TO: Engineering Criteria Review Board (ECRB) Members

FROM: Lawrence J. Goldzband, Executive Director (415/352-3653; larry.goldzband@bcdc.ca.gov)
Rafael Montes, Staff Engineer [415/352-3670; rafael.montes@bcdc.ca.gov]
Elena Perez, Coastal Program Analyst [415/352-3612; elena.perez@bcdc.ca.gov]

SUBJECT: Latitude Project (previously referred to as the Terminal One Project)
City of Richmond, Contra Costa County (25% Design)
(For Board consideration on May 24, 2017)

Project Summary

Project Name. The Latitude Project (previously referred to as the Terminal One Project), City of Richmond

Applicant. Laconia Development LLC (Laconia) and the City of Richmond

Project Representatives. Cleve Livingston (Laconia), Sam Yao (SGH), Jeff Fippin (EN GEO), Jason White (BKF Engineers), and Scott Cataffa (CMG)

On June 7, 2016, the ECRB and the Design Review Board received a briefing on the project. There were no Board motions at the time. Therefore, this meeting serves as follow-up of the original presentation. A copy of the minutes is being provided as reference.

Project Description. The Latitude Project (the “Project”) contemplates the redevelopment of an approximately 13-acre shoreline site located in the Point Richmond area of the City of Richmond, which previously served for over 80 years as a port terminal and tank farm. The Project proposes to replace these heavy industrial port-related land uses with a mix of public park and private residential uses, the two principal components of which will consist of:

1. Approximately 5.5-acre public waterfront park that runs the length of the Project’s 1,200+ foot shoreline frontage; that will include the Project’s entire 100-foot shoreline band; and that will feature the existing Terminal One Wharf repurposed for public use and a shoreline extension of the Bay Trail (the “Waterfront Park”); and

2. An approximately 8.7-acre residential neighborhood with 316 residential dwelling units (consisting of 21 single-family homes, 295 stacked condominium flats in five 4- and 5-story buildings, two single-story parking podiums, and associated common area amenities) that will be developed on the interior of the site outside the 100-foot shoreline band.
One of the signature elements of the Latitude land use program involves reutilization of the existing Richmond Municipal Wharf No. 1 as the centerpiece of the Project’s Waterfront Park and a public recreational amenity. This 1915 era wharf is approximately 555 feet in length and 90 feet in width, with coverage of almost 50,000 square feet.

The wharf was originally designed to support a large (37,000± square foot) warehouse facility (approximately 70 feet in width and 525 feet in length) which was constructed over the wharf and occupies most of the deck area, excepting an 18-foot wide clear area that runs the 555-foot length of the wharf’s Bay frontage and provided space for the loading and unloading of cargo and a 30-foot wide clear area at the western end of the wharf that provides access to and from the remainder of the Latitude site. Approximately 57,000± square feet of additional warehouse space was added in the early 1920s on the landward edge of the wharf. This additional space was tied into the original space along the wharf’s northern reach, resulting in approximately 94,000 square feet of contiguous warehouse space under one roof. The warehouse will be demolished to allow reuse of the wharf and redevelopment of the Latitude site.

The wharf is supported by piles with typical grid spacing of 10 feet in both directions. The majority of the piles are square 16-inch precast reinforced concrete piles. The reinforced concrete wharf deck is supported by concrete beams and girders that span between the piles. The top of the wharf deck is approximately 13.0 feet NAVD88. The ground surface below the wharf ranges from approximately 2 to 22 feet below the underside of the deck. A rock/gravel dike extends under the wharf for a distance of approximately 64 feet from the land side of the wharf.

**Geotechnical Engineering Criteria.** According to the Geotechnical Report prepared by ENGEO, the soil on the landside of the wharf consists of artificial fill, a layer of Young Bay Mud (YBM), a thin layer of stiff to hard clay and medium-dense to dense sand, and bedrock. The land was originally reclaimed by dredging a slot into the Young Bay Mud near the current shoreline and backfilling the slot with a mixture of sand and rock; some Young Bay Mud exists below this “rock dike.” The landside fill was placed behind the rock dike. The landward piles supporting the wharf were driven through the rock dike. The liquefaction susceptibility analysis notes that the lower portion of the sand layer on the bayside is potentially liquefiable.

The inland soil is subject to slope instability during seismic events requiring mitigation. Without mitigation, under the current Building Code-level earthquake, the slope could move between 1 to 2 feet in the direction of the Bay; this deformation could extend into the areas of proposed development and will daylight below or to the waterside of the wharf. Along the western shoreline, a historic swale was backfilled prior to original site development. The fill and alluvium in this former swale area is potentially liquefiable.

To address concerns regarding shoreline instability, the Project plans to use a deep soil mixing (DSM) buttress along the shoreline both to substantially reduce the potential for lateral spreading and to buffer the wharf from excessive ground lateral deformation. In the area of the potentially liquefiable soil, the buttress will include closed cells to reduce flow of the liquefiable soil towards the bay.
In order to evaluate the soil-structure-interaction between the existing wharf foundations and the soil, ENGEO developed soil load-displacement “springs.” They also performed a site-response analysis to develop a site-specific seismic spectra accounting for the complex site response due to the significant thickness of soft soil over bedrock at the site. In addition, ENGEO performed an analysis of the slope displacement under the wharf in front of the DSM buttress using “pinning” forces from the existing piles developed in coordination with SGH. The preliminary analysis concludes that the planned ground improvement would assist in reducing seismic-induced slope deformation to a low enough amount that adequate egress conditions from the wharf structure will exist after a Building Code-level earthquake.

**Structural Engineering Criteria.** According to the Condition Assessment and Design Criteria report prepared by SGH, the evaluation of the structural integrity of the existing wharf structure being performed by the structural engineer, SGH, will be governed by the 2013 California Building Code (CBC). The structure is classified as Risk Category II per Table 1604.5 in CBC. The wharf structure is required to achieve a level of seismic performance for life safety protection in the CBC Design Earthquake. The seismic evaluation of the structure will be performed using a displacement-based seismic performance criterion per CBC CH31F. The displacement demands will be calculated by using the “refined method” in CBC CH31F, which is similar to the “substitute structure method” in ASCE 61–14 “Seismic Design of Piers and Wharves”. The displacement capacity of the structure will be estimated based upon the strain limits in CBC CH31F or ASCE 61-14, whichever is more stringent. In addition, all capacity-protected members will be separately checked for the Design Earthquake.

To evaluate the wharf structure under seismic inertial loads, nonlinear pushover analyses will be performed using both upper bound soil/rock springs and lower bound soil/rock springs as recommended by the geotechnical engineer, ENGEO. The pushover analyses take into account the structure mass, structural effective period, and seismic spectra considering appropriate levels of damping.

To evaluate the kinematic loading effects from lateral ground movements, SGH will perform a nonlinear pushover analysis. The seismic kinematic loads will be imposed onto the wharf by incrementally increasing the kinematic displacements onto the piles in the pushover analyses. The structural capacity will be checked at each kinematic displacement increment until it fails structurally in shear or flexure. In addition to the structural evaluation of the kinematic loading effects, the pushover analysis will be used to determine pile pinning forces along the potential stability failure surface for the geotechnical slope stability analysis.

The wharf structure will be evaluated for a combination of seismic inertial loads and seismic kinematic loads in accordance with CBC CH31F. Should the seismic evaluation determine the existing wharf does not satisfy the performance criteria per CBC, seismic retrofit design will be developed. The anticipated retrofit will be designed to tie the wharf to the existing or new landward piles to increase the lateral resistance to the seismic loading, a retrofit method that has been successfully implemented on wharf structures in California following the Loma Prieta Earthquake.
**Structural Ratings.** SGH conducted a structural visual inspection of the wharf in order to rate the current conditions of the piles, beams, girders and deck. Four- to seven-inch thick shotcrete encasements cover the original pilings extending up to several feet from the deck; according to the assessment report, very little of the original piles were observed except during low tide and some of the piles were not accessible for observation.

Prior to this inspection, another consultant, J.J. Miller & Associates, had conducted another inspection in 2005. In comparison, the new inspection shows a worsening in the structural ratings in the last 11 years.

**Hydrological/Hydraulic Assessment and Flooding and Sea Level Rise (SLR) Projections.**

According to the hydrological/hydraulic evaluation prepared by BKF, the Latitude Project is designed to accommodate a Base Flood Elevation (BFE) of 11 feet as assigned to the southwesterly portion of the Latitude site, including the entirety of the Latitude shoreline, by the most recent FEMA Flood Insurance Rate Map issued September 30, 2015. In addition, the design of the Latitude Project anticipates a rise in sea level of 16-inches by 2050 and 55-inches by 2100 per the 2012 report by BCDC and NOAA Coastal Services Center entitled “Vulnerability and Risk Assessment Report.”

In order to mitigate the flood risks associated with a 100-year storm event, the minimum finished floor elevation for all structures would be set at 13 feet -- a level 2 feet above the BFE of 11 feet. To address the additional flood risks associated with a rise in sea level of 16 inches, however, the minimum finished floor elevation of all landside structures has been raised to 14.3 feet (BFE of 11 feet plus 24 inches plus 16 inches). In addition, the minimum elevation of the Bay Trail Loop which rings the Bay-side perimeter of the Latitude site has been set at 14.5 feet and the Trail is being designed to serve as a flood barrier protecting the interior of the Latitude site.

To protect against a rise in sea level in excess of 16 inches, the Latitude Project will employ adaptive strategies, including in particular, the construction of a sea wall at the outside edge of the Bay Trail.

The existing elevation of the Latitude Wharf is approximately 13 feet. The wharf improvement plans, however, contemplate the resurfacing of the wharf with a 5-6 inch concrete overlay. In addition, the wharf improvements will also include raised program space that will occupy the area previously occupied by the warehouse. This program space will have a finished elevation approximately 12 to 24 inches above the top of the wharf deck. As a result, the finished elevations of the wharf deck and the raised program area within the warehouse footprint will be approximately 13.5 feet and 14.5-15.5 feet, respectively. Adaptive measures will be employed to address sea level rise in excess of 16 inches.

SGH performed an engineering assessment of shoreline protection at the Latitude site. The waves in a 100-year storm event were evaluated using software STWAVE, which simulates depth-induced wave refraction and shoaling, depth- and steepness-induced wave breaking, diffraction, wave growth from wind input, and wave-wave interaction. The analysis model utilizes the NOAA Digital Elevation Model (DEM), and the field data collected at Alameda Naval Air Station over a period of 45 years. The analysis indicated that the shoreline along the wharf
extending to the southeast is somewhat shielded by the existing breakwater, making these regions less susceptible to storm waves. The northwest shoreline has the highest exposure. In any case, the site requires Caltrans RSP Class “Light”. Field inspections indicated that the existing rip-rap at the project site ranges from Class Light to 1 ton in size. Therefore, the existing rip-rap was adequately sized for shoreline protection of the site. The southeast shoreline currently extends to a grade of +8.0 ft. above MLLW with Rock Slope Protection (RSP) placed to the full extent. SGH recommends that a splash apron be placed to extend the current RSP inland by 4 feet in this region in order to avoid potential ponding and erosion of the back soil behind and beneath the riprap.

**Law and Policy Considerations.** Section 66605 of the McAteer-Petris Act allows the Commission to approve fill only when public benefits from fill clearly exceed public detriment from the loss of the water areas, and should be limited to water-oriented uses or minor fill for improving shoreline appearance or public access to the Bay. Authorized fill shall meet certain additional criteria, including among others, that the fill be constructed “in accordance with sound safety standards which will afford reasonable protection to persons and property against the hazards of unstable geologic or soil conditions or of flood or storm waters.”

<table>
<thead>
<tr>
<th>Bay Plan Policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>The applicable BCDC Bay Plan policies in relation to the proposed project include policies on Safety of Fills, Shoreline Protection, Public Access and Climate Change.</td>
</tr>
</tbody>
</table>

**Policies on the Safety of Fills**

1. **Policy No. 1** states, in part, that the Commission has appointed and empowered the ECRB to “establish and revise safety criteria for Bay fills and structures thereon.”

2. **Policy No. 2** states, in part, that, “even if the Bay Plan indicates that a fill may be permissible, no fill or building should be constructed if hazards cannot be overcome adequately for the intended use in accordance with the criteria prescribed by the ECRB.”

3. **Policy No. 3** states, “[t]o provide vitally needed information on the effects of earthquakes on all kinds of soils, installation of strong-motion seismographs should be required on all future major land fills. In addition, the Commission encourages installation of strong-motion seismographs in other developments on problem soils, and in other areas recommended by the U.S. Geological Survey, for purposes of data comparison and evaluation.”

---

1 Fill is defined in the McAteer-Petris Act as "earth or any other substance or material, including pilings or structures placed on pilings, and structures floating at some or all times and moored for extended periods, such as houseboats and floating docks" (Section 66632(a)).
4. **Policy No. 4** states, in part, that,

“[a]dequate measures should be provided to prevent damage from sea level rise and storm activity that may occur on fill or near the shoreline over the expected life of a project. The Commission may approve fill that is needed to provide flood protection for existing projects and uses. New projects on fill or near the shoreline should either be:

set back from the edge of the shore so that the project will not be subject to dynamic wave energy,

be built so the bottom floor level of structures will be above a 100-year flood elevation that takes future sea level rise into account for the expected life of the project, be specifically designed to tolerate periodic flooding, or employ other effective means of addressing the impacts of future SLR and storm activity...”

**Policies on the Shoreline Protection**

1. **Policy No. 1** states, in part, that,

“[n]ew shoreline protection projects and the maintenance or reconstruction of existing projects and uses should be authorized if:

(a) the project is necessary to provide flood or erosion protection for (i) existing development, use or infrastructure, or (ii) proposed development, use or infrastructure that is consistent with other Bay Plan policies;

(b) the type of the protective structure is appropriate for the project site, the uses to be protected, and the erosion and flooding conditions at the site;

(c) the project is properly engineered to provide erosion control and flood protection for the expected life of the project based on a 100-year flood event that takes future sea level rise into account;...

and (e) the protection is integrated with current or planned adjacent shoreline protection measures. Professionals knowledgeable of the Commission's concerns, such as civil engineers experienced in coastal processes, should participate in the design.”

2. **Policy No. 2** states, in part, that,

“[r]iprap revetments, the most common shoreline protective structure, should be constructed of properly sized and placed material that meet sound engineering criteria for durability, density, and porosity. Armor materials used in the revetment should be placed according to accepted engineering practice....Riprap revetments constructed out of other debris materials should not be authorized.”
3. **Policy No. 4** states, that,

“[w]henever feasible and appropriate, shoreline protection projects should include provisions for nonstructural methods such as marsh vegetation and integrate shoreline protection and Bay ecosystem enhancement, using adaptive management. Along shorelines that support marsh vegetation, or where marsh establishment has a reasonable chance of success, the Commission should require that the design of authorized protection projects include provisions for establishing marsh and transitional upland vegetation as part of the protective structure, wherever feasible.”

**Policies on Public Access**

**Policy No. 5** states, that,

“[p]ublic access should be sited, designed, managed and maintained to avoid significant adverse impacts from sea level rise and shoreline flooding.”

**Policies on Climate Change**

1. **Policy No. 2** states, that,

“[w]hen planning shoreline areas or designing larger shoreline projects, a risk assessment should be prepared by a qualified engineer and should be based on the estimated 100-year flood elevation that takes into account the best estimates of future sea level rise and current flood protection and planned flood protection that will be funded and constructed when needed to provide protection for the proposed project or shoreline area. A range of sea level rise projections for mid-century and end of century based on the best scientific data available should be used in the risk assessment. Inundation maps used for the risk assessment should be prepared under the direction of a qualified engineer. The risk assessment should identify all types of potential flooding, degrees of uncertainty, consequences of defense failure, and risks to existing habitat from proposed flood protection devices.”

2. **Policy No. 3** states, in part, that,

“[t]o protect public safety and ecosystem services, within areas that a risk assessment determines are vulnerable to future shoreline flooding that threatens public safety, all projects...should be designed to be resilient to a mid-century sea level rise projection. If it is likely the project will remain in place longer than mid-century, an adaptive management plan should be developed to address the long-term impacts that will arise based on a risk assessment using the best available science-based projection for sea level rise at the end of the century.”

3. **Policy No. 5** states that,

“[w]herever feasible and appropriate, effective, innovative sea level rise adaptation approaches should be encouraged.”
Request for the ECRB’s Technical Advice. The Latitude waterfront development is projected to include a significant public waterfront and open space along the San Francisco Bay. The engineering criteria are developed and the engineering analyses and design are ongoing. Staff seeks the expertise of the Board in assessing the adequacy of the project’s proposed overall safety criteria. Following are some issues of interest to staff regarding the proposed project; these do not preclude any others that may arise as a result of the Board's discussions.

1. **Seismic, Structural and Geotechnical Criteria and Flood Hazards**: The project proposes to improve the seismic lateral stability in upland areas and along the landside edge of the shoreline slope with a DSM buttress. Therefore, it is expected that the soil improvement would buffer the wharf from shoreline slope deformation by reducing the estimated lateral displacement in the event of a large earthquake. During such an event, the estimated “stand-alone” deformation of the wharf after ground improvement is approximately 4 inches.
   a. Considering that the wharf is over 100 years old and that there are no major proposals to improve it structurally, would it be resilient to the estimated deformation without seismic improvements?
   b. Would the wharf be able to endure 50 or more years into the future and be structurally safe from earthquakes and flooding? Would it be able to adapt to the future flooding?
   c. Could water inflow into the proposed soil improvement zone or earthquake-induced displacement of the riprap against the wharf piles become a safety concern?
   d. Are the overall safety criteria considered for the wharf—which is proposed to provide public access—including associated shoreline safety improvements, sufficient to ensure its long-term protection and safety of the public?
   e. Is the existing shoreline protection at the site adequate to protect the public access now and for the life of the project?

Summary of the Project Proponent’s Presentation

The Latitude Project team will address the following points in their presentation to the ECRB:

1. Project Overview (Laconia)
2. Landscape Design (CMG)
3. Existing Condition Analysis
   a. Geotechnical Condition Assessment (ENGEIO)
   b. Structural Condition Assessment of Wharf (SGH)
4. Flooding and Sea Level Rise Analysis (BKF)
5. Shoreline Protection Analysis (SGH)
6. Basis of Design -- Wharf (SGH)
   a. Design Codes and Standards
   b. Seismic Design Methodology
7. Anticipated Retrofit Options (SGH and ENGEO)

Enclosed References

1. Laconia Development, LLC/L Latitude. Condition Assessment and Design Criteria For Structural Evaluation of Latitude Wharf/Point Richmond, California/24 May 2017 ECRB Meetings/SGH Project 167573, Prepared for Laconia Development LLC by Simpson Gumpertz & Heger Inc. by Sam Yao, P.E.
5. ENGEIO “Terminal One/Richmond, California/Existing Geotechnical Conditions and Seismic Slope Stability,” April 27, 2017 by Todd Bradford, P.E. and Jeffrey A. Fippin, G.E.
7. Joint DRB/ECRB meeting minutes, June 7, 2016.