4.8 HYDROLOGY AND WATER QUALITY

4.8.1 Introduction

This section presents existing RBC site hydrologic and water quality conditions and analyzes the potential for development under the proposed 2014 LRDP to affect those resources. This analysis is based on information summarized in the Current Conditions Report (Tetra Tech 2008), more recent Tetra Tech reports including the 2012 Groundwater Results Technical Memorandum, and various publicly available technical studies.

The hydrology and water quality discussion includes a description of the regulatory environment; stormwater drainage features; flooding potential; groundwater hydrology, including groundwater depth and flow; surface water and groundwater interaction; and current water quality. Existing RBC site conditions are described in terms of historical and current site uses.

Public and agency NOP comments related to hydrology and water quality concerned restoration of the Meeker Ditch to a natural state, existing site contamination, completion of site remediation, increasing runoff to Western Stege Marsh, and assessing and planning for sea-level rise and storm surges.

4.8.2 Environmental Setting

The RBC site is approximately 134 acres and consists of upland areas developed with buildings that are used for academic teaching and research activities and spaces leased by private entities, areas of coastal grasslands, a tidal salt marsh (known as the Western Stege Marsh), and a transition zone between the upland areas and the marsh. Grasslands occur in a number of meadows on the RBC site. The parcel west of Regatta Boulevard is fully developed.

Surface Water

Runoff on the RFS portion of the RBC site currently flows from north to south by way of sheet flow, open swales, culverts, and storm drains. The existing storm drain system consists of two main 24-inch storm drain lines -- the Eastern Storm Drain and the Western Storm Drain – spanning the respective eastern and western edges of existing improvements. It is believed that the Western Storm Drain was originally a sewer line draining to the San Francisco Bay mudflats that was placed along Syndicate Avenue prior to the establishment of the Richmond Publically Owned Treatment Works and construction of the existing City of Richmond sewer mains traversing the north and south portion of the RFS (Hyde et al. 1941). After construction of the Richmond Publically Owned Treatment Works, the Western Storm Drain remained connected as an overflow port to the City of Richmond sanitary sewer main traversing the northern portion of the RFS before the overflow was closed by UC Berkeley in 2004 with permission from the City of Richmond. The Western Storm Drain now conveys only runoff from the central and northeastern portions of the RFS, the NRLF (Building 400), eastern portions of the coastal-terrace prairie, and the asphalt pads to the east of Building 128.

The Western Storm Drain discharges to Meeker Slough downstream of the confluence of Meeker Tidal Creek and Meeker Ditch. The Eastern Storm Drain collects runoff from the southeast portion of the RFS (Building 180 and south) and discharges in the northeastern corner of Western Stege Marsh, which drains to the west into Meeker Slough upstream of the Bay Trail bridge. The most western portion of the RFS, including most of the coastal-terrace prairie and Building 280, drains through an open swale west of the EPA Laboratory, then overland into Meeker Slough downstream of the Meeker Ditch/Meeker Tidal Creek confluence.

The Regatta portion of the RBC drains to City storm drains that discharge to Meeker Tidal Creek and Meeker Ditch.

A tidally influenced trapezoidal concrete-lined storm drain channel, Meeker Ditch, runs north-south along the eastern edge of Regatta Boulevard and South 32nd Street. Meeker Ditch is the continuation of a mostly culverted former creek channel draining a watershed extending to McBryde Avenue near Alvardo Park that is almost completely urbanized and consists of housing, light industry, commercial and institutional facilities, and some small parks. Meeker Ditch discharges at the southwest corner of the RBC upland area into Meeker Slough at the confluence with Meeker Tidal Creek. The creek is a tidally influenced storm drain channel at the northern boundary of the Marina Bay housing complex that collects runoff from the watershed between Richmond Inner Harbor and I-580, which is also almost completely urbanized and consists of housing, institutional buildings, warehouses, and rail yards.

The former Zeneca site is east of 46th Street. In the past, runoff from a portion of the former Zeneca Site drained into the RFS Eastern Storm Drain via an interconnecting storm drain originating on South 46th Street near RFS Building 185. Following 2002 and 2003 Zeneca site remediation activities, only a small amount of Zeneca site surface runoff now flows into the interconnecting and Eastern Storm Drain (Tetra Tech 2008).

Flooding

A flood hazard zone exists along the RFS southern margin as offshore winds can combine with high tides to increase shoreline water elevations. The project site's southern portion is within the 100-year flood hazard zone and is potentially subject to water inundation due to projected storm surge, a tsunami, or a seiche.

Sea levels are expected to rise in coming years due to global climate change. Estimates forecast by experts differ and are expressed in ranges; by year 2100, for example, the International Panel on Climate Change estimates a sea level rise range of 19 to 58 cm (7 to 23 inches) (IPCC 2007) while others cited in this EIR forecast a 50 to 140 cm (19 to 55 inches) range (Rahmstorf 2007). San Francisco Bay is the base level elevation for Meeker Ditch stormwater discharge west of the project site. At high tidal stands, a higher base level has the potential to reduce the Meeker Ditch stormwater discharge rate to the Bay and to increase the water table elevation, including in the project area. As a result, flooding frequency within the lower Meeker Tidal Creek reaches could increase when high tides, westerly wind-driven waves, and high storm discharges occur. However, these effects would not result from alteration of drainage patterns.

As discussed in the 2014 LRDP, the areas that are now Western Stege Marsh and the transition area just north of the marsh were historically intertidal mudflats. Offshore breakwaters constructed in the 1930s and the rerouting of Meeker Creek from further west to its current location resulted in soil deposition and transition of the mudflats to the tidal marshland which exists today. The 1959 construction of the embankment which now supports the Bay Trail includes a bridge over Meeker Slough where tidal and storm drain waters connect the marsh and the bay. Assuming natural adaptation with sea level rise, the marsh will likely transgress up the slopes that border the marsh which include areas reserved under the RBC LRDP as Natural Open Space, with or without the project. Within its existing boundary, the marsh will need to aggrade upward to continue supporting vegetation in adaptation to sea level rise. Adequate wave sheltering and sediment deposition are necessary to promote upward aggradation of the marsh.If the existing offshore structures (e.g. breakwaters and Bay Trail embankment) degrade and are not replaced by a beach dune or other shoreform, the Bay waves may limit sediment deposition. If the sea level rises at a faster rate than natural soil deposition, marsh vegetation continuity may depend on soil augmentation by the University. Aggradation at a pace slower than sea level rise would result in a lower elevation relative to the sea level which may cause the marsh to revert back to an intertidal mudflat.

Groundwater Occurrence

RBC site contamination investigations have revealed three water-bearing zones within 100 feet below the ground surface (Tetra Tech 2008). These are:

- Shallow zone, 10 to 20 feet below the surface;
- Intermediate zone, 30 to 74 feet below the surface; and
- Deeper zone, 90 to 100 feet below the surface.

The shallow water-bearing zone spans the depth in which artificial fill, Quaternary alluvium, and young Bay sediments are found. Although the sediments are generally coarser in the upper 20 feet, clay content and sufficiently discontinuous permeable lenses slow groundwater flow such that the yield from shallow wells is low (Tetra Tech 2012). Intermediate zone groundwater appears to flow through a relatively continuous, five-foot-thick sand stratum at a depth of about 30 to 35 feet. Groundwater may be under semi-confined conditions within this zone. The older Bay Mud acts as a confining layer or aquitard. The deeper groundwater zone is below or within the older Bay Mud.

The ground surface elevation slopes from about 30 in the north and 25 feet National Geodetic Vertical Datum in the RBC site northeast corner and slopes down to the south and west. To the south, it slopes to about 15 to 20 feet in the site's central portion, down to about 2 feet along the edge of Meeker Slough. To the west, it slopes to about 10 feet at the far western boundary of the Regatta property.

Groundwater gradients vary somewhat seasonally and locally across the RBC site, probably due to differences in the amount of recharge and local differences in vertical permeability. The general direction of flow is toward the southwest, in the direction of Meeker Slough. In the late fall, groundwater elevations in the shallow zone are about 10 to 11 feet National Geodetic Vertical Datum (15 feet bgs) in the RBC site northeast corner, falling to about 6 feet National Geodetic Vertical Datum (10 feet bgs) in the RBC site central area, and dropping to about just below the ground surface along Meeker Slough. During groundwater monitoring rounds between November 2010 and April 2011, groundwater elevations in the site's northeast corner increased about one foot in April relative to November, probably as a result of greater springtime recharge.

During the 2010/2011 monitoring period, a groundwater mound observed near Building 150 was reportedly caused by a leaking underground water line. The break was identified and repaired in fall 2010 but by April 2011, the mound had not diminished significantly. This suggests that vertical permeability is very low in the shallow zone and that the mounded groundwater may have been perched on low permeability sediments.

Groundwater elevation measurements in grouped wells spanning different aquifer zones reveal slight vertical gradients, probably due to the low permeability within the shallow sediments and poor hydraulic connection across zones. However, the vertical gradient direction appears to be influenced by seasonal recharge and local conditions. For example, during the spring, regional recharge would be expected to increase hydrostatic pressure in deeper aquifer units, creating an upward gradient. However, the effect might be reversed in unpaved areas that receive more local recharge and where the shallower, perched zone is replenished.

Groundwater Quality

Total dissolved solids at the RFS average 1,420 milligrams per liter with a maximum of 27,500 milligrams per liter at the northwestern edge of the Western Stege Marsh adjacent to the Meeker Slough. The high total dissolved solids levels are due to the proximity to the Bay (Tetra Tech

2013). Groundwater at the RBC site has not been significantly impacted by contaminated soils. However, as described in the 2013 Site Conditions Report, Proposed Richmond Bay Campus (Tetra Tech 2013), results of four semi-annual rounds of groundwater sampling from piezometers installed site-wide in 2010 show that volatile organic compounds (tetrachloroethylene (PCE), TCE, and others) are present along the eastern property boundary of the RFS and adjacent areas of the former Zeneca site where historic industrial activities resulted in groundwater contamination. In addition, an area of carbon tetrachloride groundwater contamination is present in the northwest portion of the RFS from an unknown source that may be on-site or off-site.

Of the 25 monitoring wells analyzed in April 2011 (Tetra Tech 2012), only three produced metal concentrations exceeding drinking water standards. Above-standards arsenic was found in a well at the edge of Western Stege Marsh; nickel was detected in a well near Building 163 at the site's southeast corner and in a well east of Building 472 at the eastern site boundary.

A passive groundwater treatment system known as a "biologically active permeable barrier" is installed across the shallow aquifer zone just south of the RBC site uplands area to treat dissolved metals from upgradient sources. The biologically active permeable barrier traps dissolved metals as the groundwater passes through the barrier toward Western Stege Marsh. In addition, a subsurface slurry wall has been installed along the RBC southeastern boundary (south from Building 178). This slurry wall prevents shallow groundwater from migrating across the RBC boundary and it channels upgradient groundwater into the biologically active permeable barrier. The primary purpose of this system is to protect water quality in Western Stege Marsh.

A Final Site Characterization Report (SCR) (Tetra Tech 2013) has been prepared to help determine remedies and prescriptive requirements for certain 2014 LRDP-defined developable areas of the RFS site. The SCR found that carbon tetrachloride concentrations (primarily) in the RFS northeast area exceeded commercial vapor intrusion risk-based concentration and maximum contaminant levels. The carbon tetrachloride source is unknown but is suspected to be historical activities near Building 280B. TCE exceeded the commercial vapor intrusion risk-based concentration and maximum contaminant levels primarily along the eastern boundary of the RFS.

Additional information on groundwater contamination is presented in Section 4.7.2.

4.8.3 Regulatory Considerations

Federal

<u>*Clean Water Act*</u>

The Clean Water Act (CWA) (33 U.S.C. 1251 et seq.) of 1972 is the principal federal law protecting the quality and integrity of the nation's surface waters. The CWA offers a range of mechanisms to reduce pollutant input to waterways, manage polluted runoff, and finance municipal wastewater treatment facilities. Permit review serves as the CWA's principal regulatory tool; CWA regulation operates on the premise that discharges to jurisdictional waters are unlawful unless authorized by a permit. The following CWA sections are particularly relevant to the proposed project:

- Section 303 – water quality standards and implementation plans
- Section 401 – State Water Quality Certification or waiver
- Section 402 – National Pollutant Discharge Elimination System (NPDES)
- Section 404 – Discharge of dredged or fill materials into waters of the US

Section 303 of the CWA requires states to identify waters that do not meet applicable water quality standards, establish priority rankings for listed waters, and develop action plans, called Total Maximum Daily Loads, to improve water quality.

Section 401 of the Clean Water Act, in order to ensure water quality standards compliance, requires State Water Quality Certification for all federal permit or license applications for any activity that may result in a discharge to a water body. Most Certifications are issued in connection with Section 404 permits for dredge and fill discharges.

Section 402 of the Clean Water Act established a permit system, the NPDES, to regulate point sources of discharges in navigable waters of the United States. The EPA implements the NPDES, although the Act also allows states with sufficient authority to implement the NPDES program in lieu of the EPA. UC Berkeley operates under its own NPDES permit. The RBC may operate under this permit or its own individual permit.

Section 404 of the Clean Water Act regulates the discharge of dredged or fill material into waters of the US, which include wetlands and vernal pools. Discharge activities regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and mining projects (www.epa.gov/owow/wetlands/pdf/reg_authority_pr.pdf).

The Water Quality Control Plan for the San Francisco Bay Basin is the San Francisco Bay RWQCB's planning document.

The State Water Resources Control Board and the nine RWQCBs share authority for implementation of the federal Clean Water Act and the state Porter-Cologne Act.

Energy Independence and Security Act

Section 438 of the Energy Independence and Security Act (42 USC 17094) requires federal agencies, or projects using federal funds, to reduce stormwater runoff from federal development and redevelopment projects to protect water resources. Stormwater management strategies should be implemented to plan, design, construct, and conduct operations in a manner to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow or retain all stormwater on site. The State Water Resources Control Board's LID goal parallels the EISA strategies. LID practices include bioretention, rain gardens, rooftop gardens, sidewalk storage, vegetated swales, buffers and strips, tree preservation, roof leader disconnection, rain barrels and cisterns, permeable pavers, soil amendments, impervious surface reduction and disconnection, pollution prevention, and good housekeeping (SWRCB 2010).

State

The State Water Resources Control Board and the San Francisco Bay RWQCB implement the Non-Point Source regulations under the Clean Water Act. The State has developed a General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit Order 2009-0009-DWQ) for developments that would disturb an acre or more of land. The General Permit requires developers to prepare a Storm Water Pollution Prevention Plan (SWPPP) that identifies BMPs to be implemented. These plans must be prepared by a Qualified Construction Storm Water Developer and must be implemented under supervision of a Qualified Construction Storm Water Practitioner with appropriate levels of training.

Local

Because the RBC would be operated by the University on UC land for UC purposes, it is exempt from many local regulations. However, LBNL and UC Berkeley seek to coordinate with local jurisdictions to reduce any potential conflicts with the local regulations.

Contra Costa County Watershed Program

The Contra Costa County Watershed Program is responsible for ensuring that the County complies with its municipal stormwater NPDES permits. The City of Richmond and 15 other cities and towns, Contra Costa County, and the Contra Costa County Clean Water Program are co-permittees under this program. The watershed program's current NPDES permits are the Municipal Regional Permit for discharges to the San Francisco Bay (Region 2) and the East Contra Costa County Permit for discharges to the Delta (Region 5). The Municipal Regional Permit was adopted on October 14, 2009; it applies to 76 Bay Area municipalities in order to standardize requirements, pool resources, and achieve results on a large scale.

Under Phase 1 Non-Point Source requirements, municipalities are responsible for ensuring that stormwater discharges from municipal storm sewers meet the receiving water standards. Municipalities must develop local ordinances or programs to ensure compliance. The Contra Costa County Watershed Program defines standards for new developments. LID is one of the requirements of the Clean Water Program.

City of Richmond General Plan

The RBC site is a University property where work within the University's mission is performed. As a state entity, the University is exempt under 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. The RBC site is located within the City of Richmond and is within the Southern Shoreline Planning Area of the City of Richmond General Plan. The following sections summarize goals and policies from the City of Richmond General Plan and local ordinances as they relate to hydrology and water quality.

The Conservation, Natural Resources and Open Space Element (Element 7) of the City of Richmond General Plan addresses hydrology and water quality issues both directly and indirectly. For example, Element 7 calls for habitat conservation and restoration, open space conservation, establishment of creek corridor performance standards, and urban creek restoration actions. Although these are not specifically intended to address hydrology and water quality, they are likely to result – indirectly – in water quality improvements and may improve drainage and hydrology. Conversely, General Plan policies that would directly address hydrology and water quality include:

Policy CN1.3 Urban Creek Restoration. Encourage the restoration of urban creeks and coordinate efforts with property owners and local interest groups. Creek "daylighting" of culverts or hardened channels shall be pursued where feasible in new and redevelopment projects. Actions identified in the General Plan to implement this policy include establishing Creek Corridor Performance Standards and restoring Urban Creeks. Among the specific Creek Corridor Performance Standards identified in the General Plan are:

- Offer sufficient width in or adjacent to preserves to allow for existing and created wildlife habitat, species sensitive to human disturbance, vegetative filtration for water quality, corridors for wildlife habitat linkage, protection from runoff, and other impacts of adjacent urban uses;

- Allow for sufficient width adjacent to natural resource preserves to allow for trails and greenbelts; and
- Discourage the use of herbicides and provide sufficient width for a mowed firebreak (where necessary), adjacent passive recreation uses, and access for channel maintenance and flood control.
- In areas of creek restoration, implement design specifications and modeled flow conditions to ensure that creek channel configuration and vegetation would withstand storm flows, that conveyance capacity is not impeded, and that the system is stabilized following construction. Design shall be conducted by a certified professional in stream restoration and fluvial geomorphology processes.
- Implement construction BMPs to reduce erosion potential including, but not limited to, construction scheduled for dry season work; high flow bypass until the system is stabilized; temporary and permanent erosion and sediment controls; prevention of run-off during construction.
- Implement monitoring, inspection, and maintenance programs and plans to ensure long-term continued function.

To restore urban creeks the General Plan calls for:

- Restoring creeks currently diverted in culverts or hardened channels to their natural state, where feasible;
- Adopting regional guidelines for channel creation or modification to ensure that channels meander, have a naturalized side slope and a varied channel bottom elevation; and
- Including improvement standards for soft bottom channels.

Policy CN3.1 Stormwater Management. Develop strategies to promote stormwater management techniques that minimize surface water runoff in public and private developments. Use low-impact development techniques to best manage stormwater through conservation, on-site filtration and water recycling.

In order to continue to comply with the City of Richmond's NPDES Permit, the General Plan calls for following actions to be implemented:

- Require development to comply with the Contra Costa Clean Water Program Stormwater Guidebook;
- Work with developers to ensure compliance with the City’s minimum standards and NPDES requirements;
- Encourage all projects to use pervious pavements, cluster structures, disconnect downspouts, minimize land disturbance and use micro- detention such as LID;
- Require adequate source control measures to limit pollution generation in businesses including draining non-stormwater discharges such as swimming pools, trash and food compactor racks, vehicle outdoor storage, fire sprinkler test water and equipment washing; and
- Require businesses that may be susceptible to polluting stormwater to implement BMPs including covering drains and storage precautions for outdoor material storage, loading docks, repair and maintenance bays and fueling areas.

Policy CN3.2 Water Quality. Work with public and private property owners to reduce stormwater runoff in urban areas to protect water quality in creeks, marshlands and water bodies and the bays. Promote the use of sustainable and green infrastructure design, construction and maintenance techniques on public and private lands to protect natural resources. Incorporate integrated watershed management techniques and to improve surface water and groundwater quality, protect habitat and improve public health by coordinating infrastructure and neighborhood planning and establishing best practices for reducing non-point runoff. To this end, the General Plan calls for:

- Support efforts by the regional water provider to increase water recycling by residents, businesses and developers;
- Installing water recycling and rainwater catchments in new developments as appropriate to recycle water; and
- Evaluation of the use of recycled water in new and existing buildings and landscapes.

Policy CN3.3 Flood Management. Minimize the flood hazard risks to people, property and the environment. Address potential damage from a 100-year flood, tsunami, sea level rise and seiche, and implement and maintain flood management measures in all creeks and in all watersheds. The General Plan requires new developments to:

- Install and maintain flood control measures on all creeks and watersheds in coordination with the Contra Costa County Flood Control and Water Conservation District;
- Include flood prevention mitigation measures within the 100-year floodplain;
- Install flood control measures to address sea level rise as appropriate; and
- Improve groundwater recharge and minimize stormwater runoff to better accommodate floodwaters.

Policy CN3.4 Water Conservation. Promote water conservation. Encourage residents, public facilities, businesses and industry to conserve water especially during drought years. Work with East Bay Municipal Utility District to advance water recycling programs including using treated wastewater to irrigate parks, golf courses and roadway landscaping and by encouraging rainwater catchment and graywater usage techniques in buildings. The General Plan calls for:

- Low-flow appliances and fixtures to be required in all new development in accordance with EBMUD Water Service Regulations (Section 31);
- Working with water providers and water conservation agencies to create an incentives program that encourages retrofitting existing development with low-flow water fixtures;
- New developments and landscaped public areas to use state-of-the-art irrigation systems that reduce water consumption including graywater systems and rainwater catchment;
- Encouraging use of drought-tolerant and native vegetation;
- New plantings to be grouped by hydrozones of water needs listed in the Water Use Classification of Landscape Species III developed by the Department of Water Resources and the UC Cooperative Extension (or successor document); and
- Development project approvals to include a finding that all feasible and cost-effective options for conservation and water reuse are incorporated into project design including graywater systems.

The 2030 General Plan EIR determined that the effects from future development pursuant to the General Plan on hydrology and water quality would be less than significant. Future development would not violate stormwater management requirements. It would not substantially alter groundwater, drainage patterns, runoff, or flooding potential, including flooding potential associated with dam failure or sea level rise. No mitigation measures would be required. Cumulative impacts would be less than significant.

City of Richmond Landscape Design and Development Guidelines

The Department of Public Works implements the City of Richmond's Landscape Design and Development Guidelines. The Department encourages new developments to design and manage landscaping that is appropriate to local environmental conditions and effective in water conservation, during both drought and normal conditions. The Guidelines apply to all new residential developments of 4 or more dwelling units or with a minimum of 10,000 square feet of landscaping and all new or rehabilitated commercial, industrial, and institutional developments. The City reviews all development plans submitted via the Site Development Review process administered by the Planning Department.

4.8.4 Impacts and Mitigation Measures

Standards of Significance

Potential impacts of the 2014 LRDP on hydrology and water quality would be considered significant if they would exceed the following Standards of Significance, in accordance with Appendix G of the *State CEQA Guidelines* and the UC CEQA Handbook:

- 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 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
- Expose people or structures to a significant risk of loss, injury, or death involving inundation by seiche, tsunami, or mudflow.

CEQA Checklist Items Adequately Addressed in the Initial Study

The NOP Initial Study concluded that further analysis of the following issue was not required in the EIR:

- 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.

As stated in the Initial Study, while the RBC could include temporary lodging, it would not include temporary or permanent housing within the 100-year flood hazard area; therefore, this topic is not discussed further in the EIR.

Analytical Methods

CEQA and University of California guidelines identify standard information sources and methods for evaluating potential hydrology and water quality impacts. The following methods have been used in this analysis:

- Information on drainage patterns, water volumes and quality, floodplains, and locations of groundwater recharge areas were obtained from available sources, including: the US Geological Survey, California Geological Survey, California Department of Water Resources, the State Water Resources Control Board, the San Francisco Bay RWQCB, the Federal Emergency Management Agency (which prepares flood insurance rate maps); and recent environmental reports for the project vicinity.
- Project-related changes (increases) in stormwater runoff were estimated in preliminary drainage studies prepared to determine whether mitigation is needed.
- The effects of stormwater runoff on the quality of the receiving water were qualitatively evaluated based on data from previous investigations at the site.
- Applicable regulatory standards were identified, including federal NPDES permits administered by the State Water Resources Control Board and the San Francisco Bay RWQCB, construction nonpoint source discharge requirements, and Phase 1 program requirements.
- Potential cumulative impacts were evaluated, with particular focus on downstream effects of increased stormwater runoff and reduction in floodplain storage area.

RBC 2014 LRDP Policies

The RBC 2014 LRDP policies related to hydrology and water quality include the following:

- UI2 – Utilities and Infrastructure Policy on Sustainability: Design infrastructure improvements to embody sustainable practices.
    - Maintain or restore, to the maximum extent technically and practically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of stormwater flow.
    - Incorporate low impact development strategies in site planning to manage stormwater.
    - Protect the campus development from 55” of sea level rise through the year 2100 using natural shore forms where practicable; and coordinate closely with the East Bay Regional Park District on maintaining the Bay Trail embankment.

LRDP Impacts and Mitigation Measures

LRDP Impact HYD-1: Stormwater runoff and dewatering associated with 2014 LRDP-related construction activities could result in a violation of water quality standards. *(Less than Significant)*

During construction, there is potential for rainwater to come into contact with disturbed soils containing elevated metals concentrations, remnant cinders, or other contaminants. During construction, some construction areas may need to be dewatered due to a high groundwater table or the accumulation of rainwater. Discharge of these fluids could violate water quality requirements if the fluids contain sediment or chemical contaminants.

For construction projects subject to the statewide stormwater general permit, the University would obtain coverage under the Storm Water General Permit and would prepare a SWPPP.

If dewatering is needed, discharge of the accumulated groundwater or rainwater to either the storm system or sanitary sewer system would require a permit from the appropriate regulatory agency. The University would apply for and obtain such a permit, which would contain requirements for discharges, including testing, treatment, monitoring, and reporting to ensure that impacts to surface and groundwater quality would be minimal.

With implementation of standard construction BMPs and the measures described above, the proposed project would not result in contaminants reaching adjacent receiving waters; any potential effect would be less than significant.

LRDP Impact HYD-2: Development under the 2014 LRDP would not 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. (*Less than Significant*)

As described in Chapter 3, Project Description, campus development in accordance with the 2014 LRDP would tend to be concentrated in already developed parts of the RBC site. As a result, RBC site impervious surfaces would increase by only about 3 acres. Impermeable surface increases typically decrease infiltration in those areas. The introduction of LID measures, such as installing pervious pavements and directing surface runoff to pervious areas, would further offset the effects of increased impervious surface. Since potable water is supplied by EBMUD and not from groundwater wells, and because the elevation of the water table is controlled by regional hydrologic conditions, and given the above stormwater management planning, no overall decline in groundwater levels is expected. The impact on groundwater would be less than significant.

Mitigation Measure: No mitigation measure is required.

LRDP Impact HYD-3: Development under the 2014 LRDP would not substantially alter the existing drainage pattern of the RBC 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. (*Less than Significant*)

There are no streams present on the project site. Meeker Ditch, Meeker Tidal Creek, and Meeker Slough are located along the western boundary of the RBC site; Meeker Ditch is within the 2014 LRDP Natural Open Space designated area. RBC development would not alter the course of

Meeker Tidal Creek or place new structures in the creek's vicinity. Furthermore, the existing RBC site drainage patterns would be maintained. The proposed project would not result in increased erosion from runoff on or off the site. 2014 LRDP development impacts would be less than significant. While scoping comments raised Meeker Ditch changes as an issue, the proposed project does not include Meeker Ditch alterations or plans to return it to a natural state.

Mitigation Measure: No mitigation measure is required.

LRDP Impact HYD-4: Development under the 2014 LRDP would not substantially alter drainage patterns in a manner which would result in flooding on- or off-site. (*Less than Significant*)

As discussed above, the existing RBC site drainage patterns would be maintained and impervious surfaces would increase by no more than approximately 3 acres under 2014 LRDP development. In addition, LID measures, such as installing pervious pavements and directing surface runoff to pervious areas, would further offset the effects impervious surface creation. Therefore campus development would not increase the risk of on or off-site flooding. The impact would be less than significant.

Sea levels are expected to rise in coming years due to global climate change. The San Francisco Bay is the base elevation for Meeker Ditch stormwater discharge. At high tidal stands, a higher base level would likely reduce the rate of Meeker Ditch stormwater discharge to the Bay while increasing the water table elevation. As a result, flooding frequency would potentially increase within the lower reaches of the creek when high tides, westerly wind-driven waves, and high storm discharges occur. However, these effects are expected to occur with or without the project and would not result or be intensified from project-related alteration of site drainage patterns.

Mitigation Measure: No mitigation measure is required.

LRDP Impact HYD-5: Development under the 2014 LRDP would not create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff. (*Less than Significant*)

The RBC site is about 54 acres or 41 percent impervious area. With full 2014 LRDP development, the RBC is anticipated to comprise approximately 43 percent impervious surface area, (an increase of about 3 acres of impervious surfaces). At full 2014 LRDP development, RBC building space would be approximately 5.4 million gsf, or about 100,000 gsf per acre of impervious surfaces. This would exceed a 3-fold increase in land use efficiency compared to the current ratio, with little reduction in pervious land area. RBC stormwater runoff would be moderated by LID design techniques that are consistent with NPDES requirements, the UC Sustainable Practices Policy, and LRDP sustainability goals. As a result, runoff rates from the RBC site are not expected to increase over existing conditions, but would likely decrease.

For construction projects subject to the Stormwater General Permit for Construction, the University would obtain coverage under the Storm Water General Permit and would prepare a SWPPP. The new construction would incorporate State Water Resources Control Board standards for stormwater runoff. Stormwater quality discharge permit requirements are anticipated to include, where practical: infiltration; evapotranspiration through landscape-based stormwater facilities; and capture, treatment, and re-use systems (tanks and ponds supported by treatment and irrigation systems or recycled water systems). Wherever possible, RBC drainage would be designed to use low-impact surface conveyance solutions to minimize need for underground drainage line construction. The RBC would also incorporate new open swales, runoff treatment features, and BMPs commensurate with San Francisco Bay RWQCB requirements to treat stormwater before it is discharged into Western Stege Marsh. Buildings that are constructed using federal funds would also be required to comply with EISA Section 438 requirements.

Mitigation Measure: No mitigation measure is required.

LRDP Impact HYD-6: **Development under the 2014 LRDP would not place structures within a 100-year flood hazard area which would impede or redirect flood flows or expose people or structures to a significant risk of loss, injury, or death involving flooding. (*Less than Significant*)**

Only the southernmost portion of the RBC site lies within the current 100-year flood hazard zone (southern portion of Illustrative Development Scenario Neighborhood 1). A flood hazard zone exists along the RBC site shoreline due to the potential for offshore winds in combination with high tides to increase shoreline water elevations. There would be no impact related to flood hazard or redirection of flood flows within a 100-year flood hazard area associated with development of other parts of the RBC site.

Future facilities to be constructed in the southern portion of this neighborhood would need to be protected from water inundation related to sea level rise combined with storm or seiche/tsunami events. As reflected in LRDP Policy UI2, campus facilities would be protected from the amount of sea level rise anticipated through 2100. Potential protective steps include increasing the base elevation of this area from an average of approximately 13 feet NGVD to a minimum of 15 feet NGVD. This would address potential flood hazards associated with predicted future sea level rise and reduce or avoid potential flood risks to site, people, and structures. That impact would be less than significant.

Future development at what would be the former Regatta property under the RBC LRDP would also potentially be subject to water inundation by year 2100 due to a 100-year flood, taking future sea level rise into account. As noted, LRDP Policy UI2 requires protection of development under the LRDP from sea level rise. Specific protections for development at the former Regatta property in accordance with that policy would be defined, using updated projections, at the time of a proposal to construct one or more facilities at that portion of the RBC.

Mitigation Measure: No mitigation measure is required.

LRDP Impact HYD-7: **Development under the 2014 LRDP would not expose people or structures to inundation by seiches, tsunamis, or mudflows. *(Less than Significant)***

The project site is located along the eastern shore of San Francisco Bay. Tsunami waves generated by seismic events outside the Bay tend to be greatly attenuated by passage through the Golden Gate's narrow channel and by the Bay's generally shallow bathymetry. Only 5 of 51 historic tsunamis are believed to have produced runups of more than 0.5 meters (1.6 feet) within San Francisco Bay (Borrero et al. 2006). The maximum probable runup in the Richmond Inner Harbor from any tsunami event is estimated to be about 1.6 meters (4.5 feet); however, the probability of such an event is very low (Borrero et al. 2006). The recurrence time for a 10 foot high tsunami wave outside the Golden Gate is estimated at about 100 years; such waves are expected to be reduced about 50 percent upon passing through the Central Bay (Ritter and Dupre, 1972).

Potential protective steps that may be taken to implement LRDP Policy UI2, discussed under LRDP Impact HYD-6 above, would keep the entire RBC development area above the maximum predicted tsunami level.

Seiches are similar to tsunamis but are generated by local seismic or other abrupt displacement events in a closed water bodies. The probable seiche height in San Francisco Bay is predicted to be approximately one foot above the water level at the time of occurrence (Ritter and Dupre 1972). The greatest impacts from a seiche would logically be when the water level was at a peak high level; however, the probability of a seiche occurring during a tidal extreme is negligible. The maximum wave height at Richmond Inner Harbor from a large, local earthquake is estimated to be 0.44 meters (1.4 feet) (Borrero et al. 2006).

Potential protection measures discussed under LRDP Impact HYD-6 above would keep the entire RBC development area above the maximum predicted seiche level.

Mitigation Measure: No mitigation measure is required.

Cumulative Impacts and Mitigation Measures

Development under the 2014 LRDP would include impacts on hydrology and water quality that would be localized and less than significant or less than significant with mitigation. Proposed project elements with a potential for off-site cumulative impacts include stormwater discharge runoff and floodplain alterations. There are no current development plans in the vicinity sufficiently defined to indicate that they would raise the level of local topography therefore there would be no cumulative effect.

LRDP Cumulative Impact HYD-1: **Development under the 2014 LRDP, in conjunction with other foreseeable development, would increase the amount of impermeable surfaces in the area which could increase stormwater discharge to Meeker Slough and Western Stege Marsh. (*Less than Significant*)**

Foreseeable development, including the proposed project, in the greater watershed area would contribute to cumulative increases in impermeable surfaces that could affect stormwater runoff. However, new development would occur within a largely built-out urban area where stormwater drainage systems generally already exist; stormwater drainage would be addressed on a site-by-site basis prior to new development approvals. The expected incremental increase in impermeable surfaces would not exceed stormwater drainage system capacity. Stormwater management associated with the proposed project would be expected to reduce the amount of stormwater discharged from the RBC site as retention and infiltration techniques are implemented in compliance with NPDES requirements and as well as EISA Section 438 requirements. The cumulative impact would be less than significant.

4.8.5 References

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