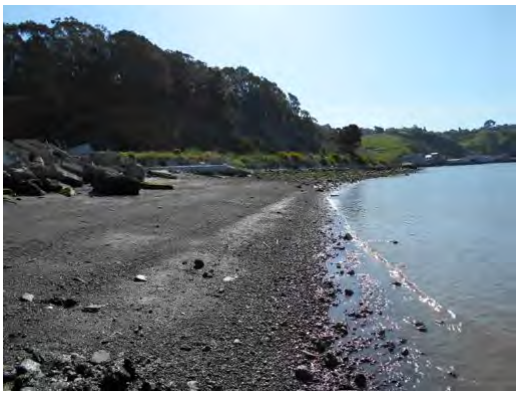
APPENDIX E-4

Field Report: Intertidal Habitat and Marine Biota Survey



Field Report

Intertidal Habitat and Marine Biota Survey of the Vallejo Marine Terminal Site, Vallejo, California

April 18, 2014

Prepared for:

Dudek
465 Magnolia Avenue
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and

The City of Vallejo
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94590

July 2014

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1.0 Introduction

Integral to the establishment of the Vallejo Marine Terminal (VMT), at the abandoned General Foods Flour Mill site in Vallejo California, is the reestablishment of the sites former wharf and dock facilities and the eventual expansion of wharf and dock space to accommodate the anticipated break-bulk ships and barges that would use the terminal.

The planned redevelopment of the marine terminal at the General Foods Flour Mill site will require the removal and replacement of existing break walls, pier pilings, and decking at the abandoned wharf paralleling the Napa river (Figure 1-1), but also the expansion of the site's original wharf area to accommodate smaller barges (Figure 1-2). Both of these activities will result in the temporary loss or alteration of existing rocky and sandy beach intertidal habitat along the former General Foods Flour Mill site. To effectively evaluate the potential environmental impact on the flora and fauna inhabiting the shorelines of the VMT site from planned redevelopment activities, as well as any indirect affects their loss or disturbance could have on Sab Francisco Bay-Delta ecology, especially special status species, it is necessary to have an understanding of the species composition and community structure of the taxa inhabiting the intertidal habitat areas of the project site.

The intertidal communities of San Francisco Bay-Delta, like those inhabiting most estuaries, are highly diverse and responsive to site-specific ecological conditions. The lack of sufficient data concerning the marine flora and fauna inhabiting the intertidal areas of the Vallejo Marine Terminal location, prompted the need for a site-specific assessment. The objectives of this biological assessment were:

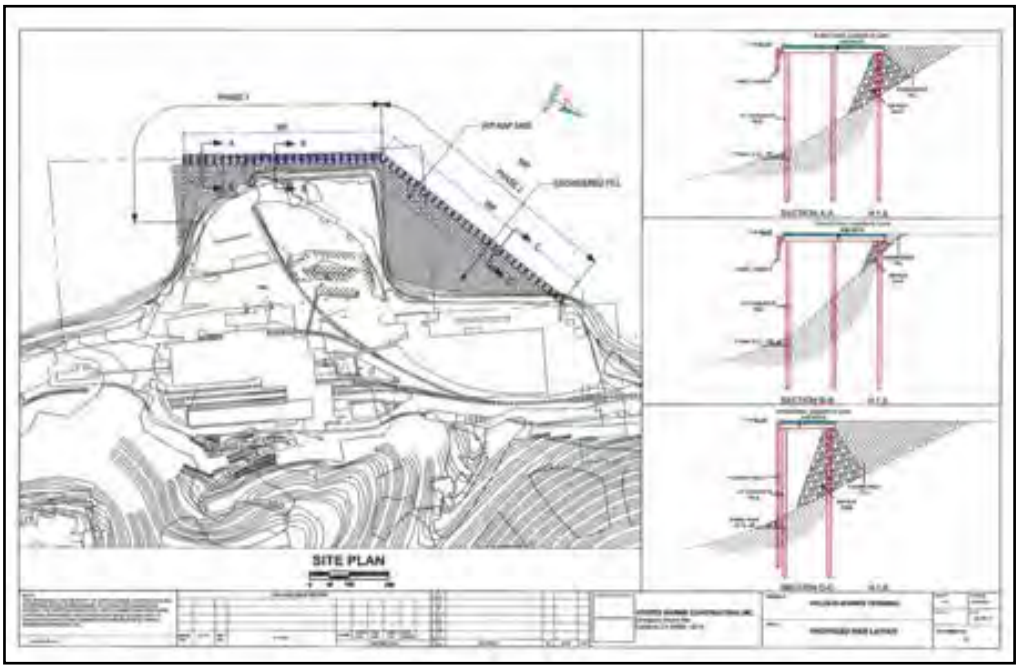
- To characterize and map intertidal habitat types present,
- To qualitatively characterize the associated flora and fauna inhabiting the intertidal areas.
- Identify the presence of any species of significant concern or sensitivity, such as eelgrass beds, native oysters, or invasive species of concern.

This report presents the results of the assessment of the intertidal habitat and associated marine biota inhabiting the shoreline of the Vallejo Marine Terminal site in Vallejo, CA conducted by Applied Marine Sciences, Inc. on April 18, 2014.

Figure 1-1. Existing shoreline conditions and intertidal habitats along the Vallejo Marine Terminal Site waterfront, Vallejo, California.

Source: Google Earth, 2014

Figure 1-2. Proposed shoreline redevelopment plan for the Vallejo Marine Terminal Site, Vallejo California.



Source: Vallejo Marine Terminal, 2013

2.0 Survey Information

Marine scientists from Applied Marine Sciences, Inc. (AMS) conducted a qualitative assessment of the upper, mid and low intertidal zones of the Vallejo Marine Terminal (VMT) project site on April 19, 2014. At the time of the survey, the low tide ranged between -0.15 and +0.06 meters (-0.5 to +0.2 ft.).

2.1 Objectives

Shoreline survey locations were selected prior to the field survey such that a minimum of two survey locations were located along each accessible shoreline segment (A, B, C, D, E, F) of the VMT site was assessed (Figure 2-1).

2.2 Personnel

Personnel who participated in the field surveys are presented in Table 2-1.

Table 2-1. Personnel for the Vallejo Marine Terminal Site Intertidal Habitat and Marine Biota Assessment

Name	Affiliation	Duties
Jay A. Johnson	Applied Marine Sciences, Inc. (AMS)	Mar, Biologist, Field Team Lead
Rebecca Isquith	Applied Marine Sciences, Inc. (AMS)	Lead Mar. Biologist
Traci Linder	Applied Marine Sciences, Inc. (AMS)	Lead Mar. Botanist

2.3 Sampling Activities

Figures 2-1 illustrates the locations of each transect site.

2.4 Sampling and Analysis Procedures

At each survey location, the field team surveyed the shoreline between the splash zone/high intertidal and the lower intertidal areas along a fixed transect line. Along each transect they:

- Identified and described the intertidal habitat(s) present in the high, mid and low intertidal zones,
- Identified the visually dominant biota (flora and fauna) inhabiting each zone and habitat type,
- Estimated overall abundance of dominant biota and characterized as either dominant, common or present,
- Identified the presence and estimated density or aerial coverage of any sensitive or important species such as eelgrass (*Zostera spp.*) or native oysters (*Ostrea conchaphila*),
- Identified the presence of any non-native, invasive species such as Pacific oysters (*Crassostrea gigas*), European Green Crab (*Carcinus maenus*), and the Chinese Mitten crab (*Eriochir sinensis*), etc.

Observations were recorded on data sheets for each survey site along with the latitude/longitude location.

Figure 2-1. Vallejo Marine Terminal survey site locations.

3.0 Results (Observations)

The shoreline habitat of the Vallejo Marine Terminal (VMT) consists primarily of cobble-sand-silt beaches with assorted quarry rock and concrete debris of assorted sizes armoring the shoreline bluff with isolated rocks or concrete debris found lower in the intertidal area. The intertidal zone is defined as that area of the shoreline that undergoes periodic exposure to air during low tide and is submerged by water or exposed to wave splash during high tide. The intertidal area is divided into different vertical zones, which are generally the result of the amount of time the shoreline area is exposed to air or kept submerged by water (Ricketts 1985). The most common or frequent vertical zonation used along the west coast consists of four zones:

- Littorine or Splash zone
- High Intertidal
- Mussel Zone or Mid-Intertidal
- Low Intertidal

Shorelines that are very steep, such as portions of the VMT tend to have fairly narrow zonal bands with less clear demarcation between each zone. As a result, this study divided the intertidal region into three zones, by combining the Splash zone with the High Intertidal into one zone. The other two zones for which the habitat and associated biota were characterized were the mid-intertidal and the low intertidal.

Tables 3-1, 3-2, and 3-3 present species lists for all taxa observed inhabiting the high, mid, and low intertidal zones, respectively, at each of the survey segments at the Vallejo Marine Terminal.

3.1 Upper Intertidal Zone

The upper intertidal zone varied slightly in habitat composition among the different VMT survey segments (Figure 2-1). Most noticeably, segments C and D had much steeper gradients and consisted almost entirely of quarried rock and concrete debris rip rap (Figure 3-1). Most of the other surveyed shoreline segments consisted of quarried rock, course gravel and sand in the upper intertidal area of the VMT site (Figure 3-2). These later segments (A, B, E, AND F) had much more gradual shoreline gradients below the riprap bluff armoring.

Despite the variation in slope gradient between survey segments A, B, E, and F and C and D, the upper intertidal zone of the entire VMT site was occupied by the same marine community and dominated by the same flora and fauna. The upper intertidal zone, which may be splashed regularly but submerged rarely, was dominated by the filamentous form of *Ulva spp*. This form of *Ulva spp.* is highly tolerant to drought and desiccation as well as salinity changes. Additionally, the more common leafy form of *Ulva spp.* was commonly observed in the lower portion of the upper intertidal zone. Invertebrates observed in the upper intertidal zone included balanoid barnacles and a colonial diatom.

Figure 3-1 Survey Segment D, Concrete Slab Bulkhead. The light green algae is the filamentous form of Ulva spp. and the dark green is the leafy form of Ulva spp.

3.2 Mid Intertidal Zone

The mid intertidal zone consisted mostly of isolated large boulders, cobble, gravel, and course sand. Again, zones C and D differed in comparison, as they were mostly concrete rip rap that extended almost vertically from the upper intertidal zone to the lower intertidal zone and in some areas, subtidally (Figure 3-1). The mid intertidal zone was dominated by the leafy form of *Ulva spp*. (Figure 3-3). Other algae species seen included the filamentous form of *Ulva spp*., *Fucus distichus* (Figure 3-4), as well as an unidentified alga.

The invertebrate community in the mid intertidal zone was similar to the high zone with colonial diatoms (Figure 3-5) dominant in segment C and balanoid barnacles present throughout. Depending on the available bare rock space and the amount of crevices, the California mussel was also observed occurring occasionally in the riprap areas of survey segments C and D. Both live and dead carapaces of the shore crab *Hemigrapsus sanguineus* were also observed.

Figure 3-2 High, mid, and lower intertidal zone habitat along the pocket beach in survey segment B.

Figure 3-3 Leafy form of *Ulva spp.*

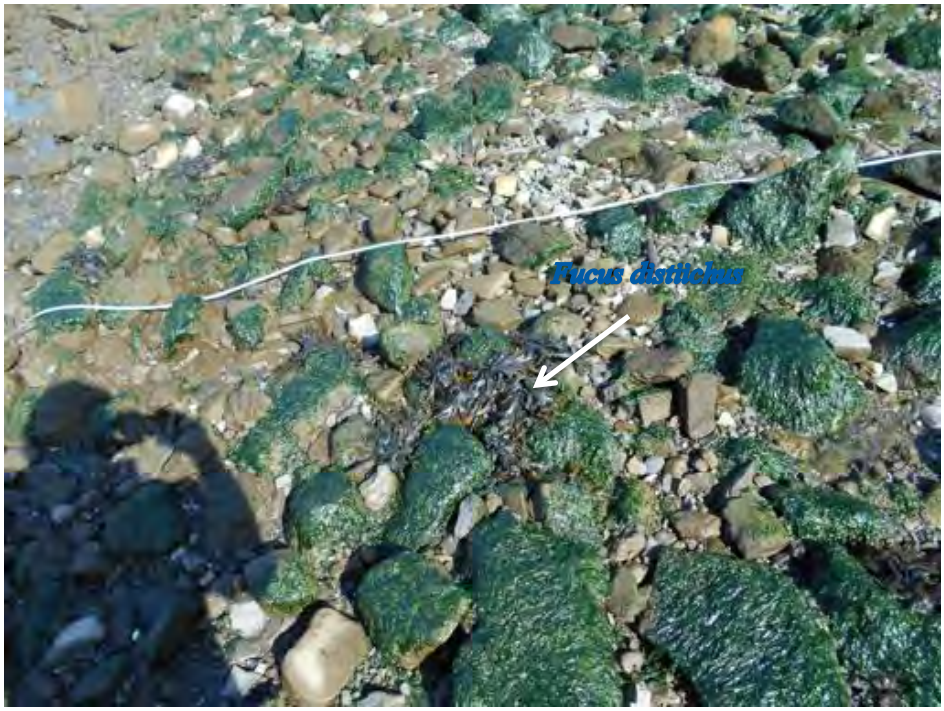


Figure 3-4 Segment F, *Fucus distichus.*

Figure 3-5 Colonial diatom.

3.3 Low Intertidal Zone

The low intertidal zone habitat varied greatly from concrete slabs and creosote pilings in Sections C and D to small boulders, cobble, sand and consolidated fine sediment (Sections A, B, E and F). Similarly, this zone was not heavily colonized by any one species. Various flora and fauna were observed with *Fucus distichus* being the only abundant algae species documented. Colonial diatoms and barnacles were abundant under the pier, which is also the only location where the native Olympia oyster *Ostrea lurida (conchaphila)* and oyster scars were observed at the VMT site (Figure 3-6). Encrusting turf, typically composed of tunicates, hydroids, bryozoans, and other encrusting species, was also observed in the low intertidal area under the pier. *Ulva spp.* (leaf form) was present in some of the VMT lower intertidal segments that consisted of rockier habitat, such as Segment E.

Figure 3-6 *Ostrea lurida (conchaphila)* and oyster scars.

3.4 Species of Special Concern

The native oyster, *Ostrea lurida (conchaphila)*, was observed on concrete and brick debris under the covered pier at the VMT site in the lower intertidal zone. Native oysters were not observed anywhere else in the intertidal zones of the VMT site. Its occurrence under the pier was characterized as very patchy with only a few pieces of concrete or brick rubble showing signs of recruitment (scars) and living oysters. The live oysters ranged between 13 and 24 mm in length and were observed on the surface or vertical faces the rubble. No oysters were observed attached to the pier pilings or the concrete bulkhead. The protected environment under the covered pier segment appears to prevent predation by birds (oyster catchers) when ultra-low seasonal tides expose the inhabited rubble as well as reduce desiccation during exposure to the air.

Table 3-1. Upper Intertidal Flora and Fauna observed along shoreline at the Vallejo Marine Terminal. Location of each numbered site is identified on Figure 2-1.
(A=abundant, C=common, P=present, R=rare, =invasive species, =dominant organisms, =species of concern).

	A[1]	B		C		D				E		F			
	1	1	2	1	2	1	2	Pilings	Under Pier	1	2	1	2	3	4
Upper Intertidal Zone															
Habitat	Quarried rock, small rock, sand, pebbles	Quarried rock (90%), concrete debris, cobble, large gravel	Boulders, sand, course gravel, exposed rock, lower edge of rip rap	Rip rap bulkhead, steep angle, pilings	Concrete debris	Concrete slabs	Gravel	Creosote pilings	Concrete, quarried rock, brick debris	Quarried rock	Concrete and asphalt boulders, brick debris	Concrete, boulders, debris	Concrete, brick & asphalt, debris, gravel	Quarried rock, small cobble & rocks	Concrete & small quarried rock
Species Name															
Ulva spp. (leaf form)		C		C	C	C							P		
Ulva spp. (filamentous form)	A	A	A	A	A	A	A	A		A	A	A	A	A	A
Colonial diatom (unident.)				P	P	P			P						
Balanoid Barnacles		C		P	P	P		P			P				

Note[1]: Area A was not directly accessible because of a fence. Observations were made from a distance through the fence.

Table 3-2. Middle Intertidal Flora and Fauna from the Vallejo Marine Terminal. Location of each numbered site is identified on Figure 2-1. (A=abundant, C=common, P=present, R=rare, =invasive species, =dominant organisms, =species of concern).

	A[1]	B		C		D				E		F			
	1	1	2	1	2	1	2	Pilings	Under Pier	1	2	1	2	3	4
Middle Intertidal Zone															
Habitat	Small cobbles	Quarried rock (90%), concrete debris, cobble, large gravel	Gravel and course sand	Some large boulders, mixed quarry rock & concrete	Concrete rip rap, some small cobble, natural rock	Concrete slabs	Concrete slabs	Creosote pilings		Concrete, silty substrate underneath the boulders	Concrete and asphalt boulders, brick debris	Course sand & fine gravel	Small cobble, course gravel	Large cobble, gravel, sand	Course sand & large cobble
Species Name															
Fucus distichus	A							P						C	
Ulva spp. (leaf form)		A	P	A	A	A	A		P	A	A	C	A	A	A
Ulva spp. (filamentous form)		P	A								P	C			
Algae (unident.)										P					
Colonial diatom (unident.)		A		A	A	A	A		P	P					
Hemigrapsus sanguineus		P													
Encrusting diatom									P						
Balanoid Barnacles		P		P	P	P	P	C		C				P	
Mytilus trossulus/ galloprovincialis [2]		P		P	P	P	P							P	

Note[1]: Area A was not directly accessible because of a fence. Observations were made from a distance through the fence.
Note[2]= Invasive species

Table 3-3. Low Intertidal Flora and Fauna from the Vallejo Marine Terminal. Location of each numbered site is identified on Figure 2-1. (A=abundant, C=common, P=present, R=rare, =invasive species, =dominant organisms, =species of concern).

	A[1]	B		C		D				E		F			
	1	1	2	1	2	1	2	Pilings	Under Pier	1	2	1	2	3	4
Low Intertidal Zone															
Habitat	Mudflat, small boulders with some areas	Some rock, cobble, heavily consolidated sediment, a lot of course sand & gravel	Well consolidated sand, fine silt in upper layer	Sheer bulkhead, sand beach, water	Boulders, some small cobble, sediment	Concrete slabs	Concrete slabs, course sand	Creosote pilings	Turf in shallow sub-tidal	Small boulders & rocks, heavily silted, fine surface layer	Large cobble, course gravel, covered in fine sediment	Course sand & fine sediment	Heavily silted rocks	Cobble with silt & sand	Large cobble & course sand
Species Name															
Fucus distichus	P												P	C	
Ulva spp. (leaf form)		P										P			
Gracilaria sjoestedtii			R												
Algae (unident.)							P			C			P	P	C
Colonial diatom (unident.)			P				C		A		P				
Balanoid Barnacles									A				P		P
Ostrea lurida (conchaphila)									P						
Ostrea lurida (conchaphila) scars									P						
Mytilus trossulus/ galloprovincialis[2]				P	P										
Encrusting turf									P						

Note[1]: Area A was not directly accessible because of a fence. Observations were made from a distance through the fence.
Note[2]= Invasive species

4.0 Discussion of Observations

Overall, there appears to be a single intertidal community inhabiting the upper and mid intertidal zones of the VMT site. This community is dominated by the algae *Ulva* spp. with colonial diatoms frequently occurring on the surface of rocks that are present in the mid intertidal zone. In those shoreline segments primarily consisting of rocky riprap and pilings (C and D), both the algae *Ulva* spp. and a colonial diatom dominated all of the rock surfaces.

The low intertidal zone appeared to contain a similar diversity of species as the middle intertidal zone depending on substrate type. Sand-silt substrate contained few epibenthic species whereas those shoreline segments that contained a lot of cobble and rock contained more species. Under the pier, where predation and desiccation appears to be minimized during low tide cycles, the greatest diversity of taxa was observed. This area is the only location where evidence of the Olympia oyster, *Ostrea lurida (conchaphila)* was observed, with both live individuals and scars. The presence of large surfaces created by concrete boulder habitat paired with a sheltered environment created a more successful settling location for this native species. Evidence of *O. Lurida* was not observed anywhere else along the VMT wterfront.

Over the entire VMT intertidal area, there appeared a slight shift in flora composition, along a north to south direction (toward the Bay) with more frequent occurrence of rockweed species, such as *F. distichus,* occurring in the mid and lower intertidal zones as you moved closer to the Bay. This shift is attributed to the increasing presence of saline Bay water vs. the fresher Napa river water.

No eelgrass or other listed protected or special status species were found anywhere along the shoreline of the VMT project site that was surveyed. The only invasive species observed was the hybrid Mytilus mussel, *Mytilus trossulus/ galloprovincialis,* which has become endemic to the entire San Francisco Bay-Delta

5.0 Literature Cited

Ricketts, E.F. Calvin, J. J.W. Hedgpeth. 1985. *Between Pacific Tides*. 5th edition, revised by D.W. Phillips. Stanford University Press, Stanford, California.