

4.7 Hydrology and Water Quality

4.7.1 Introduction

This section identifies existing hydrologic conditions at the project site and analyzes the potential for implementation of the proposed Computational Research and Theory (CRT) project to affect those resources. Information presented in the discussion and subsequent analysis was drawn from site visits, the 2006 Lawrence Berkeley National Laboratory (LBNL) Long-Range Development Plan (LRDP) EIR, and environmental documents associated with specific LBNL projects. The physical characteristics of the site and surrounding areas are discussed briefly.

In response to the Notice of Preparation for this EIR, one commenter expressed concern with respect to the potential for groundwater contamination to exist in the project vicinity as a result of a past leak from an underground storage tank near Building 50. This scoping comment is addressed in the impact assessment presented below.

4.7.2 Environmental Setting

The sections below provide a detailed description of the environmental setting of the project site, drawing on the LRDP EIR text and concentrating primarily on aspects that are specific to the CRT project site.

Regional Setting

LBNL is located in the East Bay hills, near the western edge of the Coast Range physiographic province. The hills are roughly parallel to the northwest-southeast trend of the major mountain ridges in the province with spur ridges and canyons oriented perpendicular to main ridges. About half of the Berkeley Lab site is situated in the headwaters of one of these east-west trending canyons, Strawberry Canyon, which is drained by the South Fork of Strawberry Creek. The other half of the Berkeley Lab site, including the CRT project site, lies within Blackberry Canyon, which is drained by the North Fork of Strawberry Creek. The two forks of Strawberry Creek join approximately 3,500 feet southwest of LBNL's western boundary on the University of California Berkeley campus.

Climate

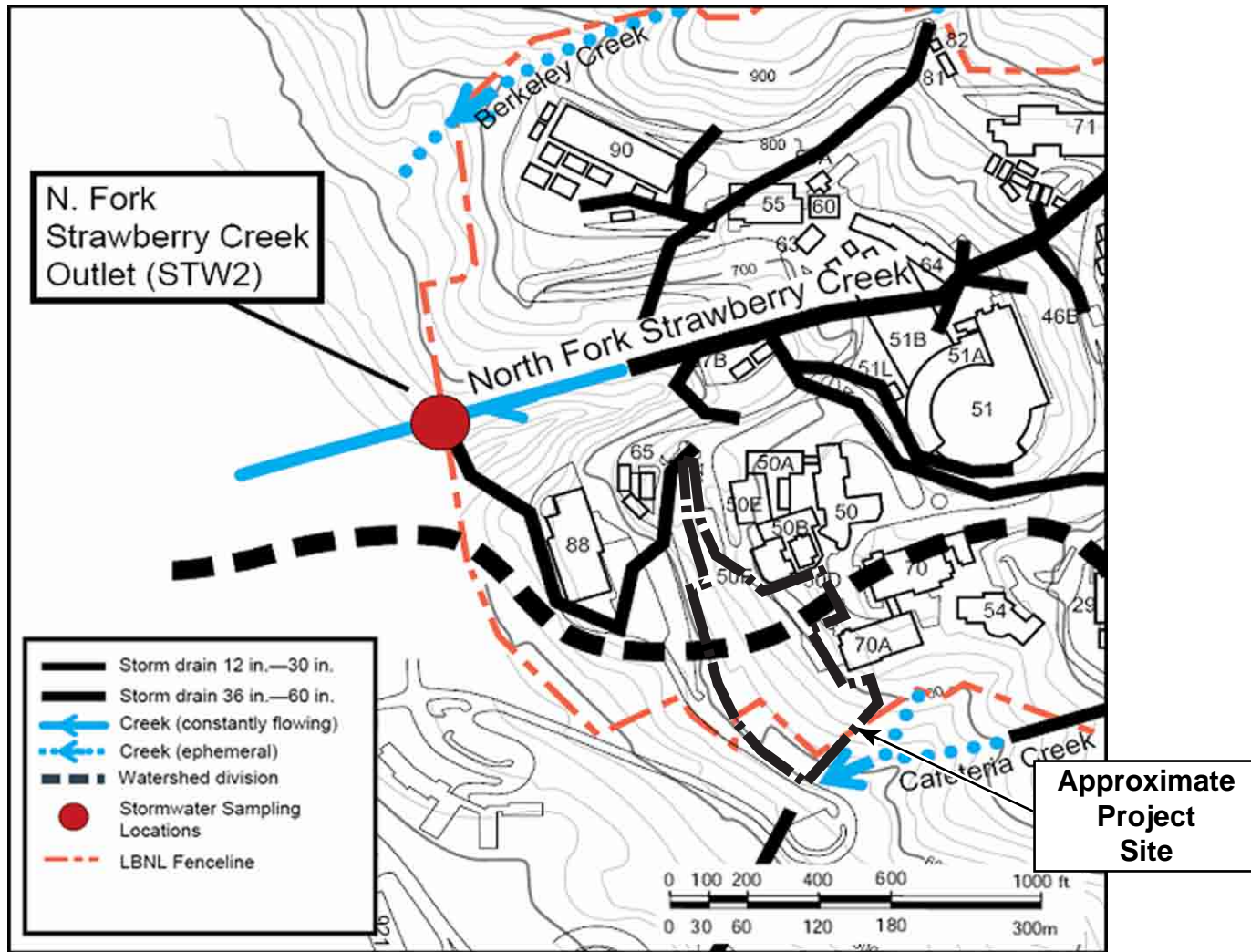
LBNL experiences a Mediterranean climate, with almost all precipitation falling between the months of October and April. The long-term mean annual rainfall is approximately 30.6 inches, calculated from more than 30 years of records (water years¹ 1975 to 2006) at the LBNL rain gauge. This is an appropriate value for hydraulic design and analysis purposes in the LBNL area. Year-to-year variability in rainfall can be considerable. Based on the long-term precipitation record at the LBNL rain gauge, in any particular month, the maximum rainfall can be twice the long-term monthly average or it can be almost zero. Evaporation rates and evapotranspiration rates are typically low during the late fall and winter months, then rise in spring in response to warmer weather.

Stormwater Drainage

Stormwater at LBNL is handled by a combination of engineered features such as storm drains, down drains and v-ditches, as well as by creeks that flow into Strawberry Creek. Drainage at the project site is strongly influenced by its position on a slope in hilly terrain. As shown in Figure 4.7-1, Stormwater Drainage Facilities and Sampling Location Near Project Site, the CRT project site is located just north of an unnamed drainage locally known as Cafeteria Creek. Cafeteria Creek drains to a culvert just downstream of the CRT site (near the LBNL Blackberry Canyon Gate), which eventually drains to Strawberry Creek at the University of California Berkeley campus.

Cafeteria Creek is a small watershed (approximately 10 acres at the Blackberry Canyon Gate) that drains part of the western portion of LBNL. The mainstem channel is approximately 350 feet long and is the outlet for a series of seven hydraugers that drain the slope west of building 54 (the LBNL Cafeteria). A secondary channel meets the Cafeteria Creek mainstem approximately 130 feet upstream of the culvert at Blackberry Canyon Gate. The headwaters of this tributary begin in a parking lot (the Big "C" Lot) and a portion of Lawrence Road.

¹ Hydrologic monitoring in much of the western United States is often carried out on a water year basis to account for the seasonality of winter rains and summer dry periods. The water year begins on October 1 and ends on September 30 of the named year. For example, water year 2007 began on October 1, 2006 and ends on September 30, 2007.



SOURCE: LBNL Long Range Development Plan - 2006, Perkins+Will - September 2007

FIGURE 4.7-1

Stormwater Drainage Facilities and Sampling Location Near Project Site

Most stormwater runoff from the project site currently drains overland to Cyclotron Road, where it is intercepted by a road ditch and diverted to the Cafeteria Creek culvert. The southern portion of the project site, however, currently drains directly to the Cafeteria Creek channel upstream of Blackberry Canyon Gate. The site receives some run-on from the access road and parking areas located west of Buildings 50 and 70. This runoff is conveyed across the site from east to west via a small pipe that enters the site near its southeast corner, ultimately draining to Cafeteria Creek.

Flooding

The project site does not fall within the 100-year flood zone as mapped by the Federal Emergency Management Agency (FEMA).

Soils

Mapping by the U.S. Department of Agriculture Natural Resources Conservation Service shows the fine-textured soils that have formed in the shale, siltstone, and sandstone setting (Welch, 1981). The CRT site is underlain by Maymen loam soils, 30 to 75 percent slopes. Although Maymen loam is described as a deep, very well-drained soil with moderate permeability, it appears relatively thin across much of the site with areas of exposed bedrock. The soil is categorized as belonging to Hydrologic Group D, the highest runoff potential in the classification system. Soils at the eastern edge of the project site have been disturbed by past building and road construction activities, and soils at the very western edge of the site have been altered by construction of Cyclotron Road and landslide stabilization work associated with improvements to Blackberry Canyon Gate.

Groundwater

Due to the high relief and the varying geologic units at the site, depth to groundwater within the LBNL site varies considerably, both spatially and seasonally, between 0 and over 100 feet below the ground surface (bgs). A generalized groundwater piezometric map of LBNL (LBNL 2006b) shows that groundwater levels are on the order of 30 to 40 feet bgs near the location of the proposed CRT project. However, locally perched water is present at some locations on the LBNL site, often at the base of landslide deposits or at the interface between the bedrock and overlying soils or other unconsolidated sediments.

Geotechnical investigations at and near the CRT project site (Kleinfelder 2006a and 2006b) did not encounter saturated conditions within 12 feet of the surface in five trenches dug across the site, although a small amount of seepage was identified along the bed of a landslide deposit. Two monitoring wells are located near the proposed CRT site. MWP-2 is located directly south of Building 70A, directly east of the

CRT Project; while OW3-225 is located on the inside bend of the Cyclotron Road hairpin turn, south of the proposed CRT facility. These monitoring wells showed groundwater levels over 110 feet bgs in 2004 (LBNL 2006b). A third monitoring well, further to the west at the south side of Building 70A, recorded groundwater at 48 feet bgs in May 2006 and 53 feet bgs in November 2006² (LBNL 2007b and 2007c).

Surface Water Quality

The entire western portion of the CRT project site and some of the eastern portion is currently undeveloped hillside land dominated by non-native vegetation and eucalyptus trees, although other tree species are present, especially to the south closer to Cafeteria Creek. A small section of the eastern portion of the CRT site consists of existing parking areas, access roads, and buildings. These land uses could contribute small amounts of pollutants commonly found in urban runoff such as oil, grease, and metal brake dust. These paved areas are bordered by curbs on the down-slope side, limiting the amount of run-on to the CRT project site. The entire CRT project site is subject to the best management practices (BMPs) as detailed in the LBNL Storm Water Pollution Prevention Plan (SWPPP) to control the quality and quantity of stormwater runoff. Steeply sloping open space areas on the site have the potential to contribute sediment (turbidity) to receiving waters, although there is no outward indication of instability on these vegetated slopes.

LBNL uses only one type of herbicide, which is used locally (no broadcast spraying) to prevent re-sprouting of cut eucalyptus trunks. Pesticide use is restricted to non-flying insects within buildings (no spraying), and rodents are controlled by non-pesticide methods (trapping). Only licensed contractors are hired to administer pesticides and herbicides in compliance with all applicable regulations. LBNL Department of Environmental Health and Safety (EH&S) reviews these practices annually.

Four stormwater sampling stations around LBNL, established in water year 1993, are currently part of the LBNL Storm Water Monitoring Program (SWMP) (LBNL 2006a) which was developed as a requirement of the National Pollutant Discharge Elimination System (NPDES) General Industrial permit for stormwater discharge. These stations are located at:

- a manhole within the Chicken Creek watershed, immediately upstream of LBNL, which measures run-on to the LBNL site;
- on Chicken Creek, upstream of the proposed Helios facility but downstream of several other LBNL buildings and Lawrence Road;
- on Winter Creek, near the Hazardous Waste Handling Facility in the East Canyon; and

² For comparison, depth to groundwater was 55 feet in August, 2004.

- on the North Fork of Strawberry Creek, just downstream of LBNL, downstream of the proposed discharge point for CRT stormwater.

Several other stations were monitored for whole effluent toxicity in the early years of the SWMP, but were dropped from the program after three years of no toxicity findings. Stormwater sampling is conducted at the above-mentioned sites twice yearly in accordance with General Industrial Permit requirements. LBNL uses automated samplers in an effort to capture runoff from the first storm event of the season and one other. Samples are analyzed for a suite of potential pollutants including the radiological constituents gross alpha and beta emitters and tritium, and non-radiological constituents that include chemical oxygen demand, metals (aluminum, iron, magnesium, mercury, and zinc), nitrate plus nitrite, oil and grease, acidity or alkalinity (pH), specific conductance, total petroleum hydrocarbons-diesel, and total suspended solids. Storm discharges are visually observed monthly during the wet season, and quarterly visits are conducted to note the presence of unauthorized non-storm water discharges.

Stormwater sampling results are reported in both the permit-required Annual Report and the yearly Site Environmental Report. The Annual Report for 2006 (LBNL 2007) states that analytical results at all stormwater stations in water year 2006 were below detectable concentrations for mercury, oil and grease, and tritium. Detectable results for other parameters varied by location and storm event. In all cases, the results were within historical levels for LBNL, consistent with background levels, within regional Water Quality Control Plan (i.e., Basin Plan) objectives, and below drinking water standards.

In addition to stormwater sampling, creeks and rainwater are sampled as part of LBNL's overall environmental surveillance program. If water is flowing, grab samples are collected quarterly from on-site locations in the North Fork of Strawberry Creek and Chicken Creek and from Strawberry Creek on the University of California Berkeley campus. The samples are analyzed for gross alpha and gross beta radioactive particle emitters, tritium, and mercury. Twice yearly, grab samples are collected from seven creeks – Botanical Creek, Cafeteria Creek, Chicken Creek, No Name Creek, the North Fork of Strawberry Creek, Ravine Creek, and Ten-Inch Creek. Samples are analyzed for tritium, metals, and organic compounds. Composite rainfall samples are collected at one on-site location and analyzed monthly for tritium, gross alpha, and gross beta activity. The Site Environmental Report for 2006 states that when detectable results were observed, they were within historical levels for LBNL, within Basin Plan objectives, and below drinking water standards (LBNL 2007a).

Groundwater Quality

Past practices at LBNL have resulted in several areas of groundwater contamination on the LBNL site. The primary chemical constituents of concern are volatile organic compounds, although polychlorinated

biphenyls (PCBs), petroleum hydrocarbons, and small amounts of polynuclear hydrocarbons have been detected (LBNL 2007a; see also Section 4.6, Hazards and Hazardous Materials). LBNL has mapped the extent of groundwater contamination and provides quarterly updates of the monitoring program (e.g., LBNL 2007a) to regulatory agencies. The CRT project does not overlie an area of groundwater contamination, although several solvent plumes have been identified approximately 0.2 mile northeast of the site, near Building 51 (see Figure 4.7-2, Groundwater Contaminant Plume Map). LBNL has a groundwater remediation program in place to treat these plumes and prevent the movement of contaminated water off site (LBNL and Parsons 2000). The identified plumes are trans-gradient from the CRT site, and therefore are not likely to be affected by dewatering activities at the CRT site. Two monitoring wells are located near the proposed CRT site. MWP-2 is located directly south of Building 70A, directly east of the CRT Project; while OW3-225 is located on the inside bend of the Cyclotron Road hairpin turn, south of the proposed CRT facility. No volatile organic compounds (VOCs) have been detected at either monitoring well over the past 10 years (LBNL 2007b).

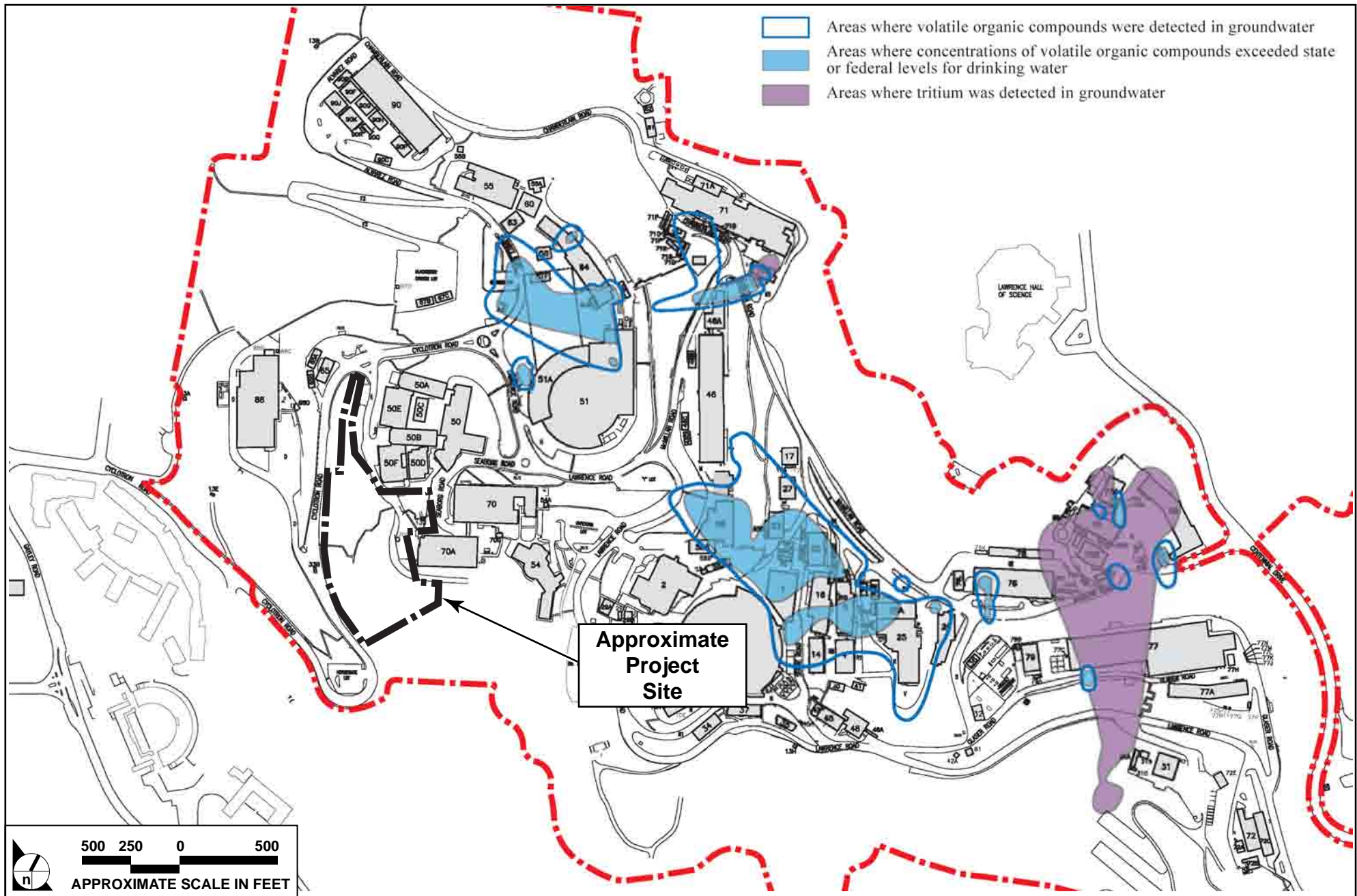
Four other “Areas of Concern” for groundwater contamination have been identified near the CRT site. These are two sanitary sewers, one former diesel tank, and one former PCB storage facility; all associated with the Building 50 and Building 70 complexes. All four of these sites have been studied in detail, and listed as requiring “no further action” by the various oversight agencies (see LBNL and Parsons 2000, for summary).

4.7.3 Regulatory Considerations

This section describes the local, state, and federal regulatory context to be considered for the CRT project. It also discusses plans and policies adopted in the 2006 LBNL LRDP to address hydrology and water quality concerns, including development strategies, stormwater pollution prevention plans, and stormwater management practices, among others.

Federal and State Regulations

Federal and state water quality regulations apply to development projects that may adversely affect the quality of surface waters or groundwater through the discharge of wastewater and stormwater. Section 303 of the Federal Clean Water Act (CWA) and the state’s Porter-Cologne Water Quality Control Act establish water quality objectives for all waters in the state. These objectives are implemented locally through Water Quality Control Plans and the NPDES permitting program. Because hydrology



SOURCE: LBNL Long Range Development Plan - 2006, Perkins+Will - September 2007

FIGURE 4.7-2

Groundwater Contaminant Plume Map

is inextricably linked to ecosystem and wildlife health, the California Department of Fish and Game (CDFG) also has regulatory oversight over projects in lakes, streambeds, and adjacent riparian zones. In addition, Section 404 of the CWA gives the U.S. Army Corps of Engineers (ACOE) authority to regulate discharges of dredged or fill material into Waters of the United States.

Water Quality Control Plan

Pursuant to the CWA and the Porter-Cologne Water Quality Control Act, the California legislature granted authority to protect and enhance water quality in California to the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCB). The SWRCB provides oversight and coordination while the RWQCBs guide and regulate water quality in streams and aquifers through development of Water Quality Control Plans, or Basin Plans. The CRT project drains to waters regulated by the Region 2 (San Francisco Bay) Basin Plan, which was approved in 1995 and updated in 2006. Beneficial water uses are designated in the Basin Plan for local aquifers, streams, marshes, and rivers, as well as water-quality objectives that must be met to protect these uses. Although beneficial uses have not been specifically designated for Strawberry Creek, they have been designated for Central San Francisco Bay to which it discharges, and it is the local Regional Board policy to protect uses that might reasonably apply to the tributaries of listed waters. Beneficial uses designated for Central San Francisco Bay include: Ocean, commercial and sport fishing; Estuarine habitat; Industrial service supply; Migration of aquatic organisms; Navigation; Industrial process supply; Rare, threatened, or endangered species; Contact water recreation; Non-contact water recreation; shellfish harvesting; Fish spawning; and Wildlife habitat.

Water quality objectives established in the Basin Plan to protect the beneficial uses from the types of potential pollutants that could be generated by the project are included in Table 4.7-1, Basin Plan Water Quality Objectives to Protect Beneficial Uses.

On May 18, 2000, the U.S. EPA published the California Toxics Rule (CTR) in the Federal Register, adding Section 131.38 to Title 40 of the Code of Federal Regulations (CFR) and establishing new water quality objectives for some constituents in the Basin Plans. On May 22, 2000, the Office of Administrative Law approved, with modifications, the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Phase 1 of the Inland Surface Waters Plan and Enclosed Bays and Estuaries Plan). The Policy establishes implementation procedures for three categories of priority pollutant criteria or water quality objectives. These are: (1) criteria promulgated by the United States Environmental Protection Act (U.S. EPA) in the National Toxics Rule that apply in California, (2) criteria proposed by the U.S. EPA in the California Toxics Rule, and (3) water quality objectives contained in RWQCB Basin Plans.

Total Maximum Daily Load – Section 303(d) of the Clean Water Act

The State of California is required by Section 303(d) of the federal Clean Water Act to provide the U.S. EPA with a list of water bodies considered by the state to be impaired (i.e., not meeting water quality standards and not supporting their beneficial uses). The list also identifies the pollutant or stressor causing impairment, and establishes a schedule for developing a control plan to address the impairment, typically a Total Maximum Daily Load (TMDL). The TMDL specifies the amount of the target pollutant that the water body can sustain on a daily or annual basis and is established by amending the water quality control plan. TMDLs are prepared by the RWQCBs and result in amendments to Water Quality Control Plans which must be approved by the U.S. EPA. The 303(d) list is used by the U.S. EPA to prepare the biennial federal Clean Water Act Section 305(b) Report on Water Quality.

Although Strawberry Creek is not included in the 2006 303(d) list, the RWQCB has found that San Francisco Bay Area urban creeks do not consistently meet the Basin Plan's narrative water quality objectives pertaining to toxicity. In response, the Basin Plan was amended on November 16, 2005 by Board Resolution R2-2005-0063 to establish a TMDL to reduce diazinon and pesticide-related toxicity in Bay Area urban creeks. The TMDL will become effective upon U.S. EPA approval.

Table 4.7-1
Basin Plan Water Quality Objectives to Protect Beneficial Uses

Parameter	Water Quality Objective
Dissolved Oxygen	7.0 mg/L minimum in Cold water habitat 5.0 mg/L minimum in Warm water habitat The median concentration for any three consecutive months shall not be less than 80 percent of the dissolved oxygen content at saturation.
Salinity	Controllable water quality factors shall not increase the total dissolved solids or salinity of waters so as to adversely affect beneficial uses.
Suspended Solids and Settleable Matter	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic pollutants in sediments or aquatic life.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 NTU.

Parameter	Water Quality Objective
pH	The pH shall not be depressed below 6.5 nor raised above 8.5. Controllable water quality factors shall not cause changes greater than 0.5 units in normal ambient pH levels.
Oil and Grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.
Floating Material	Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.
Temperature	The natural receiving water temperature of inland surface waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses. The temperature of any cold or warm freshwater habitat shall not be increased by more than 5°F (2.8°C) above natural receiving water temperature.
Toxic Pollutants	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90 percent survival or less than 70 percent survival, 10 percent of the time, of test organisms in a 96-hour static or continuous flow test. There shall be no chronic toxicity in ambient waters. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community. Numeric objectives for arsenic, cadmium, chromium III, chromium VI, copper, cyanide, lead, mercury, nickel, selenium, silver, tributyltin, and zinc are provided in the Basin Plan.
Diazinon	Diazinon concentrations in urban creeks shall not exceed 100 ng/L as a 1-hour average (Basin Plan amendment awaiting EPA approval).

Source: RWQCB 2006

National Pollutant Discharge Elimination System

The U.S. EPA has delegated management of California's NPDES program to the State Board and the nine Regional Board offices. The NPDES program was established in 1972 to regulate the quality of effluent discharged from easily detected point sources of pollution such as wastewater treatment plants and industrial discharges. The 1987 amendments to the Clean Water Act [Section 402(p)] recognized the need to address non-point source stormwater runoff pollution and expanded the NPDES program to operators of municipal separate storm sewer systems (MS4s), construction projects, and industrial facilities.

Industrial

Because of metal finishing activities and operation of a hazardous waste treatment facility (Standard Industrial Classification or SIC codes 3499 and 4953), LBNL must be permitted under NPDES industrial

regulations. The State Board administers the NPDES General Permit for Discharges of Stormwater Associated with Industrial Activities (General Industrial Permit). The General Industrial Permit requires the implementation of management measures that will achieve the performance standard of best available technology economically achievable and best conventional pollutant control technology to control pollutants in stormwater runoff from industrial facilities. The General Industrial Permit also requires the development of a SWPPP and a monitoring plan. The SWPPP identifies sources of pollutants and describes the means to manage the sources to reduce stormwater pollution. LBNL filed a Notice of Intent in March 1992 and obtained permit identification number 201S002421 (subsequently changed to 201I002421). Details of the 4th revision of their SWPPP, dated March 1, 2006, are included below.

Construction

The State Board administers the NPDES General Permit for Discharges of Stormwater Associated with Construction Activity (General Construction Permit). If projects involving 1 acre or more of construction are to be covered under the General Construction Permit, the facility must submit a Notice of Intent to the State Board prior to the beginning of construction. The General Construction Permit requires that projects develop and implement a SWPPP, identifying potential sources of pollution and specifying runoff controls during construction for the purpose of minimizing the discharge of pollutants in stormwater from the construction area. In addition, post construction control measures and a monitoring plan should be identified in the SWPPP.

Municipal

The cities of Oakland and Berkeley are both participating agencies signatory to the Alameda Countywide Clean Water Program (ACCWP) NPDES Municipal Stormwater Permit, which regulates urban runoff discharges from municipalities based on the 1987 amendments to the Clean Water Act. Since the first five-year permit was issued by the RWQCB in 1991, the ACCWP has successively implemented a series of comprehensive storm water management plans for urban runoff management meeting Regional Board standards.

When the permit was renewed in 2003, the RWQCB included new design standards for runoff treatment control measures (Provision C.3) from new development and significant redevelopment. The reissued permit also required development of a Hydrograph Modification Management Plan (HMP) to manage increased peak runoff flows and volumes (hydromodification) and avoid erosion of stream channels and degradation of water quality caused by new and redevelopment projects (Provision C.3.f). LBNL is generally exempt from local regulations (including provision C.3.f); however, LBNL has included provisions in the 2006 LRDP to control hydromodification (see LBNL Stormwater Management).

Local Plans and Policies

Although LBNL is generally exempted from compliance with local land use regulations, LBNL seeks to cooperate with local jurisdictions. LBNL is located in both the City of Berkeley and the City of Oakland. The CRT project site is entirely within the limits of the City of Berkeley.

Berkeley General Plan

The Berkeley General Plan was adopted on April 23, 2002. It contains several policies that are relevant to the implementation of the proposed CRT project:

- Policy EM-23 Water Quality in Creeks and San Francisco Bay: Take action to improve water quality in creeks and San Francisco Bay.
 - D) Restore a healthy freshwater supply to creeks and the Bay by eliminating conditions that pollute rainwater, and by reducing impervious surfaces and encouraging use of swales, cisterns, and other devices that increase infiltration of water and replenishment of underground water supplies that nourish creeks.
 - F) Encourage the maintenance and restoration of creeks and wetlands and appropriate planting to cleanse soil, water, and air of toxins.
- Policy EM-24 Sewers and Storm Sewers: Protect and improve water quality by improving the Citywide sewer system.
 - E) Ensure that new development pays its fair share of improvements to the storm sewerage system necessary to accommodate increased flows from the development.
 - F) Coordinate storm sewer improvements with creek restoration projects.
- Policy EM-25 Groundwater: Protect local groundwater by promoting enforcement of state water quality laws that ensure non-degradation and beneficial use of groundwater.
- Policy EM-27 Creeks and Watershed Management: Whenever feasible, daylight creeks by removing culverts, underground pipes, and obstructions to fish and animal migrations.
 - D) Restrict development on or adjacent to existing open creeks. When creeks are culverted, restrict construction over creeks, and encourage design solutions that respect or emphasize the existence of the creek under the site.
 - F) Work in cooperation with adjoining jurisdictions to jointly undertake creek and wetland restoration projects, to improve water quality and wildlife habitat, to allow people to enjoy creeks as part of urban open space.

- G) Regulate new development within 30 feet of an exposed streambed as required by the Creeks Ordinance and minimize impacts on water quality and ensure proper handling of stormwater runoff by requiring a careful review of any public or private development or improvement project proposed in water sensitive areas.
- H) Consider amending the Creek Ordinance to restrict parking and driveways on tops of culverts and within 30 feet of creeks.
- Policy S-27 New Development: Use development review to ensure that new development does not contribute to an increase in flood potential.
 - C) Require new development to provide for appropriate levels of on-site retention or detention of stormwater.
 - D) Regulate development within 30 feet of an exposed streambed as required by the Preservation and Restoration of Natural Watercourses (Creeks) Ordinance.

2006 LRDP and LBNL Principles and Strategies³

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 hydrology and water 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 the most developed areas of the site to preserve open space, and 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.
- Site and design new facilities in accordance with University of California energy efficiency and sustainability policies to reduce energy, water, and material consumption and provide improved occupant health, comfort, and productivity.
- Reduce the percentage of parking spaces relative to the adjusted daily population.

³ While this Environmental Impact Report is a “stand alone” 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 and strategies are identified in this section.

- Consolidate parking into larger lots and/or parking structures, and 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.
- Consolidate service functions wherever possible in the Corporation Yard.
- Utilize native, drought-tolerant plant materials to reduce water consumption; focus shade trees and ornamental plantings at special outdoor use areas.
- Minimize impervious surfaces to maintain or reduce storm water runoff and provide landscape elements and planting to stabilize slopes, reduce erosion and sedimentation.
- Maintain a safe and reliable utility infrastructure capable of sustaining the Laboratory's scientific endeavors.
- Design infrastructure improvements to embody sustainable practices.

LBL 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 specific planning and design guidance for the hydrologic and water quality 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 design guidelines and any other relevant plans and policies. Approvals would be subject to satisfactory compliance with these provisions. Design objectives that are applicable to hydrology and water quality include the following:

- Minimize impacts to disturbed slopes.
- Minimize further increases in impermeable surfaces at the Berkeley Lab.
- Minimize visual and environmental impacts of new parking lots.

LBL SWPPP

LBL developed a SWPPP and a SWMP in 1992 to comply with the NPDES General Industrial Permit. The most recent revision of the LBNL SWPPP (LBL 2006a) identifies potential sources of pollution and describes BMPs used to protect stormwater quality. In accordance with LBNL's SWMP, water quality

samples are collected during the wet season to demonstrate the effectiveness of the SWPPP and compliance with NPDES requirements.

Potential sources of pollution identified in the LBNL SWPPP include: materials management, vehicles, construction and maintenance activities,⁴ and spills and leaks. Three levels of BMPs are considered for each pollutant: source control, management control, and treatment control. Examples of BMPs that have been implemented and are described in the LBNL SWPPP include:

- Safe handling of materials during loading, unloading, and transport to avoid container breakage and spillage (i.e., spill containment, personnel training)
- Proper handling and appropriate storage of materials (i.e., indoor use, proper containers, inspections)
- Control of radionuclide use (i.e., LBNL Radiological Work Authorization Program)
- Washing and servicing of vehicles to prevent leaks and spills to the storm drain system (i.e., off-site repair, discharge of wash station to oil-water separator and sanitary sewer system)
- Parking area guidelines (i.e., routine sweeping of parking lots, pavement inspections and repair)
- BMPs to avoid impact to the storm drain system from soil erosion or construction materials (i.e., covered excavation piles, storm drain inlet protection, concrete washout controls)
- Maintenance of stormwater-related facilities (i.e., inspections and cleaning)
- Prevention of sediment and erosion (i.e., landscaping)
- Hazardous materials and waste management guidelines (i.e., waste minimization, spill prevention, personnel training)

LBNL Stormwater Management

The 2006 LRDP EIR lists examples of engineering design features that are used by LBNL to control surface water flow:

- Primary debris interceptors. Structural steel tubes, evenly spaced and embedded in concrete across drainage channels, which remove heavy, floating items such as logs, limbs, stumps, and brush from storm runoff entering the LBNL site from upstream portions of the drainage. Primary debris interceptors prevent blockage of the storm system entrance and potential flooding; as debris collects on the interceptors, these features also function as local seasonal check dams by storing, slowing, and further dissipating energy of larger storm flows.

⁴ Although construction activities are included in the SWPPP, LBNL will file a Notice of Intent prior to construction of the CRT project to comply with the NPDES General Construction Permit.

- Secondary debris interceptors. Heavy vertical grids of rebar spaced more closely together than primary debris interceptors to filter out smaller debris, constructed downstream from primary interceptors to further manage flows originating upstream of the site as they enter LBNL. Fiber rolls and similar instruments are typically placed seasonally at the secondary interceptors to help filter out suspended soil particles from runoff and act as smaller check dams, silting pools, and energy dissipaters.
- Rip-rap. Sharp-edged cobblestone typically placed at all entrances and outfall points in the storm drain system. Rip-rap is frequently cemented together and both dissipates energy and protects slopes and channels.
- Wing walls and head walls. Concrete walls used where open-channel flow enters a piping system to protect embankment and channel walls from erosion. Steel grates on the inlet structure also filter debris which may have bypassed the primary or secondary debris interceptors.
- Concrete v-ditches. Channels used in all earthwork projects along the tops of cut slopes and at intermediate benches on the face of the slope. V-ditches intercept surface runoff to keep the slope face from eroding and channeling.
- Jute mesh. Jute mesh installed on all slopes exposed by construction or grading activities on slopes steeper than 2:1 to prevent erosion until hydroseeding and/or ground cover is well established. Mesh is pinned to the slope with long metal staples and typically reinforces the emerging grasslands for up to seven years. Fiber rolls are staked at regular intervals across the faces of slopes to slow down and filter surface runoff.
- Down drains. Pipes that convey water down the face of slopes from a collection point at the top of the slope to a lower elevation at a stable outfall point to prevent erosion and damage to the slope face.
- Impervious, semi-pervious, and pervious pavements, curbs, berms, and water dispersal systems. Surfaces that convey and control storm runoff to prevent runoff from eroding otherwise unprotected surfaces or from flowing down unprotected slopes.

As part of ongoing efforts to coordinate stormwater management efforts within the Strawberry Creek watershed, as well as in response to public comments received as part of the 2006 LRDP EIR process, LBNL expanded its stormwater management practices to reflect the 'Continuing Best Practices' outlined in UC Berkeley's 2020 LRDP EIR (LBNL 2006 LRDP Final EIR, Appendix A, pp. IV.G-16 and 17). These new measures help to clarify certain specific goals to control hydrologic and water quality impacts:

- During the design review process and construction phase, LBNL will verify that the proposed project complies with all applicable requirements and BMPs (reflecting UCB Continuing Best Practice HYD-1-a).
- LBNL will implement an urban runoff management program containing the BMPs included in the Strawberry Creek Management Plan. LBNL will also continue to comply with its NPDES stormwater permitting requirements by implementing appropriate construction and post construction control measures and BMPs required by project-specific SWPPPs. Stormwater

Pollution Prevention Plans would be prepared as required by regulation to prevent discharge of pollutants and to minimize sedimentation and the transport of soils resulting from construction-related activities (reflecting UCB Continuing Best Practice HYD-1-b).

- Landscaped areas of development sites will be designed to absorb runoff from rooftops and walkways where feasible. LBNL will ensure that open or porous paving systems be included in project designs wherever feasible, to minimize impervious surfaces and absorb runoff. “Feasibility” is based on site constraints such as topography, slope steepness and stability, soil type and permeability (reflecting UCB Continuing Best Practice HYD-2-c).
- To accommodate existing runoff, LBNL will continue to maintain and clean its storm drain system (reflecting UCB Continuing Best Practice HYD-4-a).
- Development that encroaches on creek channels and riparian zones will be restricted. Creek channels will be preserved and enhanced, where feasible. An undisturbed buffer zone will be maintained between proposed LRDP projects and creek channels (reflecting UCB Continuing Best Practice HYD-4-c).
- LBNL will manage runoff into storm drain systems such that the aggregate effect of projects implementing the LRDP is to approximate pre-project runoff volumes (reflecting UCB Continuing Best Practice HYD-4-e).
- Any project proposed with potential to alter drainage patterns will be accompanied by a hydrologic modification analysis. Such an analysis will then incorporate a plan to prevent increases of flow from the newly developed site, preventing downstream flooding and substantial siltation and erosion (reflecting UCB LRDP Mitigation Measure HYD-5).

4.7.4 Impacts and Mitigation Measures

Significance Criteria

According to the LBNL LRDP Initial Study Checklist and Appendix G of the California Environmental Quality Act (CEQA) Guidelines, a project would normally have a significant environmental impact if it would:

- Violate any water quality standards or waste discharge requirements;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on or off site;

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on or off site;
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- Otherwise substantially degrade water quality;
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows;
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam; or
- Cause inundation by seiche, tsunami, or mudflow.

Issues Not Discussed Further

Since the project would not require any groundwater withdrawal, it would not result in impacts to groundwater supplies. Recharge of the groundwater table would not be affected by implementation of the proposed project because the project would infiltrate storm water to the maximum extent practicable, and, due to the steep slope and relatively clay-rich soils, the site is not an area of significant recharge to groundwater under existing conditions. Groundwater flow paths that do exist at the site are unlikely to be affected, as the building will extend a maximum of 25 feet below the ground surface, above the level at which groundwater is typically observed near the site.

The project site elevation is not located within the Federal Emergency Management Agency's (FEMA) Flood Zone A (100-year flood zone). The Initial Study found that the project would not place housing and structures in a flood hazard area, nor would it expose people to flooding.

Given the topography and elevation of the site, and the distance to the bay, the implementation of the project would result in no impact related to the risk of inundation from seiche, tsunami, or mudflow.

These issues are not discussed further.

Project Impacts and Mitigation Measures

CRT Impact HYDRO-1: Development of the project site would increase the area of impervious surfaces (i.e., pavements and hardscapes, building roofs, and compacted soil surfaces) and would result in increased peaks and duration of stormwater flows, potentially contributing to erosion and/or siltation in Strawberry Creek. (Potentially Significant; Less than Significant with Mitigation)

Construction of impervious surfaces on areas currently occupied primarily by vegetated open space would, without appropriate controls, decrease stormwater infiltration at the site and result in increased peak flow and volume of flow in downstream receiving channels. These increases (often referred to as 'hydromodification') can, in turn, increase the frequency of erosive events in downstream channels. The effects are typically most prominent for the higher frequency, lower magnitude events that occur on a yearly or decadal basis.

The CRT project includes the use of permeable pavement for the service area located on the western side of the building (between the building and the existing parking area) as a means for reducing stormwater runoff. In addition, stormwater runoff from the most of the building roof would be directed into vegetated swales before emptying to the storm drain system. While not specifically designed for hydromodification control, the swales would serve to absorb (and allow evapotranspiration of) some of the excess stormwater volume.

However, even considering the above measures, the proposed project would add approximately 1.36 acres of new impervious area to the project site, and some increase in stormwater runoff volume is expected. To mitigate this impact, as part of the project, stormwater runoff from all impervious surfaces would be directed to an array of three hydromodification vaults that would be constructed in line with the storm drain system. The vaults would exclude infiltration of water to the surrounding soil to avoid the potential of reducing slope stability. Figure 3.0-7, Conceptual Stormwater Management Plan, shows the location of these vaults. The proposed hydromodification vaults have been preliminarily sized using the Bay Area Hydrology Model, a tool that was developed and calibrated to meet the conditions of the Alameda County NPDES C.3.f (hydromodification) provision. The vaults would provide 'flow duration control'⁵ of stormwater runoff from the project site (both peaks and duration of erosive flows) for storms between 10 percent of the 2-year recurrence flow and the 10-year recurrence flow. This would reduce

⁵ 'Flow duration control' is a method used for mitigating urban hydromodification that controls the cumulative duration of frequent, erosive flows from the project, mimicking pre-project conditions. This method, originally developed for use in Western Washington, has been incorporated into the Alameda, Santa Clara, and San Mateo County (among others) hydromodification management plans.

hydromodification impacts to a less than significant level by retaining the excess stormwater and/or releasing the water at a rate below the erosion threshold of the receiving stream.⁶ To ensure that the proposed hydromodification vaults are appropriately sized, the following mitigation measure is proposed to address stormwater runoff.

CRT MM HYDRO-1: Using the Bay Area Hydrology Model, calculations shall be provided following approval of the final project design to show that the proposed hydromodification vaults are sized appropriately to control flows such that 'flow duration control' is provided between 10 percent of the 2-year recurrence storm and the 10-year recurrence storm.

Significance after Mitigation: Less than significant.

CRT Impact HYDRO-2: Development of the site would alter surface drainage patterns on the site and could result in increased peak flows and induce flooding in downstream reaches. (Potentially Significant; Less than Significant with Mitigation)

All stormwater from newly created impervious areas at the CRT site would be directed to storm drain systems that discharge to the North Fork of Strawberry Creek. Potential increases in Strawberry Creek flows below the 10-year design storm would be controlled by the hydromodification vaults, as described above. However, some increase in storm water runoff from the site is also expected for higher magnitude events (the 25-year, 50-year, and 100-year storms, for example). Because of the project site's relatively steep hillside location, much of the rainfall during large storm events (when the ground is saturated and infiltration is reduced) runs directly off the site rather than infiltrating into the soils. Therefore, the difference between pre-development and post-development flows for large storms would be small. However, a small increase could potentially exacerbate flooding in downstream reaches of Strawberry Creek, especially at the Oxford Street culvert at the western end of the UC Berkeley Campus where the existing capacity is limited to approximately a 25-year event (UCB 2005). Therefore, the project's impact related to flooding would be potentially significant.

Two options to control peak flows up to the 100-year event are being considered for the CRT project. The first option consists of oversizing the stormwater pipe system to allow detention of peak flows. The second option consists of subsurface vaults large enough to hold peak storm flows and release them at a rate no greater than the pre-development condition. To ensure that the pipe system or subsurface vaults will be appropriately sized, the following mitigation measure is proposed to address potential increases in peak flows.

⁶ See CRT Impact HYDRO-2 for discussion of flood control for storm events above the 10-year storm.

CRT MM HYDRO-2: The hydromodification vaults or stormwater pipe system shall be oversized to allow detention of peak flows for the 25-, 50- and 100-year design storms and release at a rate no greater than the pre-development condition, or equivalent separate facilities will be incorporated to provide such control. Final design calculations showing no increases in peak runoff for the 25-, 50-, and 100-year events will be provided to and reviewed by LBNL staff upon finalization of the project design.

Significance after Mitigation: Less than significant.

CRT Impact HYDRO-3: Project construction would not result in increased erosion and sedimentation, the potential release of chemicals to stormwater, or a temporary increase in turbidity or decrease in water quality in surface waterways. (Less than Significant)

LBNL currently employs, and would continue to employ, a wide array of construction-phase best management practices to minimize the potential for accidental discharges of fill or other materials into surface waters. Active management of construction-related stormwater flows from development sites is a standard part of contract specifications on all construction projects undertaken by LBNL. Construction projects incorporate control measures and are monitored to manage stormwater 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 Lab's construction specifications require that contractors properly maintain construction vehicles to minimize fluid leaks and not refuel construction equipment in proximity to waterways. These ongoing practices would reduce the potential for accidental discharge during construction to adversely affect surface and groundwater quality.

In addition to following LBNL best management practices, the impact to surface and groundwater quality would be minimized to below the level of significance through development and implementation of a SWPPP (including a project-specific erosion control plan) as required by the NPDES permit program. The SWPPP would incorporate LBNL's standard stormwater management practices and engineering controls as well as standards outlined in Association of Bay Area Governments' Manual of Standards for Erosion and Sediment Control Measures (ABAG 1995) and the California Stormwater Quality

Association's Stormwater Best Management Practice Handbook for Construction (CASQA 2003). Development of a project-specific SWPPP, including appropriate measures for construction activities on hill slopes, has been included in the project for compliance with the California NPDES General Permit for Storm Water Discharges Associated with Construction Activity. The impact related to construction site runoff would be less than significant.

Mitigation Measure: No project-level mitigation measure required.

CRT Impact HYDRO-4: Stormwater runoff from the proposed driveway and other impervious surfaces could potentially contribute to long-term pollutant discharges to surface waters, including Cafeteria Creek, Strawberry Creek, and the Bay. (Potentially Significant; Less than Significant with Mitigation)

The proposed project includes creation of a new 160-foot access driveway with a loading dock, approximately four new parking spaces, and a fire turnaround/service yard. This would result in approximately 0.3 acre of new hardscape areas that could potentially affect the quality of stormwater runoff.⁷ The service/fire turnaround area (0.2 acre) would be constructed using permeable pavers as a means for controlling and treating stormwater pollutants at the site. Although the remaining access driveway/loading dock area is small (approximately 0.1 acre), because of its use as a loading dock the potential impact to water quality is significant. CRT Mitigation Measure HYDRO-4a would reduce this impact to a less than significant level.

The footprint of the proposed CRT building and associated mechanical enclosure is approximately 1.06 acres. While roof runoff does not typically contribute contaminants at levels as high as parking areas and roads, there is still some contribution from airborne deposition of particulate matter. For this reason, a vegetated swale has been incorporated into the project to treat roof runoff. Under the current project plans, the swale has been designed at a conceptual level, pending final project designs and feasibility based on geotechnical recommendations. In the event that some of these improvements are found to be infeasible, or cannot be appropriately sized, the proposed project could result in a potentially significant impact on surface water quality. CRT Mitigation Measure HYDRO-4b is included to guide the final designs so that water quality impacts are reduced to a less than significant level.

CRT MM HYDRO-4a: An in-line pollution prevention device (such as a Continuous Deflective Separation unit or Stormceptor) shall be installed within the storm drain system to control sediment and floatables from the access driveway and loading dock

⁷ Building roofs do not generally contribute chemical pollutants to stormwater runoff at levels similar to parking and access road areas, and therefore are considered separately below.

area in the northern portion of the project site prior to release of stormwater to the storm drain at Cyclotron Road.

CRTMM HYDRO-4b: If feasible, vegetated swales or a stormwater garden shall be incorporated into the project to maintain water quality of roof runoff and avoid exceeding water quality objectives prior to discharge to creeks. LBNL shall provide calculations showing that design of these features meets recognized criteria for design of water quality BMPs. Should it be determined that appropriately sized vegetated swales are not feasible, then alternative RWQCB-approved methods of treating stormwater runoff, such as in-line pollution prevention devices or infiltration galleries, shall be incorporated into the project. All water quality treatment and source controls shall be summarized in the project-specific SWPPP, which will be available to regulatory agencies for inspection.

Significance after Mitigation: Less than significant.

4.7.5 References

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