Seaports and Marine Oil Terminals

The Bay Area is home to a significant amount of critical maritime facilities, including San Francisco's James R. Herman Cruise Ship Terminal, harbor services, commercial fishing, excursion vessels, ship repair, vessel berthing of science, military and other vessels, cargo services, dry docks, ferry terminals in a number of communities that support commuter movement, marine oil terminals and six seaports. The region was built on this kind of maritime activity and this sector, though a smaller component of the economy and society than it once was, is still vitally important to the Bay Area for the jobs, goods and services that the sector provides, the people and goods that are moved within and outside of the region and the opportunities that the sector gives to the region.

This section focuses on seaports and the role they play in moving goods in and out of the region, as an employer and as an economic catalyst and incentive for industries to locate in the region. The six seaports in the region, listed in order of the number of calls they receive each year, are located at the Port of Oakland, Port of San Francisco, Port of Richmond, Port of Benicia and Port of Redwood City. Each seaport plays a different role within the region, with the Port of Oakland's seaport being the fifth busiest container port in the United States and handling 99 percent of the container goods that move through Northern California. The Port of San Francisco has seen a significant shift away from its role in cargo movement and towards other types of maritime uses. The Port of San Francisco still plays a role in cargo movement handling small amounts of container, break bulk, neo-bulk, dry bulk and liquid bulk. The Port of Richmond handles the majority of the region's liquid bulk and automobile tonnage, and a variety of other cargo including petroleum projects, vegetable oil, molasses, steel, lumber, heavy machinery, automobiles, earth moving and road making equipment. The Port of Benicia handles automobiles and petrocoke. The Port of Redwood City has facilities to handle cement, sand, gravel, scrap metal, gypsum, bauxite and petroleum products. Due to the size and specialized nature of each of the ports, there is very little redundancy within the system and a disruption at one of these ports, particularly Oakland or Richmond, could have significant implications for the region's economy, environment and community wellbeing.

Seaports require a number of on-site and off-site facilities and services that can be disrupted or damaged by temporary flooding, storm surge or permanent flooding, such as utilities, transportation, storm water and pipelines. In broader studies of seaport vulnerability there are five key areas that have been identified, including: (i) increased exposure of port operations to a range of climate hazards such as sea-level rise, storm surge, extreme waves and wind; (ii) interrupted shipping movements, material and container handling, and inland transportation into and out of ports; (iii) disruptions in transportation and storage of sensitive goods such as agricultural products or fuel; (iv) greater sensitivity of in-transport infrastructure to climate hazards; and (v) an increased vulnerability of ports to disruptions to utilities, such as water and electricity.

ART Program findings in the ART Alameda County Project found that while the seaport was not directly vulnerable to current or future flooding at the shoreline, there were indirect vulnerabilities that would affect the Port of Oakland's seaport before direct affects from flooding. These vulnerabilities included rail and road vulnerabilities. Rail is highly vulnerable due to its adjacency to the shoreline, and because damage at any point in the system can result in system-wide disruptions. Loss of the rail service to the seaport could result in increased truck traffic, affecting congestion and air quality in surrounding neighborhoods, local roadways, and interstates. Additionally, many ports have infrastructure located under the wharves that could be damaged due to increased sea level rise and storm events.

Port of Richmond

The Port of Richmond is a deepwater port located approximately nine miles from the Golden Gate Bridge along the Richmond inner harbor. In 2012 the port ranked first in liquid bulk and automobile tonnage among the San Francisco Bay area's five ports. The port includes five city-owned and ten privately owned terminals (see Table 1) that handle bulk liquids, vehicles, dry bulk materials and break-bulk cargoes. The City's Port Department manages the city-owned terminals, which are leased to various private entities. One city-owned terminal (Terminal One) is currently in the process of being sold for residential re-development.

The Port of Richmond seaport is linked to inland parts of the region, state, and nation through rail lines, including UPRR and BNSF, and roads including I-580 and Canal Boulevard. On dock rail service is provided to many of the terminals by UP and BNSF rail lines and there is enhanced truck access to I-580 from the port. The seaport supports employment in a variety of sectors, ranging from Port-related jobs such as longshoremen, to rail and truck operators.

Table 1. The Marine Exchange of San Francisco Bay Region summarizes the Port of Richmond's 2014 goods movement in the table below.

Terminal	Commodity	Metric Tons 2014	Vessels 2014
City-Owned			
R2- CA Oils	Bulk Liquids	103,852	15
R7- Auto Warehousing Co	Automobiles	164,628	90
Private			
BP/Arco	Bulk Liquids		
Castrol	Bulk Liquids	22,941*	11*

Chevron USA	Bulk Liquids	20,047,591	727
Phillips 66	Bulk Liquids	353,014	133
IMTT	Bulk Liquids	1,324,588	29
Kinder-Morgan	Bulk Liquids	283,750	46
Levin-Richmond	Bulk Dry/Scrap Metal	1,873,000	76
Natl Gypsum	Gypsum rock	152,971	7
Plains products	Bulk Liquids	1,075,918	468
Eagle rock	Bulk aggregates	290,216	17

* Numbers from 2013

KEY ISSUE STATEMENT

While most of the Port of Richmond, and in particular the terminals, are not directly vulnerable to climate impacts, sea level rise and storm events will affect operations by limiting access to and from the seaport. Temporary or permanent disruption of local road and interstate access would disrupt seaport operations; however loss of rail service to move bulk materials and automobiles would have significant impacts on the local and regional economy as these goods cannot easily be moved by truck.

EXPOSURE TO CURRENT AND FUTURE FLOODING

A portion of the north end of the seaport, a number of access roads and some of the rail lines and terminals are within the existing 100-year flood plain. These areas may be exposed to more frequent or extensive flooding with 4 or more feet of sea levels rise. A number of the roadways that provide access to the seaport are low elevation, and could disrupt access and operations at the Port of Richmond and private marine terminal. This includes low-lying areas of West Cutting Boulevard and Canal Boulevard as well as Harbour Way South, Wright Avenue and Ohio Avenue.

VULNERABILITIES

INFO: There is a lack of detailed and easily accessible information about the private seaport terminals.

GOV: Different entities own and manage the seaport and the vital transportation systems, such as rail (Union Pacific and Burlington Northern Santa Fe) and highways (Caltrans is responsible for I-580). These entities will need to collaborate to develop and implement adaptation strategies.

PHYS1: Rail lines, local roads (Richmond Parkway/Canal Boulevard, South Garrard Boulevard, West Cutting Boulevard, Wright Avenue, Marina Way South, Hoffman Boulevard and Harbour Way South) and the Interstate that serve the seaport are vulnerable to flooding. Some of the terminals at the seaport have only one road leading in/out and operations would be disrupted if these roads were damaged or closured.

PHYS2: The Port of Richmond terminals currently do not have groundwater pumping systems in place and rising groundwater could damage roads, rails and electrical components that support port operations.

PHYS3: Flooding could damage electrical equipment located at or below-grade, such as electrical equipment found in graving basins in the Port of Richmond.

PHYS4: The historic Shipyard 3 graving basins at the Port of Richmond does not have storm drain pumps to remove floodwaters that could inundate the facility during a storm event.

FUNC1: Both the rail and interstate corridors that connect to the seaport lack redundancy, with no alternative route for rail cargo and little additional capacity for truck traffic on alternative interstates.

FUNC2: In the event that a large portion of seaport operations is disrupted, there could be insufficient capacity at either on or off site terminals to handle displaced shipping needs, in particular petroleum shipping, which could cause a ripple effect in the economy.

FUNC3: Port operations rely on electrical power, domestic water, and sanitary sewer services provided by others. The port does have backup power available to help maintain critical operations.

CONSEQUENCES

Society and Equity: Temporary or permanent disruption at the seaport would affect the capacity to ship and receive goods, and this could impact people's jobs, especially ship workers and truck drivers. Disruption of the rail to the seaport could result in increased road traffic within the surrounding neighborhoods' local roads and Interstate system.

Environment: Hazardous materials present at various sites within the seaport could be released into the Bay by floodwaters, or contaminate rising groundwater. If the rail is disrupted, the use of trucks to bring goods to and from the seaport may increase. This would lead to greater air pollution from the increased road traffic.

Economy: Loss of power or the disruption of rail or interstate access would impact the goods movement network, and result in economic losses for the city, region, and state. Disruption of rail access to the port could be especially significant, not only because it could result in increased truck traffic, but also many of the commodities shipped through the Port of Richmond cannot easily be moved by truck.

Marine Oil Terminals

Marine Oil Terminals (MOTs) are primarily used to load and unload raw materials used in refineries, typically petroleum-based materials, and are specially equipped with pipes, pumps, electrical utilities, and other mechanical equipment to load/unload material from ships. Seven of the approximately 35 MOTs in California are located in the project area. Five of these are associated with refineries and two serve refinery operations but are not owned or managed by an individual refinery.

The State Lands Commission regulates all MOTs and monitors oil transfer operations. Most MOTs were built in the early 1900s, when oil was carried by smaller ships and before seismic safety standards and environmental review requirements were established. The Marine Oil Terminal Engineering and Maintenance Standards, known as MOTEMS, are guiding the upgrade of aging terminals to ensure better resistance to earthquakes, protect public health and the environment, and reduce the potential of an oil spill. MOTEMS, which is codified in the California Building Code, establishes minimum engineering, inspection, and maintenance criteria for all MOTs in California.

A revision to the 2007 California Code of Regulations (Title 24, Part 2, California Building Code, Chapter 31F, Marine Oil Terminals) includes a new Section 3103F.5.3.4 Sea Level Rise (SLR), which requires all MOTs to consider the predicted sea level rise over the remaining life of the terminal, including the effects of local subsidence and the maximum high tide and storm surge. Suggested strategies to address sea level rise including consideration of fender locations, additional berthing loads (deeper draft vessels) and the vulnerability of components near potential splash zones.

KEY ISSUE STATEMENT

Marine Oil Terminals are built to withstand tidal, wind and wave erosion, but sea level rise and storm events will affect access to and from the terminal and may impact the equipment located on the terminals, including the pipelines connecting the terminals to their respective refinery/storage location. Temporary or permanent disruption of access to the terminal would result in economic impacts to the city, region, and state.

EXPOSURE TO CURRENT AND FUTURE FLOODING

MOTs are all vulnerable in varying degrees to rising sea levels due to their physical location next to the water, but it's the land components attached to the terminals that will be most vulnerable to sea level rise as these assets may not be built to withstand tidal, wind and wave erosion. The MOTs' land connections already in the 100-year flood plain will be the first ones to face exposure to sea level rise.

ASSET DESCRIPTION

NuStar Shore Terminal

The Nustar Shore Terminal is located on the south shore of the Carquinez Strait, just west of the Carquinez Bridge in Crockett. It is owned and managed by NuStar Energy LP, a leader in the petroleum pipeline and terminal industry. The terminal is part of a goods movement network that transports gasoline, diesel, aviation fuels, and ethanol by ship, barge, pipeline, truck and rail. The terminal operates solely as a transfer station, facilitating the loading and unloading of refined petroleum to and from storage tanks on behalf of oil companies, distributors, and brokers in the San Francisco Bay, Sacramento, and Northern California region. Terminal operations depend on many other sectors, including road and rail corridors as well as power generation and distribution.

No flooding of the terminal site is anticipated, however pipelines, roads and rail serving the facility are potential vulnerable to sea level rise. NuStar Energy LP has other refined products terminals throughout the United States; the closest alternatives to the Crockett terminal include a terminal in Los Angeles and another in Portland, Oregon. These alternative terminals are a feasible option for temporary usage with some forethought, but Bay Area operations would be negatively impacted from these temporary changes.

Plains Products Martinez Marine Oil Terminal

The Plains Products Martinez Marine Oil Terminal is located in Martinez and is owned and managed by Plains All American Pipeline. The shoreline portion of the terminal includes a wharf leased from the State Lands Commission and the upland portion storage tanks, pumps and associated pipelines, an office building, and other equipment. The Tesoro, Shell and Valero refineries as well as the Kinder Morgan distribution system have pipeline connections to the terminal. Pipes, pumps, electrical utilities, and other mechanical equipment on site are necessary to maintain operations and the terminal relies on external utility sources (electrical, natural gas, water, sewer) as well as local roads and the interstate.

The terminal is located in the 100-year flood plain. And while most of the terminal facilities is at a high enough elevation to avoid direct flooding some of the critical connections land-side connections are vulnerable to flooding with as little as one foot of sea level rise.

Terminals associated with Refineries

Chevron Richmond Long Wharf Marine Oil Terminal supports operations at the Chevron Richmond Refinery. The Chevron Richmond Refinery uses the Richmond Long Wharf Marine Terminal to receive all its crude oil, and some intermediate feed and blending

stocks. In addition, the Chevron Richmond Refinery uses the Richmond Long Wharf Marine Terminal to ship products and intermediate stocks to domestic and foreign markets.

The Phillips 66 Rodeo Marine Terminal was built in 1928 and is located just west of the Carquinez Bridge in San Pablo Bay. It is a "T-shaped" pier that contains a ship-and barge-berthing structure, a mooring breasting dolphin, and a trestle/pipeway that supports a ballast water pipeline, two crude oil pipelines, and 17 petroleum product pipelines.

The Shell Oil Terminal Martinez was built in 1964 (the original terminal was built in 1913) and includes a tanker and barge petroleum loading/unloading facility used to receive raw materials for the Shell Martinez Refinery and for exports of its refined products. In 2008, the terminal received over 2.1 million metric tons, and exported almost 464 thousand metric tons, of petroleum products.

The Tesoro Amorco Terminal has been in operation since 1923 and is located just west of the I-680 Benicia-Martinez Bridge in Martinez is primarily used to facilitate the transfer of crude oil feedstocks from tanker vessels to a tank farm immediately upland. The feedstocks are later transferred via pipelines from the tank farm to the refinery located approximately 2.5 miles east. The terminal is a single-berth docking facility supporting one active berth located on the eastern end of the wharf. The wharf supports associated unloading equipment, including pumps, pipelines, electrical utilities, fire protection equipment, spill response equipment, and other mechanical equipment.

The Tesoro Avon Terminal has been operating since 1925 and is located in Pacheco, east of the I-680 Benicia-Martinez Bridge. The terminal is used to export and import of petroleum products to support refinery operations.

VULNERABILITIES

GOV: Marine Oil Terminals (MOTs) are leased from the California State Lands Commission, and their building standards are defined in the California Building Code[1].

PHYS1: Marine Oil Terminals are largely resilient to rising sea levels, but the connections to the shoreline, such as roads and pipelines, may be exposed to impacts of rising sea level, depending on its elevation.

PHYS2: Pipelines and electrical components connecting the Marine Oil Terminals to land-based facilities may become exposed to seawater or increased liquefaction vulnerabilities due to rising sea level.

FUNC1: Marine Oil Terminals are part of the goods movement system, and if access to and from the terminals were disrupted by flooding or storm events, the economy would be severely impacted regionally and potentially nation-wide.

CONSEQUENCES

Society and Equity: Temporary or permanent disruption at the terminal would affect the capacity to ship and receive goods, potentially disrupting refinery operations and local jobs.

Environment: Hazardous materials present at the Marine Oil Terminals could be released into the Bay by floodwaters, or contaminate rising groundwater.

Economy: Marine Oil Terminal jobs and indirectly associated goods movement job may become vulnerable if Marine Oil Terminals are disrupted for a long period of time.

ASSET SCALE ASSESSMENT FINDINGS

The Plains Products Martinez Marine Oil Terminal was selected as a representative asset to assess because Plains All American Pipeline staff actively participated in the project working group, were willing and able to share information about the terminal site, and provided critical review and feedback on the information gathered to ensure it was as accurate and reflective of existing conditions as was possible. The Plains Products Martinez Marine Oil Terminal profile sheet summarizing the assessment findings can be found at the end of this chapter.