shaking, liquefaction, landslides, and other types of ground failure to better regulate development in hazard-prone areas.

Geotechnical investigations conducted within Seismic Hazard Zones must incorporate standards specified by CGS Special Publication 117, *Guidelines for Evaluating and Mitigating Seismic Hazards*. The CGS has designated much of the LBNL site as a seismic hazard zone for earthquake-induced landslides. As described above, the Helios project is located within this zone (**Figure 4.5-1, Seismic Hazard Zone Map**).

**California Building Code**

The California Building Code requires extensive geotechnical analysis and engineering for grading, foundations, retaining walls, and other structures, including criteria for seismic design. The San Francisco Bay area is located within Zone 4, which is expected to experience the greatest effects from earthquakes, and requires the most stringent requirements for seismic design.

## *Local Plans and Policies*

The proposed project would be located at LBNL, which is operated by the University of California and conducts work within the University's mission on land that is owned or controlled by The Regents of the University of California. As a state entity, the University is exempted by the state constitution from compliance with local land use regulations, including general plans and zoning. However, the University seeks to cooperate with local jurisdictions to reduce any physical consequences of potential land use conflicts to the extent feasible. LBNL is located in both the city of Berkeley and the city of Oakland. The following sections summarize objectives and policies in the LBNL 2006 LRDP, LBNL Design Guidelines, the City of Berkeley and City of Oakland General Plans, and local ordinances that relate to geology and soils.

**University of California Seismic Safety Policy**

The University of California Seismic Safety Policy requires that all "new buildings…comply with the current provisions of the California Building Code, or local seismic requirements, whichever is more stringent" and that "no new University structures…[will] be constructed on the trace of a known active fault."

**2006 LRDP Principles and Strategies**[3]

The 2006 LRDP outlines a series of development strategies to meet the core planning principles to "Preserve and enhance the environmental qualities of the site as a model of resource conservation and environmental stewardship" and to "Build a more campus-like research environment." As listed in the 2006 LRDP, the strategies most relevant to geology and soils include:

- Protect and enhance the site's natural and visual resources, including native habitats, streams, and mature tree stands by focusing future development primarily within the already developed areas of the site;
- Increase development densities within the most developed areas of the site to preserve open space, enhance operational efficiencies and access;
- To the extent possible site new projects to replace existing outdated facilities and ensure the best use of limited land resources;
- To the extent possible site new projects adjacent to existing development where existing utility and access infrastructure may be utilized; and
- Site and design new facilities in accordance with University of California energy efficiency and sustainability policy to reduce energy, water, and material consumption and provide improved occupant health, comfort, and productivity.

**LBNL Design Guidelines**

The LBNL Design Guidelines (Appendix B to the 2006 LRDP EIR; LBNL 2007) provide guidelines to meet the planning principles and strategies listed in the 2006 LRDP. The primary guidelines that pertain to geologic resources include:

- Minimize impacts of disturbed slopes;
- To the degree practicable cut and fill slopes will be minimized. Cut and fill slopes exposed to view shall be promptly restored, using best management practices to minimize erosion. New vegetation should be planted in a manner to return the visual quality of the slope to a condition similar to its original state or better;
- Building footprints shall be designed with long narrow aspect ratios in parallel to natural terrain to the degree consistent with program needs; and
- Reduce the amount of impermeable surfaces at the Berkeley Lab.

3 While this Environmental Impact Report presents a "stand alone" impact analysis that does not rely upon tiering from any programmatic CEQA document, Berkeley Lab does actively follow the 2006 LRDP as a planning guide for Lab development. Accordingly, relevant 2006 LRDP principles, strategies, and design guidelines are identified in this section.

**City of Oakland General Plan**

Open Space Objective OS-1 is "To conserve and appropriately manage undeveloped areas in Oakland which have high natural resource value, scenic value, or natural hazards which preclude safe development." The following policies are relevant to the proposed project:

> Policy OS-1.3 Relate New Development to Slope: Limit intensive urban development to areas where the predominant slope is less than 15 percent. Design development on slopes between 15 and 30 percent to minimize alteration of natural landforms. Strongly discourage development on slopes greater than 30 percent. To the extent permitted by law, when land is subdivided into two or more lots, retain areas with slopes over 30 percent as private, public, or common open space.

Open Space Objective OS-3 is "To retain major institutional and functional open space areas and enhance their recreational and aesthetic benefits." The following policies are relevant to the proposed project:

> Policy OS-3.1 University, College, and Institutional Open Space: Retain open space at Oakland's universities, colleges, and other institutions where such open space provides recreational, aesthetic, conservation, or historic benefits. Where such open spaces are publicly owned, as at the community colleges, support the permanent retention of athletic fields and other recreational areas as open space. Such areas should not be converted to development unless they are replaced in kind with comparable areas or facilities in the immediate vicinity; and
>
> Policy OS-3.1.1 Conservation of UC Hill Property: After creating the new Resource Conservation Zone, work with the University of California to include in the zone portions of the campus designated for conservation in the campus Long Range Development Plan.

Open Space Objective OS-9 is "To retain Oakland's natural features and topography wherever possible and recognize their important role in defining the character and image of the City and its neighborhoods." The following policies are relevant to the proposed project:

> Policy OS-9.1 Protection of Natural Landforms: Design new development to preserve natural topography and terrain. Enhance prominent topographic features where appropriate by parks, plazas, or architectural expressions.

Conservation Objective CO-2 is "To minimize safety hazards, environmental impacts, and aesthetic impacts associated with development on hillsides and in seismic high-risk areas." The following policies are relevant to the proposed project:

Policy CO-2.1 Slide Hazards: Encourage development practices which minimize the risk of landsliding;

Policy CO-2.2 Unstable Geologic Features: Retain geologic features known to be unstable, including serpentine rock, areas of known landsliding, and fault lines, as open space. Where feasible, allow such lands to be used for low-intensity recreational uses; and

Policy CO-2.4 Hillside Cuts and Fills: Minimize hillside cuts and fills and the removal of desirable vegetation. Limit large-scale grading to those areas where it is essential to development. Where hillside grading does occur, reshape the terrain in smooth, naturally appearing contours rather than flat, terraced benches. Immediately replant and reseed graded areas to reduce soil loss.

## 4.5.4 Impacts and Mitigation Measures

### *Significance Criteria*

The impact of the proposed project related to geology and soils would be considered significant if it would exceed the following Standards of Significance, in accordance with Appendix G of the *CEQA Guidelines* and the UC CEQA Handbook:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area, or based on other substantial evidence of a known fault (refer to CGS Special Publication 42);
  - Strong seismic ground-shaking;
  - Seismic-related ground failure, including liquefaction; or
  - Landslides.
- Result in substantial soil erosion or the loss of topsoil;
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;
- Be located on expansive soil, as defined in Table 18-1-B of the California Building Code, creating substantial risks to life or property; or

- Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

## *Issues Not Discussed Further*

No septic systems or other infiltrating wastewater disposal systems are proposed as part of the Helios project. The Helios project Initial Study found no impacts associated with wastewater infiltration facilities. This issue is not discussed further in this section.

## *Mitigation Measures included in the Proposed Project*

The following mitigation measures, adopted as part of the 2006 LRDP, are required by the 2006 LRDP for the proposed project and are thus included as part of the proposed project. The analysis presented below evaluates environmental impacts that would result from project implementation following the application of these mitigation measures. These mitigation measures that are included in the project would be monitored pursuant to the Mitigation Monitoring and Reporting Plan that will be adopted for the proposed project.

**LRDP MM GEO-1**: Seismic emergency response and evacuation plans shall be prepared for each new project at LBNL that is developed pursuant to the 2006 LRDP. These plans shall incorporate potential inaccessibility of the Blackberry Canyon entrance and identify alternative ingress and egress routes for emergency vehicles and facility employees in the event of roadway failure from surface fault rupture.

**LRDP MM GEO-2**: A site-specific, design-level geotechnical investigation shall occur during the design phase of each LBNL building project, and prior to approval of new building construction within the LBNL hill site. This investigation shall be conducted by a licensed geotechnical engineer and include a seismic evaluation of potential maximum ground motion at the site. Geotechnical investigations for sites within either a Seismic Hazard Zone for landslides or an area of historic landslide activity at LBNL, as depicted on Figures IV.E-2 and IV.E-3 [in the LRDP EIR], or newly recognized areas of slope instability at the inception of project planning, shall incorporate a landslide analysis in accordance with CGS Publication 117. Geotechnical recommendations shall subsequently be incorporated into building design.

**LRDP MM GEO-3a**: Construction under the LRDP shall be required to use construction best management practices and standards to control and reduce erosion. These

measures could include, but are not limited to, restricting grading to the dry season, protecting all finished graded slopes from erosion using such techniques as erosion control matting and hydroseeding or other suitable measures.

**LRDP MM GEO-3b**: Revegetation of areas disturbed by construction activities, including slope stabilization sites, using native shrubs, trees, and grasses, shall be included as part of all new projects.

## *Project Impacts and Mitigation Measures*

**Helios Impact GEO-1: The proposed project would not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault. (*Less than Significant*)**

Although the project is located near the Hayward Fault, the project site is not located within an Alquist-Priolo-defined fault zone associated with that fault, and no known active fault traces are present on the site. A specific fault-trace study is not required for the site, though other geotechnical investigations are being conducted (see discussion for Helios Impact GEO-3).

**Mitigation Measure:** No project-level mitigation measure required.

**Helios Impact GEO-2: The proposed project would not expose people to potential substantial adverse effects, including the risk of loss, injury, or death involving seismic ground-shaking hazards, although some structures could sustain damage. (*Potentially Significant; Less than Significant with Mitigation*)**

The project site is located in a seismically active area. Seismic ground-shaking could damage the proposed buildings, roadway, retaining walls, and other ancillary facilities such as stormwater vaults and the development of the proposed project would expose future facility users to seismic ground-shaking. The proposed Helios Facility is expected to contain up to approximately 500 people on a day-to-day basis. With the proposed auditorium, periodic maximum capacity could reach 750 persons. About 130 of the 500 people would relocate from other locations within LBNL or UC Berkeley. Seismic shaking hazards would be less or approximately equivalent for these people, as many would be moving from older buildings that were built using less stringent seismic safety codes. The other 370 employees and graduate students, however, would be "new" and would be relocating from other areas. Although some of these 370 persons may already be present in the Bay Area (or live in a similarly active seismic area) at the time that they come to the project site for work or research, conservatively it is assumed that the additional

persons would be relocating from less seismically active areas.[4] This population, then, may be at an incrementally greater risk of injury due to seismic shaking.

Similar to all new buildings at LBNL, the proposed Helios Facility would be designed and constructed under the latest and most stringent seismic guidelines. It would comply with the requirements of the current California Building Code, the University of California seismic design safety policies, and "Lateral Force Design Criteria" of LBNL Design Management Procedures. Furthermore, the structural design of the proposed building would be reviewed by the UC Berkeley Seismic Review Committee which consists of leading world experts on seismic design.

The University of California Seismic Safety Policy prescribes that all new buildings be constructed to "comply with the current seismic provisions of CCR, Title 24, California Building Standards Code, or local seismic requirements, whichever requirements are more stringent."[5] Following this policy the Helios project also includes "provisions…for adequate anchorage for seismic resistance of nonstructural building elements—including, but not limited to, glass, fixtures, furnishings, and other contents, equipment, material storage facilities, and utilities (gas, high-temperature water, steam, fire protection water, etc.)— with respect to potential hazards to persons in the event of seismic disturbances."

In compliance with CGS Publication 117 (Guidelines for Evaluating and Mitigating Seismic Hazards) and LBNL's "Force Design Criteria RD3.22," the Helios Facility has been designed to resist seismic loading. The design ground motions shall have no more than a 2 percent chance of being exceeded within a 50-year period. Although conformance to the highest seismic provisions does not constitute any guarantee that structural damage would not occur in the event of a maximum credible earthquake, it is reasonable to expect that structures built in compliance with the seismic requirements would not collapse or cause loss of life in a major earthquake. Furthermore, in order to reduce the risk of injury during seismic events, the LBNL job hazards questionnaire recommends that new employees take a 1.5-hour earthquake/wildland fire safety course to teach employees how to take the appropriate actions to protect themselves from the harmful effects of a major earthquake (or wildland fire) in the Bay Area. UC Berkeley through its Office of Emergency Preparedness also implements programs focused on emergency planning, training, response, and recovery. This includes education of all UC building occupants (UCB 2005). The Berkeley Lab or UC Berkeley would take the lead in implementing the training programs for Helios Facility occupants. All new employees at the Helios Facility would be provided training which

4 It is possible, for example, that the new population would be relocating from other National Labs, such as Argonne National Lab near Chicago, or Oak Ridge National Lab in Tennessee; both of which have considerably lower seismic risk than LBNL.

5 See http://www.ucop.edu/facil/fmc/facilman/volume1/rpsafety.html for more details.

would further reduce the potential for significant adverse impacts on those individuals from a major seismic event.

Additionally, there are seismic shaking hazards beyond that associated with building collapse, including falling debris, fire, gas leaks, and others that are difficult to quantify given the potential magnitude and unpredictable nature of seismic events. The UC Seismic Safety Policy dictates stringent standards intended to limit the impacts of such hazards; and the LBNL Master Emergency Program Plan (LBNL, 2005) outlines the procedure for assessing damages to buildings and infrastructure following large seismic events. Following major earthquakes the LBNL Damage Assessment Team, composed of engineers and EHS safety specialists, will inspect buildings for structural and other infrastructure damage.

Beyond potential damage to the Helios building itself, there are several associated facilities that, if damaged in an earthquake, could cause significant environmental impacts. Of primary concern are the stormwater (hydromodification) vaults and associated stormwater drainage system, and the retaining walls along the steeply-sloped portion of the proposed Helios Access Road. While these structures would also be built to withstand seismic shaking hazards, following the UC seismic safety code and based on site-specific geotechnical recommendations, minor damage during one event could weaken the structure(s) such that it would be more likely to fail during a subsequent event or events. Failure of the stormwater drainage system or hydromodification vault could, over time, serve to infiltrate stormwater on steeply sloped areas not suitable for infiltration. Damage to retaining walls may weaken the structure and make the area more susceptible to ground movement. This would be a potentially significant impact. Because of this concern, Helios Mitigation Measure GEO-2 expands the damage assessment component to include specific auxiliary structures that are not part of the Helios building itself, including the stormwater system and retaining walls along steeply-sloped portion of the proposed Helios Access Road.

**Helios Mitigation Measure GEO-2:** In addition to damage assessment of the Helios building (which is covered in the LBNL Master Emergency Program Plan), assessment of stormwater conveyance systems and detention/retention ponds and Helios retaining walls will be conducted by the Damage Assessment Team following earthquakes strong enough to cause damage.

**Significance after Mitigation:** With the implementation of the seismic safety measures outlined above and the proposed Helios Mitigation Measure GEO-2, the impact would be reduced to a less than significant level.

**Helios Impact GEO-3: The proposed project could expose people and structures to seismic landslide hazards. (*Potentially Significant; Less than Significant with Mitigation*)**

As described above, the proposed Helios project is located in a CGS-defined seismic landslide hazard area; though the LBNL slope stability map does not designate a risk at the site. In the late 1970s, several projects were implemented to stabilize slopes adjacent to the project site, including the installation of several hydraugers to dewater the slopes. A site-specific geotechnical investigation is currently being conducted by Alan Kropp and Associates (AKA) to address potential landslide hazard at and near the project site. Of particular concern are the thick unconsolidated deposits present within the northern portion of the project site. The geotechnical study includes a series of soil borings and a seismic refraction survey to further delineate the extent of these deposits and to differentiate true colluvial deposits from landslide deposits within the project area. This analysis will be used to develop engineering design concepts suitable to the site conditions and to meet California Building Code and UC Seismic Safety standards.

Throughout the geotechnical study, AKA will work with LBNL and the project design team to adapt project designs to geotechnical considerations, and to tailor geotechnical recommendations to specific elements considered in the project design. Given the location of the project and the potential for landslides in the area, this potential impact is considered significant. To address this potentially significant impact, implementation of Helios Mitigation Measure GEO-3 is proposed.

**Helios Mitigation Measure GEO-3**: All recommendations of the site-specific geotechnical study shall be incorporated into the project design and implemented as part of the project.

**Significance after Mitigation:** Preliminary evaluation of the project site by AKA has shown that standard engineering solutions are available to address the geologic conditions at the project site. Therefore, with the implementation of the proposed mitigation measure, the impact would be reduced to a less than significant level.

**Helios Impact GEO-4: The proposed project is located in an area of expansive soils that could create substantial risk to life or property. (*Potentially Significant; Less than Significant with Mitigation*)**

The Helios site is underlain primarily by Altamont Clay soils that are described as having a high shrink-swell capacity. Though portions of the site have been disturbed by past grading for the Redwood cluster and associated service road, there is still the potential for expansive soils to impact the proposed Helios structure. Some of the earthwork was completed over 60 years ago and fill may not have been engineered to current standards. The geotechnical investigation for the proposed project includes an assessment of the effect of expansive soils. Preliminary analysis indicates that the geotechnical risk as a result of expansive soils is low, especially because the project will require a relatively large amount of

imported fill. Therefore the impact is considered less than significant. Furthermore, based on the results and recommendations of the geotechnical investigation, adequate measures will be incorporated into the project design, if required, to address expansive soils. Implementation of geotechnical recommendations (in compliance with Helios Mitigation Measure GEO-3) will reduce this impact to a less than significant level.

**Mitigation Measure**: No project level mitigation measure required.

**Helios Impact GEO-5: The proposed project is located on a geologic unit that may be unstable or could become unstable as a result of the project. (*Potentially Significant; Less than Significant with Mitigation*)**

The discussion of Helios Impact GEO-3 highlights potential landslide hazards at the building site. Additional instability of underlying units may be attributed to differential settlement, soil creep, or the triggering of localized slumps or landslides in response to grading at the site. Of particular concern for the Helios project site is the potential for changes in groundwater conditions, caused by rerouting of the groundwater by the subdrain system or concentration of infiltrated stormwater on unstable material, to induce slope instability. The Helios Facility will extend up to 45 feet below the current ground surface, which is below the ground water piezometric surface in the area. While this does not necessarily mean that the building substructure will intercept groundwater, as groundwater in the area is generally confined and may not be present within the low-permeability units underlying the site,[6] it does suggest that groundwater levels have the potential to impact the stability of deposits within the project area. In addition, water quality swales have been included in the project that may serve to infiltrate excess stormwater, potentially affecting slope stability of deposits in the area.

The site-specific geotechnical study will address potential effects of groundwater levels on slope stability, particularly in areas where high retaining walls are proposed, such as along the Helios Access Road. Site-specific engineering measures to reduce the potential for slumping and other ground movement will be designed as part of the study, in collaboration with the project design team. Additionally, the geotechnical study will assess the stability of deposits in the area of the stormwater and water quality control features. In the areas where slumping or landslide materials are present along the Helios Access Road, the conditions will be evaluated by the project geotechnical engineer and repaired or removed before roadway construction. Furthermore, retaining walls with appropriate tie-backs and/or anchors and backdrains are proposed to stabilize the cut slopes in areas where there are major cuts along the access road.

6 In fact, the dewatering system for the Molecular Foundry building (just east of the Helios project and of similar, if not greater depth below the ground surface) has discharged little, if any, water since it was installed in 2005.

Implementation of Helios Mitigation Measure GEO-3 will reduce this impact to a less than significant level. However, to ensure that stormwater features do not result in slope instability, Helios Mitigation Measure GEO-5 is also proposed to further reduce the impact.

**Helios Mitigation Measure GEO-5:** The project proposes the use of water quality swales to treat stormwater runoff. These treatment facilities often incorporate infiltration of stormwater to provide water quality treatment. If site-specific geotechnical investigations indicate that infiltration of excess stormwater is not feasible due to slope-stability considerations, stormwater control and water quality treatment features will be designed with appropriate underdrain and/or retention systems to maintain the function of these facilities without infiltrating the collected stormwater.

**Significance after Mitigation**: Less than significant.

## 4.5.5 References

Alt, D., and Hyndman, D.W. 2000. *Roadside Geology of Northern and Central California.* Missoula, Montana: Mountain Press Publishing Company, 369p.

Bolt, B.A. Strong. 1979. Seismic Ground Motion for Design Purposes at the Lawrence Berkeley Laboratory. Technical report prepared for Lawrence Berkeley National Laboratory.

California Geological Survey (CGS). 2003. Seismic hazard zones, Richmond quadrangle, official map. Seismic Hazards Mapping Act publication, California Department of Conservation.

Coe, J.A., Godt, J.W., Brien, D., and Houdre, N. 1999. Map showing locations of damaging landslides in Alameda County, California, resulting from 1997–98 El Nino rainstorms. USGS Miscellaneous Field Studies Map, MF-2325-B.

Graymer, R.W. 2000. Geologic map and map database of the Oakland metropolitan area, Alameda, Contra Costa, and San Francisco Counties, California. U.S. Geological Survey Miscellaneous field studies MF-2342, 29p. + plates.

Korbay, S.R., and Lewis, L.E. 1980. Supplemental geotechnical exploration, Atomic Resolution Microscope Building, Lawrence Berkeley Laboratory, Berkeley, California. Consulting report prepared by Harding-Lawson Associates for LBNL, 12p.

Korbay, S.R. 2003. Landslide investigation, Molecular Foundry (Building 67), Lawrence Berkeley National Laboratory, Berkeley, California. Letter report prepared by Kleinfelder, Inc. for LBNL, dated October 14, 7p.

Lawrence Berkeley National Laboratory (LBNL). 2007. Hydrogeology and Tritium Transport in Chicken Creek Canyon, Lawrence Berkeley National Laboratory, Berkeley, California. Lawrence Berkeley National Laboratory Report, *LBNL-63557*. Prepared by P. D. Jordan and I. Javandel. October.

Lawrence Berkeley National Laboratory (LBNL). 2006. Site Environmental Report for 2005, Volume 1. Compiled by the LBNL Environment, Health, and Safety Division, 127p.

Lawrence Berkeley National Laboratory (LBNL). 1980. Master Emergency Program Plan for the Ernest Orlando Lawrence Berkeley National Laboratory. LBNL PUB-533, Revision 2, prepared by the LBNL Environment, Health and Safety Division for the U.S. Department of Energy, 49p+ appendices.

Lawrence Berkeley National Laboratory (LBNL). 1980. *Slope Stability Evaluation Map* revised March.

Lewis, L.E. 2003. Geotechnical investigation, Molecular Foundry Building, Lawrence Berkeley National Laboratory, Berkeley, California. Consulting report prepared by Kleinfelder, Inc. for LBNL, dated September 20, 2002, revised October 30, 57p.

Natural Resources Conservation Service (NRCS). 1981. Soil survey of Alameda County, western part. U.S. Department of Agriculture soil survey.

Pratt, J.J., and McCormick, W.V. 1980. Fault investigation, Computation Research and Theory building, Lawrence Berkeley National Laboratory, Berkeley, California. Consulting report prepared by Kleinfelder, Inc. for the Lawrence Berkeley National Laboratory, 44p.

Stinson, M. C., M. W. Manson, J. J. Plappert, and others. 1983. *Mineral Land Classification: Aggregate Materials in the San Francisco-Monterey Bay Area, Part II, Classification of Aggregate Resource Areas South San Francisco Bay Production-Consumption Region*, California Division of Mines and Geology Special Report 146.

UC Berkeley 2005. UC Berkeley 2020 Long Range Development Plan & Chang-Lin Tien Center for East Asian Studies Final Environmental Impact Report. January. SCH No, 2003082131.

U.S. Geological Survey (USGS).2003. Earthquake Probabilities in the San Francisco Bay Region: 2003–2032. Working Group On California Earthquake Probabilities Open-File Report 03-214, 235p.

Wentworth, C.M., Graham, S.E., Pike, R.J., Beukelman, G.S., Ramsey, D.W., and Barron, A.D. 1997. Summary distribution of slides and earth flows in Alameda County, California. Map created from USGS Open File Report 97-745, San Francisco Bay Region Landslide Folio, Digital Database.

# 4.6 HAZARDS AND HAZARDOUS MATERIALS

## 4.6.1 Introduction

This section discusses existing conditions with respect to hazards in the project vicinity (including soil and groundwater contamination from previous activities and wildland fires) and analyzes the potential for the Helios project to increase the exposure to hazards or increase the risk associated with the use, generation, and disposal of hazardous materials. This section also addresses impacts related to the use of certain scientific materials that do not meet the criteria for hazardous materials but the use of these materials in the proposed Helios project is a matter of concern for some in the surrounding community.

Information presented in the discussion and the analysis presented below was drawn from the Lawrence Berkeley National Laboratory (LBNL) 2006 Long Range Development Plan (LRDP) Environmental Impact Report (EIR), previous California Environmental Quality Act (CEQA) documents prepared for projects at LBNL, and the Master Emergency Plan Program for LBNL (2005).

In response to the Notice of Preparation for this EIR, several commenters expressed concern regarding the use of nanomaterials and genetically modified organisms in the research that would be conducted at the project site and for the potential of these materials to affect human health and the environment, both under routine operations and under upset conditions. Several commenters expressed concern with respect to the project's location in an area susceptible to wildland fires and for the project's potential to affect area evacuation. Commenters also expressed concern regarding existing contamination at the project site from historical uses. All of these scoping comments are addressed in the impact assessment presented below.

## 4.6.2 Environmental Setting

As stated in **Section 3.0, Project Description**, the Helios Facility would be constructed by LBNL and operated and maintained by University of California (UC) Berkeley. Therefore, current practices and environmental laws and regulations pertinent to both LBNL and UC Berkeley are discussed in the sections that follow.

### *Hazardous Materials*

The term "hazardous material" is defined in Section 25501 of the California Health and Safety Code as any material that, because of quantity, concentration, or physical or chemical characteristics poses a significant present or potential hazard to human health and safety or to the environment. Hazardous materials are grouped into the following four categories, based on their properties: toxic (causes human

health effects), ignitable (has the ability to burn), corrosive (causes severe burns or damage to materials), and reactive (causes explosions or generates toxic gases).

Numerous hazardous materials, including non-radioactive hazardous chemicals (solvents, organic compounds, reagents) and radioactive materials, are used in research activities at LBNL and at UC Berkeley. Other hazardous materials are used in facility operations and maintenance. Hazardous materials use at LBNL and UC Berkeley generates hazardous and mixed wastes (i.e., radioactive wastes with hazardous waste components). LBNL and UC Berkeley comply with applicable federal, state, and local laws and regulations for the handling, storage, and disposal of hazardous materials and wastes to minimize human exposure and environmental impact. In addition to the above, several sources of non-ionizing radiation (such as lasers, magnets, and microwave generators) are also used at LBNL and UC Berkeley to conduct research. The Helios project would also involve the use and management of hazardous materials and wastes in accordance with applicable federal, state, and local laws and regulations.

## *Other Scientific Materials*

Certain scientific materials that are not hazardous materials by definition would be used in the proposed Helios project. These scientific materials are a matter of concern for the surrounding community and include transgenic (genetically modified) organisms and nano scale research materials (nanomaterials).

**Nanomaterials**

Nanoscience is an emerging area of research aimed at the development of structures and devices at the atomic, molecular or macromolecular levels to produce materials with novel properties. Nanoparticles generally are particles with at least one dimension less than 100 nanometers. While some nanoparticles are naturally occurring (e.g., volcanic ash), or produced as unintentional byproducts of human activity (e.g., auto emissions), nanomaterials research focuses on nanoparticles that are intentionally created or engineered. Some of the techniques used in research laboratories to produce nanoparticles include application of heat to liquid chemical mixtures resulting in particles dispersed in solution, or the application of high electric currents to carbon or boron electrodes in metal chambers to produce fine soot-like nanoparticles.

Research involving nanomaterials is currently conducted at LBNL in the Molecular Foundry building located immediately adjacent to the proposed Helios Facility.

UC Berkeley also conducts research on nanoparticles. Although nanoscale research at UC Berkeley does not involve the handling of a wide variety or large quantities of nanomaterials (often in microgram and

milligram amounts), all research is conducted under controlled laboratory conditions. All nanoscale research with the potential to release "free" (airborne) nanoscale particles is conducted in containment equipment such as gloveboxes, fume hoods, or local capture hoods with High Efficiency Particulate (HEPA) filters. Information regarding the toxicity and environmental fate of nanomaterials is preliminary at the time and it is not clear that all nanoparticles present health hazards. However as a precaution, nanoscale materials are handled in accordance with the safe laboratory practices established in the laboratory Chemical Hygiene Plans (the Plans) Procedures in the Plans include using appropriate personal protective equipment such as double nitrile gloves or other equipment appropriate for the specific activity. The guidance for spills involving nanomaterials includes wearing gloves and respiratory protection, and containing the material by either vacuuming the area with a HEPA-filtered vacuum, wiping the area with wet towels, or both. UC Berkeley Office of Environment, Health & Safety (UC Berkeley EH&S) conducts annual laboratory safety training for all new graduate students and employees working in research laboratories. Supplemental safety and handling information regarding engineered nanoscale materials is being developed for inclusion in this training beginning in fall 2007. Principal Investigators for each research group that may be working with nanoscale materials are responsible for ensuring training on the proper techniques (e.g., handling, clean-up) and hazards of nanoscale materials. Furthermore, UC Berkeley conducts research to better define and characterize the potential impacts that manufactured nanoscale materials may have on human health and the environment. This research aims to improve current control measures and procedures to prevent harm on the ecosystem.

**Recombinant DNA Research**

LBNL performs a wide range of biological and related research involving recombinant technology, recombinant genomic materials, and recombinant or genetically modified organisms (GMOs). Transgenic organisms result when the Deoxyribonucleic Acid (DNA) from different existing organisms (plants, animals, insects, etc.) is combined using recombinant DNA techniques. Recombinant research has been commonly performed at LBNL for decades using microbiological agents (e.g., bacteria and viruses), human and animal cells, and other organisms such as mice.

Although biosafety and environmental risks associated with this research are generally low, both LBNL and UC Berkeley have Biosafety Programs based on national standards to ensure that work with biological material is conducted in a safe, ethical, environmentally sound, and compliant manner using the principles and functions of Integrated Safety Management and work authorization. Applicable federal and state regulations and standards are implemented including, for example, the National Institute of Health (NIH) Guidelines for Research Involving Recombinant DNA Molecules. Line management and researchers are required to define their biological work, evaluate the biological hazards,

determine the risk, and implement required biosafety containment controls at either Biosafety Level 1 (BSL-1) or BSL-2. At each institution, this is accomplished with the assistance, review, and oversight of the Institutional Biosafety Committee (IBC), and the EH&S office. The biosafety containment level consists of combinations of standard microbiological practices, safety equipment, and facilities needed to properly contain the biological work. These controls include, for example, properly designed laboratory facilities, biosafety cabinets, personal protective equipment, training, and biohazardous waste management. BSL-1 is suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans, and of minimal potential hazard to laboratory personnel and the environment. BSL-2 is suitable for work involving agents of moderate potential hazard to personnel and the environment. There have been no incidents of illness to personnel or the public, or release of biohazardous materials to the environment, as a result of this type of research (King 2007).

Recombinant DNA research at UC Berkeley is conducted on microorganisms and animals in laboratories, and on plants in specific greenhouses. Research laboratories studying microorganisms and animals are inspected annually by UC Berkeley EH&S for regulatory compliance and safety. Animal laboratories are inspected by the UC Animal Care and Use Committee every six months and by the Association of Assessment and Accreditation of Laboratory Animal Care International every three years. The United States Department of Agriculture also conducts random, unannounced inspections of animal facilities two times a year for compliance with the Animal Welfare Act. Recombinant DNA research on plants is performed within greenhouses to avoid contamination of non-transgenic plants from cross-pollination. Greenhouses containing transgenic plants are inspected by the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service. UC Berkeley has no recorded incidents of unintentional release of transgenic organisms or any harm caused by transgenic or recombinant DNA technology (UCB 2005)

### *Soils and Groundwater Contamination*

There are some areas of soil and groundwater contamination that exist at LBNL as a result of historical releases of hazardous materials into the environment. The primary chemical constituents of concern are volatile organic compounds, mostly degreasing solvents used to clean equipment. Other detected constituents include Polychlorinated Biphenyls (PCBs), petroleum hydrocarbons, and very small amounts of polynuclear aromatic hydrocarbons, semivolatile organic compounds, and metals. The principal radioactive contaminant is tritium. All areas of soil contamination have been cleaned up to levels consistent with LBNL operations (designated as institutional land use) and acceptable to regulatory oversight agencies (LBNL 2007).

While there is remaining groundwater contamination, it is confined within the boundary of LBNL's main hill site. Remediation and monitoring of non-radioactive contamination in groundwater are being conducted under the Resource Conservation and Recovery Act of 1976 Corrective Action Program. Department of Toxic Substances Control (DTSC) has the primary responsibility for regulatory oversight of non-radioactive contamination. In addition, the San Francisco Bay Regional Water Quality Control Board (RWQCB) and city of Berkeley have oversight roles with respect to these activities. Monitoring of a tritium plume in groundwater on the other hand is being conducted under the Atomic Energy Act, and the Department of Energy (DOE) is responsible for the regulatory oversight of tritium in groundwater. These agencies have been involved in review and approval of various work plans and reports related to these investigation and cleanup activities. LBNL submits quarterly progress reports to these agencies and meets with them periodically to review the status of these activities. Currently, there are about 150 groundwater monitoring wells at LBNL, with an additional groundwater monitoring well located off site. It should be noted that tritium concentrations in all monitoring wells at LBNL are currently less than the drinking water standard (LBNL 2007). Groundwater under the LBNL site is not used as a drinking water source by LBNL or by local utilities, and groundwater contamination is therefore not a threat to the local drinking water supply.

### *Fire Hazards*

The western boundary of LBNL is located along a portion of the interface between wildlands and developed lands in the East Bay hills. LBNL is similar in character to other developed hillside areas in the region as it combines developed lands, groves of trees, and non-irrigated grassland areas. Dry summers desiccate plant materials and make them more prone to burning. The fire risk during brief periods of the fall months is even more pronounced when strong offshore winds, often called "Diablo winds," occur in the East Bay hills, which further dry up fuel material and can drive fire fronts and fire brands at extreme speeds.

These winds contributed to the extensive damage that occurred in the devastating Oakland-Berkeley hills fire of October 1991. On average, serious Diablo-wind-driven wildland fires that destroy structures occur in the regional vicinity of LBNL approximately every 20 years. The site where LBNL now is situated last burned in 1923 (LBNL 2007). These fire conditions are now well understood. Although these fires can spread over large areas, it has been shown that each structure is at risk of damage for approximately 10 minutes, since during this interval a Diablo-wind-driven fire will typically consume the adjacent fuel. LBNL has reviewed fire histories, worked with fire researchers, and applied computer models to determine how the fuels adjacent to its buildings can be reduced to levels that will not support fire intensities that pose serious risks to the structures.

The Helios project site is currently managed to minimize wildland fire damage to structures under LBNL's vegetation management program. This program provides for annual treatment of vegetation on the LBNL site such that ground fuels cannot produce flame heights in excess of 3 feet (and ground plantings within 10 feet of buildings and roadways produce even lower flame heights); trees are "limbed up" so that flammable branches are at least 8 to 10 feet above the ground, and bushes that would allow ground-based fires to rise into tree canopies are removed.

UC Berkeley is responsible for wildland fire protection on campus lands adjacent to the project site. The UC Berkeley Manager of Emergency Preparedness oversees the campus wildland fire protection program. The focus of this program is fire prevention through fuel reduction and fire hazard minimization in the hill wildland areas managed by UC Berkeley on behalf of The Regents (Strawberry Canyon and Claremont Canyon). A campus Fire Mitigation Committee coordinates the actions of campus units with regard to fire hazard management; recommends policy and strategies to reduce fire hazards in the wildland/urban interface areas; recommends measures to reduce fire hazards in the canyons; and verifies that the program is implemented and is effective in reducing fire hazard risks. As outlined in the UC Berkeley 2020 LRDP policy, "Manage the Hill Campus Landscape to Reduce Fire and Flood Risk and Restore Native Vegetation and Hydrology Patterns," UC Berkeley maintains an ongoing program of fire fuel management in the hill area adjacent to LBNL. While the treatment used in a given area is customized to address its specific conditions, including vegetation type, access, and proximity to roads and structures, in general the treatments are designed to meet one or more of the following goals:

- Reducing fuel load by removing dead material, reducing plant density, and favoring species with lower fuel content;
- Reducing horizontal spread by reducing fine fuel material and by separating dense clusters of vegetation with areas of lower fuel load; and
- Reducing vertical fire spread by increasing separation of understory and crown fuels.

Whenever feasible, campus fuel management projects include the selective replacement of high-hazard introduced species with native species: for example, the restoration of native grassland and oak-bay woodland through the eradication of invasive exotics (broom, acacia, pampas grass) and the replacement of aged Monterey pines and second growth eucalyptus.

LBNL is provided firefighting services by the Alameda County Fire Department, which staffs a fire station on LBNL grounds (Alameda County Station 19 is located at LBNL Building 48). At least four firefighters are on duty at all times. Equipment at the station includes one fire engine, one reserve fire engine, a hazardous materials vehicle, and a light-duty four-wheel drive "brush rig" that can be used for low-intensity wildland fires (LBNL 2007).

Through an Automatic Aid Agreement between LBNL and the city of Berkeley Fire Department, the Alameda County Fire Department, who has been contracted by LBNL, would provide emergency response to the Helios Facility. As Station 19 is the closest fire station, it will provide first response, with Berkeley Fire Department augmenting response with other fire apparatus as needed. The Alameda County Fire Department has mutual aid agreements with other agencies, including Oakland and the East Bay Regional Park District, which can be activated in the event of a major emergency (LBNL 2007).

### *LBNL Emergency Response Plan*

LBNL has developed a Master Emergency Program Plan (MEPP) that establishes policies, procedures, and an organizational structure for responding to and recovering from a major disaster at LBNL (LBNL 2005). The MEPP utilizes the Standardized Emergency Management System for managing response to multi-agency and multi-jurisdiction emergencies in California and the National Incident Management System which is a nationwide standardized approach to incident management prescribed by Homeland Security Presidential Directive 5. The Plan includes a hazard analysis and assessment which finds that the primary hazards for the hill site are a major earthquake along the Hayward Fault and a major urban-wildland fire. In view of these primary hazards, the plan includes four phases of emergency management, including mitigation, preparedness, response, and recovery. Mitigation includes activities that eliminate or reduce the occurrence or effects of a disaster. For instance to address earthquake hazard, LBNL uses both structural and non structural measures to make buildings and work area seismically safe, and to address wildland fires, as discussed above, LBNL implements vegetation management. Preparedness includes planning as to how to respond when an emergency occurs; LBNL provides regular training to employees so that they are prepared to respond to an emergency. For response, LBNL relies on local fire and police services and also maintains response equipment on site for use by employees. Recovery includes short and long term actions necessary to return all systems to normal or near-normal conditions. LBNL's plan includes a planned transition from response to recovery.

The MEPP also includes a Wildland Fire Evacuation/Relocation Plan, which is presented to LBNL employees for training purposes on a video titled "May I have your attention please." The plan presents the steps that LBNL will implement in the event that any portion of the site is threatened by a major fire. In such an emergency, LBNL will order an evacuation of the site either by vehicle or foot, order relocation of employees from one area to another, more protected area, or provide instructions to employees to remain in place and await further instructions. The plan outlines the steps involved in a vehicular evacuation which include traffic control and use of those gates and routes that are not threatened by fire. UC Berkeley has prepared a Hazardous Material Management Plan (HMMP) in compliance with the Hazardous Material Release Response Plan and Inventory Act of 1985. The HMMP contains an inventory

of hazardous waste handled and stored on campus as well as an emergency response plan and a training program in safety procedures and emergency response.

### *Project Site*

The project site is located in the southwestern portion of the LBNL site. There is no history of hazardous materials use, storage or disposal on the project site and there is no existing contamination at the project site. Contrary to a scoping comment that stated that the project site was used for aeration of tritium contaminated soil, the Environmental Restoration Program did not use the terraces below Building 31 to aerate tritium contaminated soil. A network of groundwater monitoring wells demonstrates that the tritium source was located in the area of the National Tritium Labeling Facility (Building 75) and that it has migrated from there to below the Building 31 area (Pauer 2007). The presence of the tritium plume near the proposed project site was taken into account, and the project was sited so that project footprint does not extend into the area of the tritium plume. While the presence of tritium in the Building 31 area is not a health hazard to persons present in the area, the proposed project's construction area has been limited in order to avoid disturbance of the tritium plume. There is minimal wildland fuel load (vegetation) present where the building and parking area would be located. The area where the access road would be constructed and improved is more densely vegetated with seasonal scrub, evergreen trees, and grasses.

## 4.6.3 Regulatory Considerations

LBNL and UC Berkeley are subject to environmental, health, and safety regulations applicable to the transportation, use, management, and disposal of hazardous materials and wastes. This section provides an overview of the regulatory setting and describes current health and safety policies and procedures.

The primary federal agencies with responsibility for hazardous materials management include the United States Environmental Protection Agency (U.S. EPA), U.S. Department of Transportation (DOT), and DOE. The applicable federal laws, regulations, and responsible agencies are discussed in detail in this section. In many cases, California state law mirrors or is more restrictive than federal law, and enforcement of these laws has been delegated to the state or a local agency. In January 1996, the California Environmental Protection Agency adopted regulations implementing a Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program). The program has six elements: hazardous waste generators and hazardous waste on-site treatment, underground storage tanks, aboveground storage tanks, hazardous materials release response plans and inventories, risk management and prevention programs, and Unified Fire Code hazardous materials management plans and inventories. The local agency responsible for implementation of the Unified Program is called the

Certified Unified Program Agency (CUPA). Since the LBNL main site is located within the city limits of Berkeley and Oakland, both Cities are the designated CUPAs. In order to streamline their oversight of CUPA regulations at LBNL, Berkeley and Oakland have entered into a Memorandum of Understanding that established the City of Berkeley as the lead agency for all CUPA activities (other than emergency release reporting) (LBNL 2007).

### *Hazardous Materials Management*

Federal and state laws require detailed planning to ensure that hazardous materials are properly handled, used, stored, and disposed of, and in the event that such materials are accidentally released, to prevent or to mitigate injury to health or the environment. These laws require hazardous materials users to prepare written plans, such as Hazardous Materials Management Plan. The City of Berkeley, through its CUPA program, requires any business that handles hazardous materials above certain thresholds to prepare a Hazardous Materials Business Plan, which must include the following:

- Details of the facility and business conducted at the site;
- An inventory of hazardous materials that are handled or stored on site;
- An emergency response plan and contact information; and
- A safety and emergency response training program for new employees with annual refresher courses.

LBNL and UC Berkeley voluntarily comply with these state requirements as implemented by the city of Berkeley.

### *Hazardous Waste Handling*

The federal Resource Conservation and Recovery Act of 1976 (RCRA) created a major new federal hazardous waste "cradle-to-grave" regulatory program administered by U.S. EPA. Under RCRA, U.S. EPA regulates the generation, treatment, and disposal of hazardous waste, and the investigation and remediation of hazardous waste sites. Individual states may apply to U.S. EPA to authorize them to implement their own hazardous waste programs in lieu of RCRA, as long as the state program is at least as stringent as federal RCRA requirements. California has been authorized by U.S. EPA to implement its own hazardous waste program, with certain exceptions. In California, DTSC regulates the generation, transportation, treatment, storage, and disposal of hazardous waste, and the investigation and remediation of hazardous waste sites. The California DTSC program incorporates the provisions of both federal and state hazardous waste laws (LBNL 2007).

### *Hazardous Materials Transportation*

The DOT regulates the transportation of hazardous materials between states and foreign countries. DOT regulations govern all means of transportation, except that the U.S. Postal Service regulations govern packages sent by mail. The State of California has adopted DOT regulations for the intrastate movement of hazardous materials. In addition, the State of California regulates the transportation of hazardous waste originating in the state and passing out of the state.

The two state agencies that have primary responsibility for enforcing federal and state regulations and responding to hazardous materials transportation emergencies are the California Highway Patrol (CHP) and the California Department of Transportation (Caltrans). The CHP enforces hazardous material and hazardous waste labeling and packing regulations to prevent leakage and spills of material in transit and to provide detailed information to cleanup crews in the event of an accident. The CHP conducts regular inspections of licensed transporters to assure regulatory compliance. Caltrans has emergency chemical spill identification teams at as many as 72 locations throughout the state that can respond quickly in the event of a spill (LBNL 2007).

Every hazardous materials package type used by a hazardous materials shipper must undergo tests that imitate some of the possible rigors of travel. While not every package must be put through every test, representative packages for any package design must be able to be dropped, fully loaded, onto a concrete floor with no significant leakage; survive a compression test in a stacked configuration with no significant damage or distortion; demonstrate leakproofness when subjected to internal air and/or liquid pressure; and not have package closure mechanisms adversely affected by vibration.

### *Occupational Safety*

Occupational safety standards exist in federal and state laws to minimize worker safety risks from both physical and chemical hazards in the workplace. In the State of California, the Division of Occupational Safety and Health Administration (Cal/OSHA) is generally responsible for assuring worker safety in the workplace.

Cal/OSHA regulations contain requirements concerning the use of hazardous materials in the workplace and during construction that mandate employee safety training, safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, emergency action and fire prevention plan preparation, and a hazard communication program. The hazard communication program regulations contain training and information requirements, including procedures for identifying and labeling hazardous substances, and communicating hazard information relating to hazardous substances and their handling. The hazard communication program also requires that Material Safety Data Sheets or

equivalent safety information be available to employees, and that employee information and training programs be documented. These regulations also require preparation of emergency action plans (escape and evacuation procedures, rescue and medical duties, alarm systems, and training in emergency evacuation).

Cal/OSHA regulations include special provisions for hazard communication to employees in research laboratories, including training in chemical work practices. Specific, more detailed training and monitoring is required for the use of carcinogens, ethylene oxide, lead, asbestos, and certain other chemicals. Emergency equipment and supplies, such as fire extinguishers, safety showers, and eye washes, must also be provided and maintained in accessible places.

Cal/OSHA regulations also include extensive, detailed requirements for worker protection applicable to any activity that could disturb asbestos-containing materials, including maintenance, renovation, and demolition. These regulations are also designed to ensure that people working near the maintenance, renovation, or demolition activity are not exposed to asbestos.

### *Biosafety Standards*

Federal and state laws establish standards for working with biohazardous materials. A hazardous biological material is any potentially harmful biological material (including infectious agents, oncogenic viruses, and recombinant DNA) or any material contaminated with a potentially harmful biological material. The U.S. Public Health Service, the National Institutes of Health, and the Centers for Disease Control (CDC) and Prevention establish standards for working with biohazardous materials. The CDC and NIH have issued federal guidelines that address biological safety, including containment and handling guidelines to be used in microbiological and biomedical laboratories. These guidelines identify four Biosafety Levels which laboratories are required to comply with, depending on the risk group of the agent used. Biosafety level 1 is for the least hazardous biological agent and Biosafety level 4 is for the most hazardous biological agents. Similarly, four biosafety levels have been identified for research involving transgenic plants. The USDA Animal and Plant Health Inspection Services inspect greenhouses and laboratories using transgenic plants to ensure no unintentional release of transgenic organisms or harm cause by transgenic or recombinant DNA technology has occurred due to their operation.

UC Berkeley and LBNL conduct research in compliance with these federal guidelines and in compliance with the California Department of Public Health. UC Berkeley is classified as a large quantity medical waste generator and contracts for off-site hauling, treatment and disposal of all medical waste generated.

## Nanomaterials Guidelines

Nanomaterials research and development is an emerging field and at the present time, there are no federal or state regulations controlling nanomaterials research. The U.S. EPA has listed nanotechnology as an area for future study under its "Future Analysis" program, and only recently has U.S. EPA begun funding research in this area. Guidance and information from regulatory agencies available so far is summarized below.

- The CDC National Institute for Occupational Safety and Health (NIOSH) has published an informational document on approaches to safe nanotechnology, and that document is used at LBNL and UC Berkeley.

- The U.S. Food and Drug Administration (FDA) has created the Nanotechnology Interest Group (NTIG) that is designed to facilitate the regulation of the nanotechnology. In addition, the National Nanotechnology Initiative (NNI), which is managed by the National Science and Technology Council, is a federal research and development program established to coordinate multi agency efforts in nanoscale science, engineering, and technology. The NNI acts as a cross-disciplinary network for all sectors that would potentially have an interest in nanotechnology. The three main goals in terms of environmental health and safety (EHS) research conducted by the NNI are (1) to understand how nanomaterials behave in the environment and within the human body; (2) to develop instrumentation and measuring methods to characterize, test, and monitor nanomaterials; and (3) to conduct research to assess safety of nanomaterials in chemicals, foods, drug, and devices. As further toxicity and epidemiological research is conducted, regulatory standards for environmental health and safety will be established.

LBNL and UC Berkeley staff monitor the development of nanotechnology guidelines from all regulatory agencies to ensure safe and legally compliant research involving nanoparticles.

## Emergency Response

The Federal Emergency Planning and Community Right-to-Know Act of 1986 requires detailed planning to ensure that hazardous materials are properly handled, used, stored, and disposed of to prevent or minimize adverse effects to human health or the environment in the event such materials are accidentally released. California has developed an emergency response plan to coordinate emergency services provided by federal, state, and local government and private agencies.

Responding to hazardous materials incidents is one part of this plan. The plan is administered by the State Office of Emergency Services, which coordinates the responses of other agencies, including the California Environmental Protection Agency, the CHP, the Department of Fish and Game, the San Francisco Bay RWQCB, and Alameda County Fire Department. LBNL's on-site fire department provides first response capabilities, if needed, for hazardous materials emergencies.

## LBNL and UC Berkeley Hazardous Materials Plans and Policies

LBNL and UC Berkeley have established environment, safety and health policies and procedures to ensure all work is performed safely and in a manner that strives for the highest protection for the employees, guests, visitors, the public and the environment. In addition, LBNL and UC Berkeley have developed Environmental Management Systems to implement sound environmental stewardship practices that protect the air, water, land and other resources that could potentially be affected by facility operations. LBNL and UC Berkeley EH&S have the primary responsibility of developing strategies for compliance with local, state, and federal laws and regulations. LBNL and UC Berkeley EH&S have the authority to require abatement of any condition or operation that could endanger people or facilities or result in violations of pertinent federal or state laws or policies concerning health and safety. LBNL and UC Berkeley EH&S develop specific policies and programs in the following areas: industrial hygiene, chemical safety, physical safety, radiation safety, biohazard safety, occupational medicine, hazardous waste management, and environmental protection.

The Helios facility will be operated and managed by UC Berkeley in accordance with its hazardous materials policies and procedures. UC Berkeley's Policy on Management of Health, Safety and the Environment integrates safety practices and the U.S. EPA's Environmental Management System (EMS) into a single management framework, Integrated Safety and Environmental Management (ISEM). The policies contained in the ISEM are applicable to all activities that occur on the UC Berkeley campus. Component 1 of the ISEM includes the policy named "Responsibility for Environmental, Health & Safety at the University of California, Berkeley," also known as the "Responsibility Policy." This policy assigns responsibility for safety and environmental stewardship of activities occurring at the UC Berkeley campus to the Office of EH&S, department administrators and managers, senior campus administrators, and all students, faculty, staff, visitors, and guests. Component 2 discusses the Guiding Principles of the ISEM such as management responsibility for safety and the environment, management commitment to health and safety, establishing clear roles for responsibility, prioritizing safety, and identification of safety and environmental standards and requirements. Components 3 and 4 discuss the core functions and implementation of the ISEM system, respectively.

## LBNL and UC Berkeley Hazardous Materials Storage, Handling and Disposal

LBNL stores chemicals and other hazardous materials in aboveground tanks and storage drums. Hazardous, radioactive and mixed wastes are stored in designated areas in research and support areas throughout LBNL. From these locations, they are taken to the permitted Hazardous Waste Handling Facility for temporary storage. From this site, the wastes are hauled off for treatment and disposal.

Because the Helios Facility will be a non-DOE facility operated and managed by UC Berkeley, hazardous materials at Helios will be handled, and disposed of in accordance with UC Berkeley requirements. Before shipping hazardous and mixed wastes generated at the Helios Facility off site for treatment and disposal, UC Berkeley will determine whether reuse is possible, then manage and hold these unwanted materials. Such wastes will not be stored or managed at the LBNL Hazardous Waste Handling Facility.

### *LBNL and UC Berkeley Emergency Response Plans*

UC Berkeley and LBNL have developed emergency response plans that establish policies, procedures, and an organizational structure for responding to and recovering from a major disaster at the campus and Lab. UC Berkeley has emergency management jurisdiction over the Helios Facility and site, thus responsible for the primary emergency planning function. However, depending on the nature, magnitude, and location of the emergency event, UC Berkeley's emergency plan might require coordination with LBNL's emergency plan. The Emergency Operations Plan (UC Berkeley) and the Master Emergency Program Plan (LBNL) utilize the Standardized Emergency Management System (SEMS) which was mandated in 1996 by the State of California via Government Code 8607(a) and the National Incident Management System (NIMS) which was mandated in 2005 by the federal government via the Homeland Security Presidential Directive 5. These emergency management systems use the California Master Mutual Aid Agreement, existing mutual aid systems, the County Operational Area concept, and inter-agency and multi-jurisdiction coordination in California, which is a state and nationwide standardized approach to incident management using the Incident Command System (ICS). The UC Berkeley and LBNL plans include a hazard analysis and assessment which determine the primary hazards for the campus and Lab; a major earthquake along the Hayward Fault and a major urban-wildland fire. In view of these primary hazards, the plans incorporate four phases of emergency management, including mitigation, preparedness, response, and recovery. Mitigation includes activities that eliminate or reduce the occurrence or effects of a disaster. For instance to address earthquake hazard, the campus and LBNL use both structural and non structural measures to make buildings and work area seismically safe, and to address wildland fires, ongoing vegetation management programs are utilized. Preparedness includes planning as to how to respond when an emergency occurs and training employees so that they are prepared to respond to an emergency. For response, the campus and LBNL rely on local fire and police services and also maintain response equipment on site for use by employees. Recovery includes short-and long-term actions necessary to return all systems to normal or near-normal conditions through comprehensive business continuity planning. UC Berkeley and LBNL's plans are well coordinated and include planned transitions from response to recovery.

Although UC Berkeley has the primary emergency planning responsibility for the Helios Facility and site, UC Berkeley and LBNL are currently evaluating the Helios facility to identify the appropriate and

coordinated response to be taken should a significant threat to loss of life and/or significant property loss be imminent. UC Berkeley and LBNL plan, train, and exercise together using the Incident Command System in preparing for emergencies and coordinating an effective response involving communication, evacuation, care and shelter, and medical aid through sustained operations and mutual aid. Both UC Berkeley and LBNL share the mission of responding to an emergency in a safe, effective, and timely manner. The campus and Lab personnel and equipment will be used to accomplish the priorities of (1) protection of life safety, (2) maintenance of life support and assessment of damages, and (3) restoration of general operations.

## *Local Plans and Policies*

The proposed project would be located at LBNL, which is operated by the University of California and conducts work within the University's mission on land that is owned or controlled by The Regents of the University of California. As a state entity, the University is exempted by the state constitution from compliance with local land use regulations, including general plans and zoning. However, the University seeks to cooperate with local jurisdictions to reduce any physical consequences of potential land use conflicts to the extent feasible. LBNL is located in the cities of Oakland and Berkeley. The following sections summarize objectives and policies from the LBNL 2006 LRDP and LBNL Design Guidelines, the City of Berkeley and City of Oakland General Plans, and local ordinances that relate to hazards and hazardous materials.

### 2006 LRDP Principles and Strategies[1]

The 2006 LRDP proposes four fundamental principles that form the basis for the Plan's development strategies provided for each element of the Plan. The two principles most applicable to concerns regarding hazards and hazardous materials related to new development are to "Preserve and enhance the environmental qualities of the site as a model of resource conservation and environmental stewardship" and to "Build a safe, efficient, and cost-effective scientific infrastructure capable of long-term support of evolving scientific missions."

[1] While this Environmental Impact Report presents a "stand alone" impact analysis that does not rely upon tiering from any programmatic CEQA document, LBNL does actively follow the 2006 LRDP as a planning guide for LBNL development. Accordingly, relevant 2006 LRDP principles, strategies, and design guidelines are identified in this section.

Development strategies provided by the 2006 LRDP are intended to minimize potential environmental impacts that could result from implementation of the 2006 LRDP (see **Section 3.0, Project Description** for further discussion). Development strategies set forth in the 2006 LRDP applicable to hazards and hazardous materials include the following:

- Improve efficiency and security of Laboratory access through improvements to existing gates and the creation of new gates.
- Develop all new landscape improvements in accordance with the Laboratory's vegetation management program to minimize the threat of wildland fire damage to facilities and personnel.

**LBNL Design Guidelines**

LBNL Design Guidelines were developed in parallel with the 2006 LRDP. There are no design guidelines that are specifically relevant to hazards and hazardous materials.

**City of Berkeley General Plan**

The City of Berkeley General Plan was adopted on April 23, 2002. The following policies are contained in the General Plan pertaining to hazards and hazardous materials:

> Policy EM-13 Hazardous Materials Disclosure: Continue to require the disclosure of hazardous materials usage and encourage businesses using such materials to prepare and implement a plan to reduce the use of hazardous materials and the generation of hazardous wastes;
>
> Policy EM-14 Hazardous Materials Regulation: Control and regulate the use, storage, and transportation of toxic, explosive, and other hazardous and extremely hazardous material to prevent unauthorized and accidental discharge;
>
> Policy EM-15 Environmental Investigation: When reviewing applications for new development in areas historically used for industrial uses, require environmental investigation as necessary to ensure that soils, groundwater, and buildings affected by hazardous material releases from prior land uses would not have the potential to affect the environment or the health and safety of future property owners, users, or construction worker.;
>
> Policy EM-16 Risk Reduction: Work with owners of vulnerable structures with significant quantities of hazardous materials to mitigate potential risks;
>
> Policy EM-17 Warning Systems: Establish a way to warn residents of a release of toxic material or other health hazard, such as sirens and/or radio broadcasts;

Policy EM-31 Landscaping: Encourage drought-resistant, rodent-resistant, and fire-resistant plants to reduce water use, prevent erosion of soils, improve habitat, lessen fire danger, and minimize degradation of resources; and

Policy S-23 Property Maintenance: Reduce fire hazard risks in existing developed areas by ensuring that private property is maintained to minimize vulnerability to fire hazards.

**City of Berkeley Manufactured Nanoparticle Disclosure Ordinance**

In 2006, the city of Berkeley approved a change to the Hazardous Materials and Wastes Management portion of its Municipal Code. The amendment adds to facilities subject to reporting requirements, those facilities "that manufacture or use manufactured nanoparticles," and requires such facilities to disclose "current toxicology of the materials reported, to the extent known, and how the facility will safely handle, monitor, contain, dispose, track inventory, prevent releases, and mitigate such materials."

**City of Oakland General Plan**

The following policies from the City of Oakland General Plan Open Space, Conservation and Recreation Element would relate to hazards and hazardous materials.

Policy CO-1.2 Soil Contamination Hazards: Minimize hazards associated with soil contamination through the appropriate storage and disposal of toxic substances, monitoring of dredging activities, and cleanup of contaminated sites. In this regard, require soil testing for development of any site (or dedication of any parkland or community garden) where contamination is suspected due to prior activities on the site.

Policy CO-5.2 Improvements to Groundwater Quality: Support efforts to improve groundwater quality, including the use of nontoxic herbicides and fertilizers, the enforcement of anti-litter laws, the cleanup of sites contaminated by toxics, and ongoing monitoring by the Alameda County Flood Control and Water Conservation District.

## 4.6.4 Impacts and Mitigation Measures

### *Significance Criteria*

The impact of the proposed project related to hazards and hazardous materials would be considered significant if it would exceed the following Standards of Significance, in accordance with Appendix G of the *CEQA Guidelines* and the UC CEQA Handbook:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school;
- Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment;
- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; or
- Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

### *Issues Not Discussed Further*

The Helios project Initial Study found that compliance with federal, state, and local rules and regulations and LRDP Mitigation Measures HAZ-3a, HAZ-3d, and HAZ-3e which are included in the proposed project, would reduce potential impacts to nearby schools associated with the handling of hazardous materials and wastes to a less-than-significant level during the construction of the Helios Facility. The Initial Study also found that implementation of the project would not expose people on the project site to any safety hazards related to public airports or private airstrips because the project site is more than 11 miles northeast of the Oakland Metropolitan Airport, and is also not located within the vicinity of a private airstrip. These issues are not discussed further in this section.

## *Mitigation Measures included in the Proposed Project*

The following mitigation measures, adopted as part of the 2006 LRDP, are required by the 2006 LRDP for the proposed project and are thus included as part of the proposed project.[2] In addition, because the proposed project will be operated and managed by UC Berkeley, Continuing Best Practices included in the UC Berkeley 2020 LRDP are incorporated into the proposed project with minor modifications. These Continuing Best Practices are modified for the proposed project because some elements of these practices are not applicable to the proposed project. The differences between the Continuing Best Practices as adopted by UC Berkeley and as now incorporated into the proposed project are noted in footnotes on these pages. The analysis presented below evaluates environmental impacts that would result from project implementation following the application of these mitigation measures and Continuing Best Practices. These measures that are included in the project would be monitored pursuant to the Mitigation Monitoring and Reporting Plan (MMRP) that will be adopted for the proposed project.

**LRDP MM HAZ-3a:** LBNL shall continue to prepare an annual self-assessment summary report and a Site Environmental Report that summarize environment, health, and safety program performance and identify any areas where LBNL is not in compliance with environmental laws and regulations governing hazardous materials, and worker safety, emergency response, and environmental protection

**LRDP MM HAZ-3d**: LBNL shall continue its waste minimization programs and strive to identify new and innovative methods to minimize hazardous waste generated by LBNL activities.

**LRDP MM HAZ-3e:** In addition to implementing the numerous employee communication and training requirements included in regulatory programs, LBNL shall undertake the following additional measures as ongoing reminders to workers of health and safety requirements:

- Continue to post phone numbers of LBNL EH&S subject matter experts on the EH&S website.
- Continue to post Emergency Response and Evacuation Plans in all LBNL buildings.

[2] Because the Helios Facility will be managed and operated by UC Berkeley and not LBNL, only those LBNL 2006 LRDP mitigation measures that are directly pertinent to the proposed project are included in the project. For example, LRDP Mitigation Measure HAZ-3a is included because LBNL's construction of the Helios Facility will be among the activities covered by the environmental self-assessment, even though the operation of the facility will be governed by UC Berkeley's continuing best practices, as set forth later in this chapter. Other 2006 LRDP mitigation measures that are applicable Lab-wide are not specifically included in the project but would be implemented by LBNL in compliance with the MMRP adopted in conjunction with the approval of the 2006 LRDP.

- Continue to post sinks, in areas where hazardous materials are handled, with signs reminding users that hazardous materials and wastes cannot be poured down the drain.

- Continue to post dumpsters and central trash collection areas where hazardous materials are handled with signs reminding users that hazardous wastes cannot be disposed of as trash.

**LRDP MM HAZ-3f:** LBNL shall update its emergency preparedness and response program on an annual basis and shall provide copies of this program to local emergency response agencies and to members of the public upon request.

**Continuing Best Practice HAZ-1:** UC Berkeley shall continue to implement the same (or equivalent) health and safety plans, programs, practices, and procedures related to the use, storage, disposal, or transportation of hazardous materials and wastes (including chemical, radioactive, and bio-hazardous materials and waste) during the 2020 LRDP planning horizon. These include, but are not necessarily limited to, requirements of safe transportation of hazardous materials, EH&S training programs, the Hazard Communications Program, publication and promulgation of drain disposal guidelines, the requirement that laboratories have Chemical Hygiene Plans, the Chemical Inventory Database, the Toxic Use Reduction Program, the Aboveground Storage Tank Spill Prevention Control and Countermeasure Plan, hazardous waste disposal policies, the Chemical Exchange Program, the Hazardous Waste Minimization Program, the Biosafety Program, the Medical Waste Management Program, and the Radiation Safety Program. These programs may be subject to modification as more stringent standards are developed of if the programs become obsolete through replacement by other programs that incorporate similar health and safety protection measures.[3]

**Continuing Best Practice HAZ-3:** UC Berkeley shall continue to implement the same (or equivalent) programs related to transgenic materials use during the 2020 LRDP planning horizon, including, but not necessarily limited to, compliance with the NIH Guidelines for Research Involving Recombinant DNA Molecules, and requiring registration with EH&S for all research involving transgenic plants. These programs may be subject to modification as more stringent standards are developed of if the programs become obsolete through replacement by other

[3] Continuing Best Practice HAZ-1 as adopted by UC Berkeley is modified for the proposed project in that the reference to monitoring of underground storage tanks is deleted. The Helios Facility does not include underground storage tanks.

programs that incorporate similar health and safety protection measures.[4]

## *Project Impacts and Mitigation Measures*

**Helios Impact HAZ-1: Implementation of the proposed project would increase the routine use, transport and storage of hazardous materials and other scientific materials at LBNL but would not create a significant hazard to the public or the environment under the routine or reasonably foreseeable upset and accident conditions. (*Less than Significant*)**

The proposed project involves the construction and operations of new laboratories which would increase the total amount of hazardous materials and scientific materials transported to, stored and used at LBNL. Impacts of the proposed project from the transport, use, storage, and disposal of hazardous materials, wastes and scientific materials are discussed below organized in terms of impacts from routine operations and impacts from accidental releases.

**Impact from Routine Operations**

Within the Helios portion of the proposed project, temporary storage and use of hazardous chemicals, radioactive materials, and biohazardous materials would occur in the laboratories designed for the synthetic biology research program, located in the upper basement of the Helios Facility. Nanomaterials and chemical use would occur in the laboratories assigned to nano structures research in the Helios Facility. The development of and research related to transgenic plant materials and microorganisms would occur in laboratories associated with the Energy Biosciences Institute (EBI) portion of the building. A greenhouse would be located on top of the EBI portion of the proposed facility that would be used to grow transgenic plants. Small amounts of treatment chemicals (biocides and scale inhibitors) would be stored on site and used in the cooling towers.

Similar to all research and development laboratories, the Helios project will include the following four types of controls to reduce the potential for worker exposure, public exposure, and release of hazardous and other scientific materials to the environment: (1) engineered controls; (2) administrative controls; (3) use of personal protective equipment (PPE); and (4) training.

[4] Continuing Best Practice HAZ-3 as adopted by UC Berkeley is modified for the proposed project in that the reference to compliance with USDA requirements for open field-based research involving transgenic plants is deleted. The Helios Facility does not include any open field-based research involving transgenic plants.

All lab areas would be appropriately designed and constructed for the types of materials that would be handled in each laboratory. All wet chemistry laboratories would be fitted with fume hoods and biosafety cabinets which are designed to reduce worker exposure to hazardous chemicals. An appropriate number of air changes would be implemented for worker safety. All lab facilities would maintain negative pressure which would control the release of any airborne materials to non-lab areas via doors and other openings. All flooring in the labs would be designed to be chemical resistant.

Administrative controls that will be implemented by UC Berkeley consistent with its current practices at similar laboratories on the campus and Continuing Best Practice HAZ-1 include but are not limited to the development and implementation of a chemical hygiene plan and good housekeeping practices in areas where chemicals or other scientific materials are handled. The latter include maintaining all surfaces free of chemicals and scientific materials; using appropriate cleaning methods and materials; disposing used cleaning materials and wastes appropriately; transferring all materials in closed, labeled containers; posting signs indicating level and type of hazards; and labeling all storage containers. All lab personnel will be required to wear PPE appropriate for the type of materials they are handling. In addition, training would be provided to all personnel who work with these materials and those who enter these spaces.

Radioactive material use in the facility is expected to be limited. The use of these materials would be subject to UC Berkeley's Radiation Safety Program, which includes safety controls and procedures to limit exposure to ionizing radiation. The UC Berkeley's Radiation Safety Program is intended to ensure compliance with UC Berkeley's Radioactive Materials License No. 1333-01 issued by the California Department of Public Health. The Department of Public Health's governing regulations for radioactive materials (California Code of Regulations, Title 17, Division 1, Chapter 5, Subchapter 4) establish a total effective dose equivalent (i.e., the public exposure dose) of 100 millirem (mrem) per year at the unrestricted area boundary. In the interest of maintaining the public dose as low as is reasonably achievable, UC Berkeley limits the total effective dose equivalent from all pathways (e.g., water, air, and direct radiation) to less than 10 mrem in any one year and 0.2 mrem in any one hour to the maximally exposed member of the public. Adherence to the Radiation Safety Program will ensure that the public is not exposed to significant levels of ionizing radiation from activities associated with the Helios Facility.

Similar to the existing practices at LBNL and UC Berkeley and in compliance with Continuing Best Practice HAZ-3, all research within the Helios Facility related to transgenic organisms will be required to comply with NIH Guidelines for Research Involving Recombinant DNA Molecules. The Guidelines specify containment practices for plants and microorganisms, depending on the potential hazard posed by the organism. The potential for worker exposure is minimized by compliance with CDC and NIH guidelines for research involving these materials. NIH has identified four biosafety levels for recombinant DNA research for both microorganisms and plants – BSL-1 through 4. All of the research at

the facility will be conducted at the lowest biosafety level, BSL-1, with organisms that pose no risk if accidentally released to the environment.[5]

The research in the Helios building currently envisioned with transgenic plants will be performed at Biosafety Level 1 - Plants (BL1-P) according to the NIH Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines) dated April 2002. Standard practices for BL1-P include: limiting and restricting access to greenhouse operations to isolate plant material, decontamination and inactivation procedures, control of undesired species, and designs standards for greenhouse structures to ensure appropriate containment of plant material. As stated in the NIH Guidelines, BL1-P is designed to provide a moderate level of containment for experiments for which there is convincing biological evidence that precludes the possibility of survival, transfer or dissemination of recombinant DNA into the environment, or in which there is no recognizable and predictable risk to the environment in the case of an accidental release. However, in an effort to provide the maximum protection from transgenic plant materials and to ensure greater flexibility in meeting research needs and objectives, greenhouse and other facilities within the building may be designed to a higher level of containment, such as a BL2-P level. Any work involving plants will be subject to ongoing institutional review to ensure appropriate safeguards and safety measures are in place and effective.

Any research involving pathogens (human or plant) would performed under the appropriate Biosafety Level (BSL) procedures and controls. Work with these pathogens will be conducted in growth chambers which will be physically isolated from other laboratory research areas in the building to eliminate the potential for transfer of these pathogens. Any work of this nature would also be subject to ongoing institutional review and surveillance, as well as, implementation of safety measures such as standard microbiological practices, lab coats, gloves, safety glasses, disinfection, disposal of biological waste as medical or biohazardous waste, certified biosafety cabinet use and training.

The proposed project includes the outdoor storage of nitrogen (for cryogenic use) in a 1,500-gallon tank which would be secured to a slab to ensure stability during an earthquake. The project also includes a 3,000 gallon above-ground diesel fuel storage tank which would be located in the utility area north of the research building. The tank would be installed and monitored in compliance with applicable federal and state regulations for fuel storage tanks. All outdoor storage areas will be enclosed or otherwise secured.

---

5 Although BSL-2 research is currently not planned in the proposed facility (BSL-1 research is planned), the Helios Facility's biological research areas would be built to BSL-2 standards, which is the standard required for working with organic agents with a moderate potential hazard to allow for BSL-2 work in the event that Risk Group 2 materials need to be used in the research in the Helios Facility.

All hazardous wastes generated at the Helios Facility would be handled in compliance with federal and state laws. Nanomaterial wastes would also be handled in accordance with federal and state hazardous waste laws.

In summary, consistent with Continuing Best Practices HAZ-1 and HAZ-3, UC Berkeley would implement at the Helios Facility the same health and safety plans, programs, practices, and procedures related to the use, storage, disposal, or transportation of hazardous materials and wastes (including chemical, radioactive, and biohazardous materials and waste) that are implemented at other UC Berkeley laboratories with similar types of research activities. Furthermore, it would implement the ISEM which focuses on the effective communication of health, safety, and environmental requirements to all members of the UC Berkeley community and UC Berkeley contractors. All of these programs will ensure that the project's impact from routine operations is less than significant.

**Impact related to Accidental Releases**

The potential for an off-site impact under upset conditions relates mainly to any releases of incoming hazardous materials while in transit to the site or from the release of hazardous waste as it is hauled offsite for disposal or reuse. However, similar to existing conditions all incoming hazardous materials would be transported generally in small quantities and in compliance with DOT requirements; therefore the potential for an accidental release would be minimized. Similar to other laboratory facilities managed by UC Berkeley and in compliance with Continuing Best Practice HAZ-1, the Helios project would also minimize generation of hazardous wastes. The UC Berkeley ISEM system involves a program for the minimization of hazardous waste which included mandatory procedures and guidance materials for this purpose. Furthermore, off-haul of hazardous wastes from the project site would comply with Continuing Best Practice HAZ-1.[6] As a result, the potential for a substantial impact under upset conditions would be minimized and the impact would be less than significant.

The potential for an accidental release of hazardous materials, including other scientific materials, from the project site as a result of a major earthquake on the regional fault system would be minimized by both the design of the proposed building and by the anchoring, bracing, and securing of all non-structural building elements.

- Similar to all new buildings at LBNL, the proposed Helios Facility would be designed to comply with the requirements of the current California Building Code, the University of California seismic design safety policies, and "Lateral Force Design Criteria" of LBNL Design Management Procedures,

6 The ISEM system involves a program for Hazardous Material Shipping as well as guidelines for Chemical Waste Management. These programs would include procedures for ensuring hazardous waste haulers are licensed to haul the specific waste and also confirmation of facilities licensed to receive hazardous waste.

including lateral force anchorage provisions. Furthermore, the structural design of the proposed building would be reviewed by the UC Berkeley Seismic Review Committee which consists of leading world experts on seismic design.

- The project would also comply with LBNL Construction Standards and Design Requirements for the design of mechanical systems and plumbing, including supports, vibration isolators, tie-downs and seismic bracing for equipment and piping in the laboratories. Specialized safety measures would be applied to mechanical systems serving areas containing toxic chemicals and/or radioactive materials. The mechanical design of the proposed project will be reviewed by the LBNL Mechanical Safety Subcommittee prior to release of construction documents for construction.

- The LBNL Construction Standards and Design Requirements also include guidelines for non-structural elements, including anchoring of all free-standing equipment; restraints on shelves to keep items from falling (for chemicals and in other laboratory areas, the restraint must extend at least 1.5 inches above the shelf); use of mechanical latches on cabinet doors; restraint of compressed gas cylinders using approved brackets; and flexible utility connections for fume hoods and other equipment to minimize the potential for breakage. This equipment is secured to contain any possible releases and materials are stored at all times when not in use under seismically-controlled conditions to minimize releases from a seismic event.

The impact related to hazardous materials use, transport, and storage under normal operations and upset conditions would therefore be less than significant.

**Mitigation Measure**: No project-level mitigation measure required.

**Helios Impact HAZ-2: The proposed project would not be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5, but some project components would be located in areas where contamination may be present and as a result, could create a potentially significant hazard to the public or the environment. (*Potentially Significant; Less than Significant with Mitigation*)**

Although some portions of the LBNL site are classified as hazardous waste sites by Government Code Section 65962.5, the project site is not included on any lists prepared pursuant to this section. Furthermore, the project site has been examined for contamination, and none was found. The project site does not extend into the tritium plume which is to the north of the site (see **Figure 4.7-4,** in **Section 4.7, Hydrology and Water Quality**), nor has the project site been used previously for aeration of contaminated soils. There would be no impact related to existing contamination on the building site.

Under Helios Access Road intersection options, one or two buildings (Buildings 73 and 73A) would be demolished. Due to the age of these buildings, asbestos and lead-based paint could potentially be present in these structures. In addition, contamination from radioactive materials used in Building 73 may also

be present in some areas of that building. Demolition of these buildings would be conducted in compliance with laws and regulations for handling of materials containing asbestos, lead-based paint and radioactive elements and LBNL's current management practices. LBNL has developed detailed project specifications that all contractors performing demolition activities are required to comply with. Implementation of these specifications and compliance with laws and regulations would ensure that workers at the demolition site are not exposed to these hazardous materials or that the environment is affected by the release of these materials. The impact related to exposure to existing contamination within Buildings 73 and 73A would be less than significant.

A section of the wastewater pipeline under Wastewater Option 1 would traverse through the portion of LBNL underlain by the tritium plume. In order to avoid trenching in the area of the plume, the pipeline would be placed aboveground on pipe supports. Other appropriate construction-phase construction specification would be implemented while working in this area. No known contamination is present in other portions of this option. Under Wastewater Options 2 and 3 which involve some limited trenching in UC Berkeley streets to install new pipelines and mainly the use of pipe bursting to increase the capacity of existing sewer lines, the potential to encounter subsurface contamination during construction activities is generally considered low. UC Berkeley 2020 LRDP EIR notes that known contamination on the campus has been or is being fully characterized and remediated with oversight from local and regional agencies (UCB 2005). However, because all areas where ground disturbance would occur (even though limited) to construct the new sewer lines have not yet been evaluated for presence of hazardous materials, there is a potential that some contamination may be encountered during construction which could potentially result in exposure to construction workers and the environment. This would be a potentially significant impact. Mitigation is proposed below which would reduce the impact to a less than significant level.

**Helios Mitigation Measure HAZ-2:** LBNL will prepare a due diligence assessment of all areas that would be excavated in order to install the new sewer pipeline. If contaminated materials are anticipated, the soils will be tested, and LBNL will implement appropriate measures to ensure that the contaminated soils or groundwater do not adversely affect construction workers and the environment.

**Significance after Mitigation:** The impact from contaminated materials would be reduced to a less than significant level.

**Helios Impact HAZ-3: The proposed project would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. (*Less than Significant*)**

The proposed project would not construct any facilities that would interfere with the implementation of the UC Berkeley Emergency Operations Plan (EOP) or the LBNL MEPP. The proposed building has been designed with adequate access for emergency vehicles which are expected to access the site via LBNL's Lawrence Road and the existing service road adjacent to the Molecular Foundry building from the east and via the proposed Helios Access Road when entering the site from Centennial Drive. As discussed further under Helios Impact TRANS-2, the four design options for the Helios Access Road intersection provide adequate space for a standard fire engine (about 48 foot long non-articulated) to turn into and out of the intersection. The project would not interfere with access to any of the LBNL's gates and all routes would continue to be available to UC Berkeley and LBNL employees for evacuation.

In compliance with 2006 LRDP Mitigation Measure GEO-1, a draft evacuation plan is being prepared for the Helios Facility which identifies ingress and egress routes for emergency vehicles and facility employees. The main features of this plan are summarized below and the project's effect on evacuation of neighboring areas is evaluated in light of this draft plan. Normal building evacuation routes will be posted throughout the building with an assembly area in the adjacent parking area proposed as part of the Helios project. In the event of an emergency that requires building evacuation, occupants would exit the building following the evacuation route signage and proceed to the designated Helios assembly area (parking area). UC Berkeley officials will be in charge of the assembly area. Depending on the nature and location of the emergency event, individuals at this assembly area might remain in place or proceed to Centennial Drive depending on the evacuation orders from UC Berkeley officials. If an event posed an imminent danger or threat to the assembly area (unsafe for individuals to remain in place or proceed to Centennial Drive), an evacuation of the individuals would be facilitated through an LBNL-controlled fenced gate (i.e., to the north or east of the building) staffed by LBNL security officers. The security officers would escort the individuals to a new assembly area and wait for further instructions for evacuation from LBNL emergency officials.

Some concern has been expressed that the proposed project could affect the ability of the residents of the Panoramic Hills neighborhood to evacuate their neighborhood in an emergency. The proposed project would not alter the vehicular evacuation route of the Panoramic Hills neighborhood which is via Prospect Road and not via Centennial Drive. Even though the proposed project provides an additional roadway for UC Berkeley and LBNL employees to exit the LBNL site, that new road would not connect directly to Lawrence Road (see **Section 4.12**, **Transportation and Traffic**) and thus would not be a new vehicular route for general LBNL traffic. Depending on the emergency event and conditions, UC Berkeley officials will determine if employees in the Helios Facility with automobiles on site are allowed or not allowed to evacuate in their vehicles from the Helios site via Centennial Drive. The gate at Centennial Drive could be used to restrict Helios occupants from driving off the site. Furthermore, under

the imminent danger and threat of loss of life by remaining at the Helios assembly area, UC Berkeley officials could facilitate a swift controlled vehicular evacuation. Under appropriate conditions, UC Berkeley officials could allow an uncontrolled vehicular evacuation.

Note that under the 2006 LRDP, the LBNL's emergency response procedures would not allow uncontrolled vehicle evacuation of the site if conditions did not warrant this. During or after a catastrophic event, the LBNL's perimeter gates would be controlled. For example, the gates would be closed to all vehicles except for emergency vehicles. If evacuation by vehicle is determined by the LBNL Emergency Operations Center or emergency official, traffic control would be provided on Centennial Drive by LBNL and UC Berkeley to ensure orderly evacuation of all vehicles and individuals in the area. In a regional emergency where exigent circumstances do not exist, any decision to evacuate would be coordinated with UC Berkeley and the City of Berkeley, and with Alameda County and the City of Oakland if necessary.

In the event that evacuation of the Helios site is not advised by UC Berkeley officials, LBNL has resources on site that can be used by the on-site population to shelter-in-place for approximately three days. These resources include internal water supply, stocked food supply, medical facilities and staff, fire station and emergency response staff, emergency generators and fuel supply, security staff, communications and EMS system, and on-site construction crews and craftspeople. The on-site resources would be adequate to serve the increased population to include UC Berkeley and Helios staff if required. There would be no impact related to the LBNL emergency response plan or evacuation plan.

The proposed project involves three wastewater options, two of which would involve some limited trenching in public streets for the construction of new sewer pipelines. In the case of Wastewater Option 2, the length of the new pipeline would be approximately 500 feet of which only a few small sections would be in streets open to the public (the majority of the new pipeline length would be under parking lots). Under Wastewater Option 3, the length of the new pipeline would be approximately 750 feet, of which about half would be in roadways open to the public. Given the short length of the pipeline sections that would be located in streets used by the public, it is anticipated that the construction would be completed in a period of less than one week. Furthermore, to minimize disruption to traffic and maintain access at all times, one lane would be kept open under all conditions and traffic control would be provided. Therefore, pipeline construction would not adversely affect emergency access.

**Mitigation Measure:** No project-level mitigation measure required.

**Helios Impact HAZ-4: The proposed project would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires. (*Less than Significant*)**

The LBNL site is located in the Oakland-Berkeley Hills in an area that is prone to wildland fires. As discussed in **Section 3.0, Project Description**, the proposed building is being located close to existing buildings to foster collaboration and interaction. The siting of the building in this manner also minimizes the intrusion of new facilities into undeveloped wildland areas and thus minimizes the potential for human activities to cause wildland fires.

The proposed project would add another building to the Redwood cluster in the southeastern portion of the LBNL site and would bring approximately 368 additional persons to the LBNL site during normal business hours on weekdays (the remainder of the facility population would be staff relocating to the new building from other nearby facilities at LBNL or at UC Berkeley). Although both the proposed building and the new population associated with the new building could be exposed to the risk from wildland fires, a significant impact related to risk of loss, injury or death involving wildland fire is not expected for a number of reasons:

- The building would be designed and constructed in conformance with Title 24, California Code of Regulations, the requirements for Group B research laboratory occupancies as defined by the California Building Code, Type I-B Fire Resistive Construction for the laboratory building and Type II-B for the auditorium, and with applicable fire code safety requirements. The fire protection system would meet all statutory requirements which apply to the hazardous materials that would be handled in the facility. The building would be fitted with automatic sprinklers. Fire hydrants would be provided on the north side of the building near the loading dock and also on the south and west sides of the building to protect the building against wildland fire threats and protect the wildland in case of a fire in the proposed building that threatens the surrounding lands.

- In compliance with LBNL's vegetation management program and consistent with 2006 LRDP design strategies, all new landscaping in the areas surrounding the building and the access road will be developed to minimize the threat of wildland fire damage to facilities and personnel. A landscaped vegetation zone will be established to a distance of at least 100 feet from the proposed building. The landscaping plan would provide for adequate spacing between trees to avoid interconnecting canopies and would provide for control of accumulation of light medium vegetation (grasses and woody shrubs).

- Vegetation management to reduce fuel loads will continue to be conducted on all areas near the project site and access road, as well in the Perimeter Open Space land use zone as depicted in the 2006 LRDP Land Use Plan. Because a portion of the Helios project site lies within UC Berkeley lands, LBNL and UC Berkeley will develop a memorandum of understanding as to how vegetation management will be handled for the entire Helios project site. Both agencies have vegetation management programs for fire fuel reduction.

- All new employees would be provided training and information regarding measures to be taken in the event of a fire.

- The fire station on the LBNL site is within 2,400 feet of the project site and is adequately staffed to serve this project along with other existing facilities on the LBNL site. As discussed above and under Helios Impact TRANS-2, the proposed access road has adequate space for a standard fire engine to

turn into and out of the intersection and therefore fire engines would be able to serve the project site. Fire engine access from the east would continue to be provided by the existing service lane below the Molecular Foundry building.

Therefore, the impact related to exposure to wildland fire risk would be less than significant.

**Mitigation Measure:** No project-level mitigation measure required.

## 4.6.5 References

Lawrence Berkeley National Laboratory. 2007. 2006 Long Range Development Plan Final Environmental Impact Report. SCH No. 2000102046. July.

Lawrence Berkeley National Laboratory (LBNL). 2005. Master Emergency Program Plan for the Ernest Orlando Lawrence Berkeley National Laboratory. LBNL PUB-533, Revision 2, prepared by the LBNL Environment, Health and Safety Division for the U.S. Department of Energy, 49p + appendices.

UC Berkeley 2005. UC Berkeley 2020 Long Range Development Plan & Chang-Lin Tien Center for East Asian Studies Final Environmental Impact Report. January. SCH No, 2003082131.