ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **Grand Canal East** Between South Bay Front and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: December 21, 2004	REVISION:	

Grand Canal East, 133 ft N. of South Bay Front

Grand Canal East, 145 ft N. of South Bay

Grand Canal East, 165 ft N. of South Bay Front

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION **Grand Canal East** Between South Bay Front and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: December 21, 2004	REVISION:	

Grand Canal East, 189 ft N. of South Bay Front

Grand Canal East, 190 ft N. of South Bay

Grand Canal East, 217 ft N. of South Bay Front

Grand Canal East, 234 ft N. of South Bay Front

Grand Canal East, 240 ft N. of South Bay

Grand Canal East, 240 ft N. of South Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **Grand Canal East** Between South Bay Front and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: December 21, 2004	REVISION:	

Grand Canal East, 268 ft N. of South Bay Front

Grand Canal East, 279 ft N. of South Bay

Grand Canal East, 323 ft N. of South Bay Front

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: December 21, 2004	REVISION:
Grand Canal East	ASSISTANT:		
Between South Bay Front and Park Ave			

Grand Canal East, 329 ft N. of South Bay Front

Grand Canal East, 341 ft N. of South Bay

Grand Canal East, 367 ft N. of South Bay Front

Grand Canal East, 367 ft N. of South Bay Front

Grand Canal East, 372 ft N. of South Bay

Grand Canal East, 394 ft N. of South Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **Grand Canal East** Between South Bay Front and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: December 21, 2004	REVISION:

Grand Canal East, 411 ft N. of South Bay Front

Grand Canal East, 433 ft N. of South Bay

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: December 21, 2004	REVISION:
Grand Canal East	ASSISTANT:		
Between South Bay Front and Park Ave			

		QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
Item	Description	Number	Unit	Unit Cost	Total	Unit Cost	Total	Unit Cost	Total
1	5' North of South Bay Front, spall repair	2	SF					$70.00	$140
2	7' North of South Bay Front, spall repair	4	SF					$70.00	$280
3	41' North of South Bay Front, crack injection	8	LF					$70.00	$560
4	68' North of South Bay Front, shotcrete repair	6	SF					$70.00	$420
5	78' North of South Bay Front, shotcrete repair	6	SF					$70.00	$420
6	82'-92' North of South Bay Front, spall repair	10	SF					$70.00	$700
7	91' North of South Bay Front, shotcrete repair	6	SF					$70.00	$420
8	92'-103' North of South Bay Front, spall repair	6	SF					$70.00	$420
9	116' North of South Bay Front, sealant repair	3	LF					$25.00	$75
10	119' North of South Bay Front, spall repair	10	SF					$70.00	$700
11	133' North of South Bay Front, shotcrete repair	6	SF					$70.00	$420
12	133' North of South Bay Front, shotcrete repair	6	SF					$70.00	$420
13	145' North of South Bay Front, sealant repair	4	LF					$25.00	$100
15	189' North of South Bay Front, shotcrete repair	6	SF					$70.00	$420
16	190' North of South Bay Front, sealant repair	6	LF					$25.00	$150
17	217' North of South Bay Front, shotcrete repair	10	SF					$70.00	$700
18	240' North of South Bay Front, shotcrete repair	6	SF					$70.00	$420
19	240' North of South Bay Front, crack injection	10	LF					$70.00	$700
20	234' North of South Bay Front, sealant repair	4	LF					$25.00	$100
21	268' North of South Bay Front, crack injection	4	LF					$70.00	$280
22	279' North of South Bay Front, sealant repair	6	LF					$25.00	$150
23	323' North of South Bay Front, sealant repair	4	LF					$25.00	$100
24	329' North of South Bay Front, shotcrete repair	6	SF					$70.00	$420
25	341' North of South Bay Front, shotcrete repair	6	SF					$70.00	$420
26	367' North of South Bay Front, sealant repair	6	LF					$25.00	$150
27	372' North of South Bay Front, shotcrete repair	6	SF					$70.00	$420
28	394' North of South Bay Front, shotcrete repair	6	SF					$70.00	$420
29	394' North of South Bay Front, crack injection	4	LF					$70.00	$280
30	411' North of South Bay Front, sealant repair	6	LF					$25.00	$150

Continued onto next page

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: December 21, 2004	REVISION:	
Grand Canal East	ASSISTANT:			
Between South Bay Front and Park Ave				

Subtotal		$10,355
Contingency	20 %	$2,071
Contractor OH & P	10 %	$1,036
City Cost Index	10 %	$1,036
GRAND TOTAL		$14,497

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 6, 2005	REVISION:
Grand Canal East	ASSISTANT:		
Between Balboa Ave and Park Ave			

Item	Location	Description
1	6' South of Balboa Avenue	Waterside, shotcrete at pile, facing and sides cracked, 72" long x 1/8" wide
2	18' South of Balboa Avenue	Waterside, shotcrete at pile, facing and sides cracked, 72" long x 1/8" wide
3	30' South of Balboa Avenue	Waterside, shotcrete at pile, facing only cracked, 24" long x 1/8" wide
4	41' South of Balboa Avenue	Waterside, shotcrete at pile, facing and sides cracked, 48" long x 1/8" wide
5	53' South of Balboa Avenue	Construction joint, waterside sealant in good condition, landside sealant in rough condition
6	53' South of Balboa Avenue	Waterside, shotcrete at pile facing and sides cracked, 48" long x 1/8" wide
7	65' South of Balboa Avenue	Waterside, shotcrete at pile facing and sides cracked, 48" long x 1/8" wide
8	76' South of Balboa Avenue	Waterside, shotcrete pile face at mudline spalled off
9	88' South of Balboa Avenue	Waterside, shotcrete pile face at mudline spalled off
10	100' South of Balboa Avenue	Waterside, shotcrete at pile face spalled off
11	111' South of Balboa Avenue	Waterside, shotcrete at pile face spalled off
12	123' South of Balboa Avenue	Waterside, shotcrete at pile face spalled off
13	128' South of Balboa Avenue	Landside, crack at top of cap rebar exposed 120" long
14	130' - 153' South of Balboa Avenue	Landside, crack at lower step
15	135' South of Balboa Avenue	Waterside, shotcrete at pile face spalled off
16	146' South of Balboa Avenue	Waterside, shotcrete at pile facing and sides cracked, 48" long x 1/8" wide
17	153' South of Balboa Avenue	Construction joint, waterside and landside sealant cracked and split
18	158' South of Balboa Avenue	Waterside, shotcrete cover at pile loose and cracked 4 square feet
19	170' South of Balboa Avenue	Waterside, shotcrete cover at pile loose and cracked 6 square feet
20	181' South of Balboa Avenue	Waterside, shotcrete at pile facing and sides cracked, 48" long x 1/8" wide
21	192' South of Balboa Avenue	Waterside, shotcrete at pile lost at mudline 2 square feet
22	205' South of Balboa Avenue	Waterside, shotcrete at pile lost at mudline 2 square feet
23	216' South of Balboa Avenue	Waterside, shotcrete cover cracked on south side 36" long x 1/8" wide
24	228' South of Balboa Avenue	Waterside, shotcrete at pile spalled at mudline 1 square foot
25	240' South of Balboa Avenue	Waterside, shotcrete at pile spalled at mudline 3 square foot
26	253' South of Balboa Avenue	Construction joint, waterside and landside sealant cracked and split
27	257' South of Balboa Avenue	Waterside, rust spots and cracking at bottom of cap 36" long x 6" wide
28	263' South of Balboa Avenue	Waterside, shotcrete cover cracked on south side 36" long x 1/32" wide
29	286' South of Balboa Avenue	Waterside, shotcrete cover cracked on south side and south face 48" long x 1/32" wide
30	298' South of Balboa Avenue	Waterside, spall at bottom of cap 120" long, rust stains through cap
31	298'-305' South of Balboa Avenue	Landside, crack at lower step
32	314' South of Balboa Avenue	Waterside, spall at bottom of cap 120" long, rust stains through cap
33	323' South of Balboa Avenue	Waterside, shotcrete at pile cracked at front and south side, vertical cracks through cap
34	346' South of Balboa Avenue	Waterside, shotcrete at pile at mudline spalled 3 square feet

Continued onto next page

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 6, 2005	REVISION:	
Grand Canal East	ASSISTANT:			
Between Balboa Ave and Park Ave				

35	357' South of Balboa Avenue	Waterside, shotcrete at pile at mudline crumbling and cracked
36	381' South of Balboa Avenue	Waterside, shotcrete at pile at mudline cracked 24"long x 1/32" wide
37	400' South of Balboa Avenue	Waterside, cracks in cap at lower half of cap 48" long x 1/32" wide
38	410' South of Balboa Avenue	Waterside, cracks at lower half of cap, 120" long x 1/32" wide
39	442' South of Balboa Avenue	Waterside, shotcrete spall on wall 120" long x 48" high x 1.5" thick
40	438' South of Balboa Avenue	Construction joint, landside lower step sealant cracked
41	420' South of Balboa Avenue	Landside, exposed reinforcing bars

Grand Canal East, 6 ft South of Balboa

Grand Canal East, 18 ft South of Balboa

Grand Canal East, 30 ft South of Balboa

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION **Grand Canal East** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

Grand Canal East, 41 ft South of Balboa

Grand Canal East, 53 ft South of Balboa

Grand Canal East, 53 ft South of Balboa

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **Grand Canal East** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

Grand Canal East, 65 ft South of Balboa

Grand Canal East, 76 ft South of Balboa

Grand Canal East, 88 ft South of Balboa

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **Grand Canal East** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

Grand Canal East, 100 ft South of Balboa

Grand Canal East, 111 ft South of Balboa

Grand Canal East, 123 ft South of Balboa

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **Grand Canal East** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

Grand Canal East, 135 ft South of Balboa

Grand Canal East, 146 ft South of Balboa

Grand Canal East, 153 ft South of Balboa

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **Grand Canal East** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

Grand Canal East, 153 ft South of Balboa

Grand Canal East, 158 ft South of Balboa

Grand Canal East, 170 ft South of Balboa

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **Grand Canal East** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

Grand Canal East, 178 ft South of Balboa

Grand Canal East, 181 ft South of Balboa

Grand Canal East, 192 ft South of Balboa

Grand Canal East, 205 ft South of Balboa

Grand Canal East, 216 ft South of Balboa

Grand Canal East, 228 ft South of Balboa

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **Grand Canal East** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 5, 2005	REVISION:	

Grand Canal East, 240 ft South of Balboa

Grand Canal East, 253 ft South of Balboa

Grand Canal East, 253 ft South of Balboa

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **Grand Canal East** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

Grand Canal East, 257 ft South of Balboa

Grand Canal East, 263 ft South of Balboa

Grand Canal East, 286 ft South of Balboa

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **Grand Canal East** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

Grand Canal East, 298 ft South of Balboa

Grand Canal East, 300 ft South of Balboa

Grand Canal East, 314 ft South of Balboa

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **Grand Canal East** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2006	REVISION:

Grand Canal East, 323 ft South of Balboa

Grand Canal East, 346 ft South of Balboa

Grand Canal East, 357 ft South of Balboa

ACTIVITY
Balboa Island Bulkhead Inspection

CASH & ASSOCIATES
Engineering and Architecture

STREET LOCATION
Grand Canal East
Between Balboa Ave and Park Ave

INSPECTOR: CTM
ASSISTANT:

INSPECTION DATE: Jan 6, 2005

REVISION:

Item	Description	QUANTITY Number	QUANTITY Unit	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Unit Cost	LABOR COST Total	ENGINEERING ESTIMATE Unit Cost	ENGINEERING ESTIMATE Total
1	6' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
2	18' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
3	30' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
4	41' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
5	53' South of Balboa Avenue, sealant repair	3	LF					$25.00	$75
6	53' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
7	65' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
8	76' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
9	88' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
10	100' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
11	111' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
12	123' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
13	128' South of Balboa Avenue, crack injection	10	LF					$70.00	$700
14	130' - 153' South of Balboa Avenue, crack injection	23	LF					$70.00	$1,610
15	135' South of Balboa Avenue, shotcrete pile repair	2	SF					$70.00	$140
16	146' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
17	153' South of Balboa Avenue, sealant repair	6	LF					$25.00	$150
18	158' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
19	170' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
20	181' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
21	192' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
22	205' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
23	216' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
24	228' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
25	240' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
26	253' South of Balboa Avenue, sealant repair	6	LF					$25.00	$150
27	257' South of Balboa Avenue, crack injection	3	LF					$70.00	$210
28	263' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
29	286' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
30	298' South of Balboa Avenue, crack injection	10	LF					$70.00	$700
31	298'-305' South of Balboa Avenue, crack injection	7	LF					$70.00	$490
32	314' South of Balboa Avenue, crack injection	10	LF					$70.00	$700
33	323' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420
34	346' South of Balboa Avenue, shotcrete pile repair	6	SF					$70.00	$420

Continued onto next page

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **Grand Canal East** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

Grand Canal East, 381 ft South of Balboa

Grand Canal East, 400 ft South of Balboa

Grand Canal East, 410 ft South of Balboa

Grand Canal East, 420 ft South of Balboa

Grand Canal East, 438 ft South of Balboa

Grand Canal East, 442 ft South of Balboa

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 6, 2005	REVISION:	
Grand Canal East	ASSISTANT:			
Between Balboa Ave and Park Ave				

35	357' South of Balboa Avenue, shotcrete pile repair	6	SF		$70.00	$420
36	381' South of Balboa Avenue, shotcrete pile repair	6	SF		$70.00	$420
37	400' South of Balboa Avenue, crack injection	4	LF		$70.00	$280
38	410' South of Balboa Avenue, crack injection	10	LF		$70.00	$700
39	442' South of Balboa Avenue, shotcrete repair	40	SF		$70.00	$2,800
40	438' South of Balboa Avenue, sealant repair	6	LF		$25.00	$150
41	420' South of Balboa Avenue, spall repair	1	SF		$70.00	$70

Subtotal		$19,845
Contingency	20 %	$3,969
Contractor OH & P	10 %	$1,985
City Cost Index	10 %	$1,985
GRAND TOTAL		$27,783

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 6, 2005	REVISION:	
Grand Canal East	ASSISTANT:			
Between Balboa Ave and East Bay Front				

Item	Location	Description
1	Corner btwn N. Bay Front and Grand Canal East	Rust spots at middle to bottom of cap
2	0-17' South of East Bay Front	Landside, cracking at sidewalk level
3	3' - 13' South of East Bay Front	Waterside, cracking at bottom of cap, rust present
4	13' South of East Bay Front	Construction joint, waterside and landside sealant cracked and split
5	20' South of East Bay Front	Waterside, rust spots present no cracking
6	36' South of East Bay Front	Waterside, shotcrete pile cover cracked and spalled at mudline
7	41' South of East Bay Front	Waterside, shotcrete spall on wall 24" long x 4" high x 1/2" deep
8	49' South of East Bay Front	Waterside, shotcrete pile cover cracked 24" long x 1/8" wide
9	62' South of East Bay Front	Waterside, shotcrete pile cover loose and cracked
10	86' South of East Bay Front	Waterside, shotcrete pile cover cracked at face
11	98' South of East Bay Front	Construction joint, waterside and landside sealant cracked and split
12	121' South of East Bay Front	Waterside, shotcrete pile cover face and sides cracked
13	133' South of East Bay Front	Waterside, shotcrete pile cover face only cracked 24" long x 1/32" wide
14	144' South of East Bay Front	Waterside, shotcrete pile cover sides cracked 48" x 1/32" wide
15	168' South of East Bay Front	Waterside, shotcrete pile covering face and sides cracked
16	174' South of East Bay Front	Landside, transverse crack at top of cap
17	180' South of East Bay Front	Waterside, shotcrete pile covering sides only cracked 24" long x 1/32" wide
18	191' South of East Bay Front	Waterside, shotcrete pile covering face and sides cracking 60" long x 1/32" wide
19	204' South of East Bay Front	Construction joint, waterside and landside sealant cracked and split
20	215' South of East Bay Front	Waterside, shotcrete pile covering cracked 48" long x 1/32" wide
21	238' South of East Bay Front	Waterside, shotcrete pile covering cracked 48" long x 1/32" wide
22	262' South of East Bay Front	Waterside, shotcrete pile covering cracked on face and sides 60" long x 1/32" wide
23	304' South of East Bay Front	Landside, top of cap cracked 72" long x 1/16" - 1/4" wide
24	308' South of East Bay Front	Waterside, spall at bottom of cap 24" long x 4" high x 2" deep under cap
25	308' South of East Bay Front	Waterside, shotcrete pile covering cracked both sides
26	321' South of East Bay Front	Construction joint, waterside and landside sealant cracked and split
27	321' South of East Bay Front	Waterside, shotcrete pile covering side cracks 60" long x 1/32" wide
28	326' South of East Bay Front	Waterside, longitudinal cracks on sheet 98" long x 1/32" wide
29	343' South of East Bay Front	Waterside, face of cap pealing, 240" long x 18" high x surface
30	373' South of East Bay Front	Waterside, vertical crack through cap 30" long x 1/32" wide
31	373' South of East Bay Front	Landside, transverse crack through shotcrete
32	378' South of East Bay Front	Waterside, face of cap pealing, 120" long x 18" high x surface
33	402' South of East Bay Front	Waterside, shotcrete pile covering face and sides cracking 60" long x 1/32" wide
34	437' South of East Bay Front	Waterside, shotcrete pile covering face and side cracked 60" long x 1/32" wide

Continued onto next page

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 6, 2005	REVISION:
Grand Canal East Between Balboa Ave and East Bay Front	ASSISTANT:		

35	437'-444' South of East Bay Front	Waterside, bottom of cap spalled and cracked
36	437'-510' South of East Bay Front	Landside, crack at lower step, longitudinal 876" long x 1/32" wide
37	469' South of East Bay Front	Waterside, bottom of cap spalled and reinforcing cage exposed
38	472' South of East Bay Front	Waterside, shotcrete pile covering face and sides cracked 60" long x 1/32"-1/4" wide
39	479' South of East Bay Front	Waterside, bottom of cap spalled 96" long
40	496' South of East Bay Front	Waterside, shotcrete pile covering at bottom spalled north side, 2 square feet
41	519'-527' South of East Bay Front	Landside, crack at lower step, longitudinal 96" long x 1/32" wide
42	537' South of East Bay Front	Construction joint, waterside and landside sealant cracked and split
43	540'-550' South of East Bay Front	Landside, crack at lower step, longitudinal 120" long x 1/32" wide
44	543' South of East Bay Front	Waterside, shotcrete pile covering at mudline, spalled off
45	555' South of East Bay Front	Waterside, shotcrete pile covering cracked at face and vertical through cap
46	555' South of East Bay Front	Landside, crack through cap
47	579' South of East Bay Front	Waterside, shotcrete pile covering cracked 60" long x 1/32" wide
48	584' South of East Bay Front	Centerline of Balboa Avenue

Grand Canal East at East Bay Front

13 feet South of East Bay Front

13 feet South of East Bay Front

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION **Grand Canal East** Between Balboa Ave and East Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

13 feet South of East Bay Front

20 feet South of East Bay Front

36 feet South of East Bay Front

41 feet South of East Bay Front

49 feet South of East Bay Front

62 feet South of East Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **Grand Canal East** Between Balboa Ave and East Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2006	REVISION:

86 feet South of East Bay Front

98 feet South of East Bay Front

98 feet South of East Bay Front

121 feet South of East Bay Front

133 feet South of East Bay Front

144 feet South of East Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **Grand Canal East** Between Balboa Ave and East Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

168 feet South of East Bay Front

174 feet South of East Bay Front

180 feet South of East Bay Front

191 feet South of East Bay Front

204 feet South of East Bay Front

204 feet South of East Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **Grand Canal East** Between Balboa Ave and East Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

215 feet South of East Bay Front

215 feet South of East Bay Front

238 feet South of East Bay Front

262 feet South of East Bay Front

304 feet South of East Bay Front

308 feet South of East Bay Front

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION **Grand Canal East** Between Balboa Ave and East Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

308 feet South of East Bay Front


321 feet South of East Bay Front


321 feet South of East Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **Grand Canal East** Between Balboa Ave and East Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

326 feet South of East Bay Front

343 feet South of East Bay Front

373 feet South of East Bay Front

373 feet South of East Bay Front

378 feet South of East Bay Front

402 feet South of East Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			
STREET LOCATION **Grand Canal East** Between Balboa Ave and East Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

437 feet South of East Bay Front

469 feet South of East Bay Front

469 feet South of East Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **Grand Canal East** Between Balboa Ave and East Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

472 feet South of East Bay Front

479 feet South of East Bay Front

496 feet South of East Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **Grand Canal East** Between Balboa Ave and East Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2006	REVISION:	

519 feet South of East Bay Front

537 feet South of East Bay Front

537 feet South of East Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			C&A
STREET LOCATION **Grand Canal East** Between Balboa Ave and East Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

540 feet South of East Bay Front

543 feet South of East Bay Front

555 feet South of East Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			
STREET LOCATION **Grand Canal East** Between Balboa Ave and East Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2006	REVISION:	

555 feet South of East Bay Front

579 feet South of East Bay Front

579 feet South of East Bay Front

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 6, 2005	REVISION:
Grand Canal East	ASSISTANT:		
Between Balboa Ave and East Bay Front			

		QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
Item	Description	Number	Unit	Unit Cost	Total	Unit Cost	Total	Unit Cost	Total
2	0-17' South of East Bay Front, crack injection	17	LF					$70.00	$1,190
3	3' - 13' South of East Bay Front, crack injection	13	LF					$70.00	$910
4	13' South of East Bay Front, sealant repair	6	LF					$25.00	$150
6	36' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
7	41' South of East Bay Front, spall repair	2	SF					$70.00	$140
8	49' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
9	62' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
10	86' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
11	98' South of East Bay Front, sealant repair	6	LF					$25.00	$150
12	121' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
13	133' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
14	144' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
15	168' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
16	174' South of East Bay Front, crack injection	6	LF					$70.00	$420
17	180' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
18	191' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
19	204' South of East Bay Front, sealant repair	6	LF					$25.00	$150
20	215' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
21	238' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
22	262' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
23	304' South of East Bay Front, crack injecion	6	LF					$70.00	$420
24	308' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
25	308' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
26	321' South of East Bay Front, sealant repair	6	LF					$25.00	$150
27	321' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
28	326' South of East Bay Front, crack injection	8	LF					$70.00	$560
29	343' South of East Bay Front, surface overly	30	SF					$30.00	$900
30	373' South of East Bay Front, crack injection	3	LF					$70.00	$210
31	373' South of East Bay Front, crack injection	3	LF					$70.00	$210
32	378' South of East Bay Front, surface overly	15	SF					$30.00	$450
33	402' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
34	437' South of East Bay Front, shotcrete pile repair	6	SF					$70.00	$420
35	437'-444' South of East Bay Front, spall repair	10	SF					$70.00	$700
36	437'-510' South of East Bay Front, crack injection	73	LF					$70.00	$5,110

Continued onto next page

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 6, 2005	REVISION:
Grand Canal East	ASSISTANT:		
Between Balboa Ave and East Bay Front			

CASH & ASSOCIATES ENGINEERING & ARCHITECTURE (714)895-2072 HUNTINGTON BEACH, CA

37	469' South of East Bay Front, spall repair	10	SF	$70.00	$700
38	472' South of East Bay Front, shotcrete pile repair	6	SF	$70.00	$420
39	479' South of East Bay Front, spall repair	8	SF	$70.00	$560
40	496' South of East Bay Front, shotcrete pile repair	6	SF	$70.00	$420
41	519'-527' South of East Bay Front, crack injection	8	LF	$70.00	$560
42	537' South of East Bay Front, sealant repair	6	LF	$25.00	$150
43	540'-550' South of East Bay Front, crack injection	10	LF	$70.00	$700
44	543' South of East Bay Front, shotcrete pile repair	6	SF	$70.00	$420
45	555' South of East Bay Front, shotcrete pile repair	6	SF	$70.00	$420
46	555' South of East Bay Front, crack injection	6	LF	$70.00	$420
47	579' South of East Bay Front, shotcrete pile repair	6	SF	$70.00	$420
48	General, bottom of cap is subject to spalling	280	SF	$70.00	$19,600

Subtotal		$44,170
Contingency	20 %	$8,834
Contractor OH & P	10 %	$4,417
City Cost Index	10 %	$4,417
GRAND TOTAL		$61,838

ACTIVITY
Balboa Island Bulkhead Inspection

CASH & ASSOCIATES
Engineering and Architecture

STREET LOCATION
East Bay Front
Between Grand Canal East and Balboa Ave

INSPECTOR: CTM
ASSISTANT:

INSPECTION DATE: Jan 6, 2005

REVISION:

CASH & ASSOCIATES ENGINEERING & ARCHITECTURE
(714)895-7072
NEWPORT BEACH, CA

Item	Location	Description
1	6' North of Balboa Avenue	Landside, crack at lower step 36" long
2	34' North of Balboa Avenue	Waterside, crack at bottom of cap 30" long
3	40' North of Balboa Avenue	Waterside, crack at bottom of cap 30" long
4	65' North of Balboa Avenue	Waterside, crack at bottom of cap 24" long
5	89' North of Balboa Avenue	Waterside, spall at bottom of cap 48" long x 12" high x 2" deep
6	95' North of Balboa Avenue	Waterside, crack at bottom of cap 72" long under pier decking
7	113' North of Balboa Avenue	Waterside, crack at bottom of cap 96" long
8	117' North of Balboa Avenue	Construction joint, sealant landside and waterside cracked and split
9	122' North of Balboa Avenue	Waterside, crack at bottom of cap 84" long
10	145' North of Balboa Avenue	Pullbox, transverse crack through box.
11	153' North of Balboa Avenue	Waterside, crack at bottom of cap 60" long
12	173' North of Balboa Avenue	Waterside, crack at bottom of cap 264" long
13	206' North of Balboa Avenue	Waterside, crack at bottom of cap under pier 72" long
14	222' North of Balboa Avenue	Waterside, pile cracked at top 12" long
15	234' North of Balboa Avenue	Construction joint, sealant landside and waterside cracked and split
16	264' North of Balboa Avenue	Landside, crack at lower step 24" long
17	257' North of Balboa Avenue	Waterside, crack at bottom of cap 16" long
18	275' North of Balboa Avenue	Waterside, lightpole vertical crack either side of base to north of pole base, 36" long
19	264' North of Balboa Avenue	Landside, crack at lower step of cap 24" long
20	285' - 300' North of Balboa Avenue	Waterside, crack at bottom of cap 180" long
21	333' North of Balboa Avenue	Waterside, transverse crack through top of cap and lateral spreading at interface, 24" long
22	346' North of Balboa Avenue	Waterside, transverse crack through top of cap and lateral spreading at interface, 36" long
23	352, North of Balboa Avenue	Construction joint, sealant landside and waterside cracked and split
24	347' North of Balboa Avenue	Landside, crack at lower step 12" long
25	357' North of Balboa Avenue	Waterside, crack at bottom of cap 96" long
26	372' North of Balboa Avenue	Waterside, transverse crack through cap
27	398' North of Balboa Avenue	Waterside, vertical cracks at either side of pile 12" tall
28	414' North of Balboa Avenue	Waterside, crack at bottom of cap 48" long
29	414' North of Balboa Avenue	Landside, vertical crack at angle point
30	439' North of Balboa Avenue	Pullbox, transverse crack through box.
31	432' North of Balboa Avenue	Waterside, crack at bottom of cap 36" long
32	445' North of Balboa Avenue	Waterside, vertical crack through cap at angle point
33	445' North of Balboa Avenue	Waterside, crack forming at bottom of cap above pile 48" long
34	469' North of Balboa Avenue	Construction joint, sealant waterside cracked and split, landside sealant in good condition

Continued onto next page

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 6, 2005	REVISION:	
East Bay Front	ASSISTANT:			
Between Grand Canal East and Balboa Ave				

35	480' North of Balboa Avenue	Waterside, crack at bottom of cap 60" long with rust present
36	485' - 505' North of Balboa Avenue	Waterside, crack at bottom of cap
37	515' North of Balboa Avenue	Waterside, crack at bottom of cap 96" long, site of previous repair
38	527' North of Balboa Avenue	Waterside, crack at bottom of cap 96" long extending from previous repair
39	538' North of Balboa Avenue	Waterside, crack at bottom of cap 96" long extending from previous repair
40	551' North of Balboa Avenue	Construction joint, sealant landside and waterside cracked and split
41	557' North of Balboa Avenue	Waterside, crack at bottom of cap 72" long
42	568' - 600' North of Balboa Avenue	Waterside, crack at bottom of cap 384" long
43	620' North of Balboa Avenue	Waterside, cracking at bottom of cap 60" long site of previous repair
44	644' North of Balboa Avenue	Waterside, crack at bottom of cap 24" long
45	666' North of Balboa Avenue	Construction joint, sealant landside and waterside cracked and split
46	678' North of Balboa Avenue	Waterside, crack at bottom of cap above pile, 48" long
47	691' North of Balboa Avenue	Waterside, crack at bottom of cap 120" long with rust
48	703' North of Balboa Avenue	Waterside, crack and spall at bottom of cap, 46" long x 3" high x 2" deep rust present
49	714' North of Balboa Avenue	Waterside, crack/spall at bottom of cap 48" long x 7" high x 2" deep (1/8" wide)
50	725' North of Balboa Avenue	Waterside, crack/spall at bottom of cap 132"long x 6"high x 2"deep (1/16" wide) previous repair
51	737' North of Balboa Avenue	Beginning of shotcrete bottom of wall and bottom of piles exposed.
52	749' North of Balboa Avenue	Waterside, pile spall at mudline
53	761' North of Balboa Avenue	Waterside, pile spall at mudline
69	General	Transverse cracks throughout length of cap spaced 2'-6' on center

6 feet North of Balboa Avenue

34 feet North of Balboa Avenue

40 feet North of Balboa Avenue

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 6, 2005	REVISION:	
East Bay Front	ASSISTANT:			
Between Grand Canal East and Balboa Ave				

65 feet North of Balboa Avenue

89 feet North of Balboa Avenue

95 feet North of Balboa Avenue

113 feet North of Balboa Avenue

117 feet North of Balboa Avenue

117 feet North of Balboa Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Grand Canal East and Balboa Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

122 feet North of Balboa Avenue

145 feet North of Balboa Avenue

145 feet North of Balboa Avenue

153 feet North of Balboa Avenue

173 feet North of Balboa Avenue

173 feet North of Balboa Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Grand Canal East and Balboa Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

185 feet North of Balboa Avenue

206 feet North of Balboa Avenue

222 feet North of Balboa Avenue

234 feet North of Balboa Avenue

234 feet North of Balboa Avenue

257 feet North of Balboa Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Grand Canal East and Balboa Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

x feet North of Balboa Avenue

264 feet North of Balboa Avenue

275 feet North of Balboa Avenue

275 feet North of Balboa Avenue

285 feet North of Balboa Avenue

333 feet North of Balboa Avenue

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 6, 2005	REVISION:	
East Bay Front	ASSISTANT:			
Between Grand Canal East and Balboa Ave				

346 feet North of Balboa Avenue

347 feet North of Balboa Avenue

352 feet North of Balboa Avenue

352 feet North of Balboa Avenue

357 feet North of Balboa Avenue

372 feet North of Balboa Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **East Bay Front** Between Grand Canal East and Balboa Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

372 feet North of Balboa Avenue

398 feet North of Balboa Avenue

414 feet North of Balboa Avenue

422 feet North of Balboa Avenue

422 feet North of Balboa Avenue

432 feet North of Balboa Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Grand Canal East and Balboa Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

439 feet North of Balboa Avenue

439 feet North of Balboa Avenue

439 feet North of Balboa Avenue

445 feet North of Balboa Avenue

469 feet North of Balboa Avenue

469 feet North of Balboa Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Grand Canal East and Balboa Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

480 feet North of Balboa Avenue

491 feet North of Balboa Avenue

503 feet North of Balboa Avenue

515 feet North of Balboa Avenue

527 feet North of Balboa Avenue

538 feet North of Balboa Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			C&A
STREET LOCATION **East Bay Front** Between Grand Canal East and Balboa Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

551 feet North of Balboa Avenue

551 feet North of Balboa Avenue

551 feet North of Balboa Avenue

557 feet North of Balboa Avenue

573 feet North of Balboa Avenue

585 feet North of Balboa Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **East Bay Front** Between Grand Canal East and Balboa Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:	

595 feet North of Balboa Avenue

608 feet North of Balboa Avenue

620 feet North of Balboa Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Grand Canal East and Balboa Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

644 feet North of Balboa Avenue

668 feet North of Balboa Avenue

668 feet North of Balboa Avenue

678 feet North of Balboa Avenue

678-720 feet North of Balboa Avenue

691 feet North of Balboa Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Grand Canal East and Balboa Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

703 feet North of Balboa Avenue

714 feet North of Balboa Avenue

725 feet North of Balboa Avenue

737 feet North of Balboa Avenue

737 feet North of Balboa Avenue

749 feet North of Balboa Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Grand Canal East and Balboa Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2005	REVISION:

761 feet North of Balboa Avenue

797 feet North of Balboa Avenue

798 feet North of Balboa Avenue

ACTIVITY
Balboa Island Bulkhead Inspection

CASH & ASSOCIATES
Engineering and Architecture

STREET LOCATION
East Bay Front
Between Grand Canal East and Balboa Ave

INSPECTOR: CTM
ASSISTANT:

INSPECTION DATE: Jan 6, 2005

REVISION:

Item	Description	QUANTITY Number	QUANTITY Unit	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Unit Cost	LABOR COST Total	ENGINEERING ESTIMATE Unit Cost	ENGINEERING ESTIMATE Total
1	6' North of Balboa Avenue, crack injection	3	LF					$70.00	$210
2	34' North of Balboa Avenue, crack injection	3	LF					$70.00	$210
3	40' North of Balboa Avenue, crack injection	3	LF					$70.00	$210
4	65' North of Balboa Avenue, crack injection	2	LF					$70.00	$140
5	89' North of Balboa Avenue, crack injection	4	LF					$70.00	$280
6	95' North of Balboa Avenue, crack injection	6	LF					$70.00	$420
7	113' North of Balboa Avenue, crack injection	8	LF					$70.00	$560
8	117' North of Balboa Avenue, sealant repair	6	LF					$25.00	$150
9	122' North of Balboa Avenue, crack injection	7	LF					$70.00	$490
10	145' North of Balboa Avenue, crack injection	4	LF					$70.00	$280
11	153' North of Balboa Avenue, crack injection	5	LF					$70.00	$350
12	173' North of Balboa Avenue, crack injection	22	LF					$70.00	$1,540
13	206' North of Balboa Avenue, crack injection	6	LF					$70.00	$420
14	222' North of Balboa Avenue, crack injection	2	LF					$70.00	$140
15	234' North of Balboa Avenue, sealant repair	6	LF					$25.00	$150
16	264' North of Balboa Avenue, crack injection	2	LF					$70.00	$140
17	257' North of Balboa Avenue, crack injection	2	LF					$70.00	$140
18	275' North of Balboa Avenue, crack injection	6	LF					$70.00	$420
19	264' North of Balboa Avenue, crack injection	2	LF					$70.00	$140
20	285' - 300' North of Balboa Avenue, crack injection	15	LF					$70.00	$1,050
21	333' North of Balboa Avenue, crack injection	5	LF					$70.00	$350
22	346' North of Balboa Avenue, crack injection	6	LF					$70.00	$420
23	352, North of Balboa Avenue, sealant repair	6	LF					$25.00	$150
24	347' North of Balboa Avenue, crack injection	1	LF					$70.00	$70
25	357' North of Balboa Avenue, crack injection	8	LF					$70.00	$560
26	372' North of Balboa Avenue, crack injection	3	LF					$70.00	$210
27	398' North of Balboa Avenue, crack injection	2	LF					$70.00	$140
28	414' North of Balboa Avenue, crack injection	4	LF					$70.00	$280
29	414' North of Balboa Avenue, crack injection	6	LF					$70.00	$420
30	439' North of Balboa Avenue, crack injection	3	LF					$70.00	$210
31	432' North of Balboa Avenue, crack injection	3	LF					$70.00	$210
32	445' North of Balboa Avenue, crack injection	6	LF					$70.00	$420
33	445' North of Balboa Avenue, crack injection	4	LF					$70.00	$280
34	469' North of Balboa Avenue, sealant repair	6	LF					$25.00	$150

Continued onto next page

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 6, 2005	REVISION:	
East Bay Front	ASSISTANT:			
Between Grand Canal East and Balboa Ave				

35	480' North of Balboa Avenue, crack injection	5	LF	$70.00	$350
36	485' - 505' North of Balboa Avenue, crack injection	20	LF	$70.00	$1,400
37	515' North of Balboa Avenue, crack injection	8	LF	$70.00	$560
38	527' North of Balboa Avenue, crack injection	8	LF	$70.00	$560
39	538' North of Balboa Avenue, crack injection	8	LF	$70.00	$560
40	551' North of Balboa Avenue, sealant repair	6	LF	$25.00	$150
41	557' North of Balboa Avenue, crack injection	6	LF	$70.00	$420
42	568' - 600' North of Balboa Avenue, crack injection	32	LF	$70.00	$2,240
43	620' North of Balboa Avenue, crack injection	5	LF	$70.00	$350
44	644' North of Balboa Avenue, crack injection	2	LF	$70.00	$140
45	668' North of Balboa Avenue, sealant repair	6	LF	$25.00	$150
46	678' North of Balboa Avenue, crack injection	4	LF	$70.00	$280
47	691' North of Balboa Avenue, crack injection	10	LF	$70.00	$700
48	703' North of Balboa Avenue, crack injection	4	LF	$70.00	$280
49	714' North of Balboa Avenue, crack injection	4	LF	$70.00	$280
50	725' North of Balboa Avenue, crack injection	11	LF	$70.00	$770
51	General, shrinkage cracks, minor through cap	400	LF	$70.00	$28,000

Subtotal		$48,500
Contingency	20 %	$9,700
Contractor OH & P	10 %	$4,850
City Cost Index	10 %	$4,850
GRAND TOTAL		$67,900

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:	
East Bay Front	ASSISTANT:			
Between Balboa Ave and Park Ave				

Item	Location	Description
1	12' North of Park Avenue	Waterside, crack at bottom of cap 96" long
2	23' North of Park Avenue	Waterside, mooring anchor insert, rusted
3	30' North of Park Avenue	Landside, lower step spalled 36" long x 12" high x 2" deep
4	30' North of Park Avenue	Waterside, crack at bottom of cap to construction joint
5	41' North of Park Avenue	Waterside, crack at bottom of cap to construction joint
6	53' North of Park Avenue	Waterside, crack at bottom of cap to construction joint
7	66' North of Park Avenue	Construction joint, sealant waterside and landside cracked and split
8	59' North of Park Avenue	Landside, crack at lower step 60" long
9	44' North of Park Avenue	Landside, crack at lower step 30" long
10	73' North of Park Avenue	Waterside, crack at bottom of cap 132" long
11	107' North of Park Avenue	Waterside, transverse wall, groin wall 288" long x 16" wide x 5" deep top of cap spalled.
12	120' North of Park Avenue	Waterside, crack at bottom of cap 84" long
13	109' North of Park Avenue	Waterside, vertical crack at corner 16" high
14	125' North of Park Avenue	Landside, vertical crack at drain lower step
15	138' North of Park Avenue	Waterside, crack at bottom of cap 48" long
16	138' North of Park Avenue	Waterside, mooring anchor insert, rusted
17	159' North of Park Avenue	Waterside, crack at bottom of cap 48" long
18	183' North of Park Avenue	Construction joint, sealant waterside and landside cracked and split
19	249' North of Park Avenue	Lightpole, waterside two transverse vertical cracks at either side of pole
20	249' North of Park Avenue	Lightpole, waterside one transverse vertical cracks at north side of pole
21	252' North of Park Avenue	Landside, hole in cap 2" wide x 1" high x 14" deep
22	299' North of Park Avenue	Construction joint, sealant waterside and landside cracked and split
23	364' North of Park Avenue	Waterside, crack at bottom of cap 60" long site of previous repair.
24	383' North of Park Avenue	Waterside, crack at bottom of cap 60" long site of previous repair.
25	405' North of Park Avenue	Pullbox, transverse crack through top of cap across pullbox
26	416' North of Park Avenue	Construction joint, sealant waterside and landside cracked and split
27	427' North of Park Avenue	Waterside, crack at bottom of cap 216" long
28	440' North of Park Avenue	Waterside, crack at bottom of cap above pile 48" long x 7" high x 2" wide
29	440' North of Park Avenue	Landside, crack at bottom of step 48" long
30	443' North of Park Avenue	Landside, top of cap transverse crack through cap
31	450'-488' North of Park Avenue	Waterside, crack at bottom of cap 456" long
32	473' North of Park Avenue	Landside, lower step cracked 18" long x 2" high x 6" wide
33	468' North of Park Avenue	Landside, lower step cracked 16" long x 2" high x 6" wide
34	492' North of Park Avenue	Landside, lower step spalled 60" long x 2" high x 6" wide

Continued onto next page

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR:	CTM	INSPECTION DATE: Jan 5, 2005	REVISION:
East Bay Front	ASSISTANT:			
Between Balboa Ave and Park Ave				

35	501' North of Park Avenue	Waterside, crack at bottom of cap 120" long, site of previous repair
36	518' North of Park Avenue	Landside, crack at bottom of step 60" long, site of previous repair
37	533' North of Park Avenue	Construction joint, sealant waterside and landside cracked and split
38	533' North of Park Avenue	Waterside, crack at bottom of cap 36" long south of construction joint
39	524' North of Park Avenue	Waterside, crack bottom of cap 60" long
40	General	Transverse cracks throughout length of cap spaced 2'-6' on center
41	General	Note: station 553' North of Park, centerline of Balboa Avenue

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:	
East Bay Front Between Balboa Ave and Park Ave	ASSISTANT:			

12 feet North of Park Avenue

23 feet North of Park Avenue

30 feet North of Park Avenue

30 feet North of Park Avenue

41 feet North of Park Avenue

44 feet North of Park Avenue

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 5, 2005	REVISION:

59 feet North of Park Avenue

66 feet North of Park Avenue

66 feet North of Park Avenue

73 feet North of Park Avenue

107 feet North of Park Avenue

107 feet North of Park Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 5, 2005	REVISION:

107 feet North of Park Avenue

109 feet North of Park Avenue

120 feet North of Park Avenue

125 feet North of Park Avenue

138 feet North of Park Avenue

159 feet North of Park Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 6, 2006	REVISION:

183 feet North of Park Avenue

183 feet North of Park Avenue

249 feet North of Park Avenue

249 feet North of Park Avenue

252 feet North of Park Avenue

299 feet North of Park Avenue

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:
East Bay Front Between Balboa Ave and Park Ave	ASSISTANT:		

299 feet North of Park Avenue

364 feet North of Park Avenue

383 feet North of Park Avenue

405 feet North of Park Avenue

405 feet North of Park Avenue

405 feet North of Park Avenue

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:
East Bay Front Between Balboa Ave and Park Ave	ASSISTANT:		

416 feet North of Park Avenue

416 feet North of Park Avenue

427 feet North of Park Avenue

440 feet North of Park Avenue

440 feet North of Park Avenue

443 feet North of Park Avenue

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture		
STREET LOCATION **East Bay Front** Between Balboa Ave and Park Ave	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 5, 2005	REVISION:

450 feet North of Park Avenue

462 feet North of Park Avenue

468 feet North of Park Avenue

473 feet North of Park Avenue

474 feet North of Park Avenue

485 feet North of Park Avenue

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:
East Bay Front Between Balboa Ave and Park Ave	ASSISTANT:		

492 feet North of Park Avenue

501 feet North of Park Avenue

518 feet North of Park Avenue

524 feet North of Park Avenue

533 feet North of Park Avenue

533 feet North of Park Avenue

ACTIVITY
Balboa Island Bulkhead Inspection

CASH & ASSOCIATES
Engineering and Architecture

STREET LOCATION
East Bay Front
Between Balboa Ave and Park Ave

INSPECTOR: CTM
ASSISTANT:

INSPECTION DATE: Jan 5, 2005

REVISION:

Item	Description	QUANTITY Number	QUANTITY Unit	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Unit Cost	LABOR COST Total	ENGINEERING ESTIMATE Unit Cost	ENGINEERING ESTIMATE Total
1	12' North of Park Avenue, crack injection	8	LF					$70.00	$560
2	23' North of Park Avenue, mooring anchor	1	EA					$25.00	$25
3	30' North of Park Avenue, crack injection	5	LF					$70.00	$350
4	30' -66' North of Park Avenue, crack injection	36	LF					$70.00	$2,520
5	44' North of Park Avenue, crack injection	3	LF					$70.00	$210
6	59' North of Park Avenue, spall repair	5	SF					$70.00	$350
7	66' North of Park Avenue, sealant repair	6	LF					$25.00	$150
8	73' North of Park Avenue, crack injection	11	LF					$70.00	$770
9	107' North of Park Avenue, spall repair	32	SF					$70.00	$2,240
10	109' North of Park Avenue, crack injection	2	LF					$70.00	$140
11	120' North of Park Avenue, crack injection	7	LF					$70.00	$490
12	125' North of Park Avenue, crack injection	3	LF					$70.00	$210
13	138' North of Park Avenue, crack injection	4	LF					$70.00	$280
14	138' North of Park Avenue, mooring anchor	1	EA					$25.00	$25
15	159' North of Park Avenue, crack injection	4	LF					$70.00	$280
16	183' North of Park Avenue, sealant repair	6	LF					$25.00	$150
17	249' North of Park Avenue, crack injection	6	LF					$70.00	$420
18	249' North of Park Avenue, crack injection	3	LF					$70.00	$210
19	252' North of Park Avenue, patch hole	1	LF					$70.00	$70
20	299' North of Park Avenue, sealant repair	6	LF					$70.00	$420
21	364' North of Park Avenue, crack injection	5	LF					$70.00	$350
22	383' North of Park Avenue, crack injection	5	LF					$70.00	$350
23	405' North of Park Avenue, crack injection	3	LF					$70.00	$210
24	416' North of Park Avenue, sealant repair	6	LF					$25.00	$150
25	427' North of Park Avenue, crack injection	18	LF					$70.00	$1,260
26	440' North of Park Avenue, crack injection	4	LF					$70.00	$280
27	440' North of Park Avenue, crack injection	4	LF					$70.00	$280
28	443' North of Park Avenue, crack injection	3	LF					$70.00	$210
29	450'-488' North of Park Avenue, crack injection	38	LF					$70.00	$2,660
30	473' North of Park Avenue, crack injection	2	LF					$70.00	$140
31	468' North of Park Avenue, crack injection	2	LF					$70.00	$140
32	492' North of Park Avenue, spall repair	3	SF					$70.00	$210
33	501' North of Park Avenue, crack injection	10	LF					$70.00	$700
34	518' North of Park Avenue, crack injection	5	LF					$70.00	$350

Continued onto next page

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:	
East Bay Front	ASSISTANT:			
Between Balboa Ave and Park Ave				

35	524' North of Park Avenue, crack injection				
36	533' North of Park Avenue, sealant repair	6	LF	$25.00	$150
37	533' North of Park Avenue, crack injection	3	LF	$70.00	$210
38	General, shrinkage cracks, minor	350	LF	$70.00	$24,500

Subtotal		$42,020
Contingency	20 %	$8,404
Contractor OH & P	10 %	$4,202
City Cost Index	10 %	$4,202
GRAND TOTAL		$58,828

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:	
East Bay Front	ASSISTANT:			
Between Park Ave and South Bay Front				

Item	Location	Description
1	0' North of South Bay Front	Waterside, pile cracked vertically, rust present
2	1' North of South Bay Front	Landside, cracking on lower inside step of cap 24" long
3	4' North of South Bay Front	Landside, crack through top of cap 12" long x 12" high x 1/32" wide
4	6' North of South Bay Front	Landside, crack through top of cap 12" long x 12" high x 1/32" wide
5	8' North of South Bay Front	Landside, lower corner of step damaged
6	8' North of South Bay Front	Landside, spall 24" long x 15" high rebar rust present
7	8' North of South Bay Front	Landside & waterside, cracking through cap
8	8' North of South Bay Front	Waterside, crack at bottom of cap
9	8' North of South Bay Front	Waterside, crack 12" long x 2" high x 10" wide
10	13' North of South Bay Front	Crack through top of cap
11	16' North of South Bay Front	Crack through top of cap
12	18' North of South Bay Front	Crack through top of cap
13	21' North of South Bay Front	Construction joint, sealant in good condition both sides
14	21' North of South Bay Front	Waterside, crack on south side of construction joint 24" long
15	21' North of South Bay Front	Landside, crack at inside corner of step 30" long
16	45' North of South Bay Front	Waterside, crack at bottom of cap over pile 24" long
17	56' North of South Bay Front	Waterside, crack at bottom of cap over pile, rust present 12" long
18	67' North of South Bay Front	Waterside, crack at bottom of cap 36" long previous repair cracked and potential for movement
19	80' North of South Bay Front	Construction joint, sealant landside and waterside cracked and split
20	80' North of South Bay Front	Waterside, crack at south side of construction joint, 36"
21	80' North of South Bay Front	Landside, ponding of water at sidewalk
22	80' North of South Bay Front	Landside, crack at inside corner of step 120" long south of const. joint (CJ), 252" long north of CJ
23	90' North of South Bay Front	Waterside, crack at bottom of cap over pile 54" long
24	102' North of South Bay Front	Waterside, crack at bottom of cap 48" long site of previous repair cracking
25	114' North of South Bay Front	Waterside, crack at bottom of cap 84" long rust present
26	117' North of South Bay Front	Landside, crack at lower step 120" long each side of station 117'
27	123' North of South Bay Front	Waterside, crack over pile 12" long previous repaired crack
28	134' North of South Bay Front	Waterside, crack at bottom of cap 72" long
29	147' North of South Bay Front	Waterside, crack and rust at bottom of cap 48" long, spall at bottom of cap 24"long x4"high x6"wide
30	158' North of South Bay Front	Waterside, cracking at bottom of cap over pile 18" long
31	170' North of South Bay Front	Waterside, crack at bottom of cap 84" long rust present
32	170' North of South Bay Front	Waterside, vertical crack at crack control joint
33	170' North of South Bay Front	Landside, cracking at bottom step through cap
34	185' North of South Bay Front	Waterside, crack at bottom of cap 72" long rust present from previous repair

Continued onto next page

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:	
East Bay Front Between Park Ave and South Bay Front	ASSISTANT:			

35	194' North of South Bay Front	Construction joint, sealant on landside and waterside cracked and split
36	240' North of South Bay Front	Waterside, vertical crack 12" high up from pile
37	253' North of South Bay Front	Waterside, crack at bottom of cap 84" long
38	300' North of South Bay Front	Pullbox, transverse crack through pullbox
39	303' North of South Bay Front	Waterside, crack at bottom of cap 48" long
40	311' North of South Bay Front	Construction joint, sealant on landside and waterside cracked and split
41	311' North of South Bay Front	Waterside, crack at bottom of cap 48" long
42	340' North of South Bay Front	Waterside, crack at bottom of cap 72" long
43	370' North of South Bay Front	Waterside, three mooring anchors spalled.
44	370' North of South Bay Front	Waterside, crack at bottom of cap 144" long
45	428' North of South Bay Front	Construction joint, sealant on landside and waterside cracked and split.
46	465' North of South Bay Front	Landside, spall and cracked lower step 72" long x 12" high x 12" deep
47	471' North of South Bay Front	Pullbox, transverse crack through pullbox
48	General	Transverse cracks throughout length of cap spaced 2'-6' on center

0 feet North of South Bay Front

1 foot North of South Bay Front

4 feet North of South Bay Front

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:
East Bay Front Between Park Ave and South Bay Front	ASSISTANT:		

4 feet North of South Bay Front

6 feet North of South Bay Front

8 feet North of South Bay Front

8 feet North of South Bay Front

8 feet North of South Bay Front

21 feet North of South Bay Front

ACTIVITY **Balboa Island Bulkhead Inspection**	CASH & ASSOCIATES Engineering and Architecture			CA
STREET LOCATION **East Bay Front** Between Park Ave and South Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 5, 2005	REVISION:	

21 feet North of South Bay Front

45 feet North of South Bay Front

56 feet North of South Bay Front

67 feet North of South Bay Front

80 feet North of South Bay Front

80 feet North of South Bay Front

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:
East Bay Front Between Park Ave and South Bay Front	ASSISTANT:		

80 feet North of South Bay Front

90 feet North of South Bay Front

102 feet North of South Bay Front

114 feet North of South Bay Front

117 feet North of South Bay Front

123 feet North of South Bay Front

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION **East Bay Front** Between Park Ave and South Bay Front	INSPECTOR: CTM ASSISTANT:	INSPECTION DATE: Jan 5, 2005	REVISION:	

134 feet North of South Bay Front

147 feet North of South Bay Front

158 feet North of South Bay Front

170 feet North of South Bay Front

170 feet North of South Bay Front

185 feet North of South Bay Front

ACTIVITY	CASH & ASSOCIATES			
Balboa Island Bulkhead Inspection	Engineering and Architecture			
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:	
East Bay Front Between Park Ave and South Bay Front	ASSISTANT:			

194 feet North of South Bay Front

194 fee North of South Bay Front

240 feet North of South Bay Front

253 feet North of South Bay Front

300 feet North of South Bay Front

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:
East Bay Front	ASSISTANT:		
Between Park Ave and South Bay Front			

300 feet North of South Bay Front

303 feet North of South Bay Front

311 feet North of South Bay Front

311 feet North of South Bay Front

340 feet North of South Bay Front

370 feet North of South Bay Front

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2006	REVISION:
East Bay Front	ASSISTANT:		
Between Park Ave and South Bay Front			

428 feet North of South Bay Front

428 feet North of South Bay Front

465 feet North of South Bay Front

471 feet North of South Bay Front

471 feet North of South Bay Front

471 feet North of South Bay Front

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:
East Bay Front	ASSISTANT:		
Between Park Ave and South Bay Front			

		QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
Item	Description	Number	Unit	Unit Cost	Total	Unit Cost	Total	Unit Cost	Total
1	0' North of South Bay Front, crack injection	2	LF					$70.00	$140
2	1' North of South Bay Front, crack injection	2	LF					$70.00	$140
3	4' North of South Bay Front, crack injection	3	LF					$70.00	$210
4	6' North of South Bay Front, crack injection	3	LF					$70.00	$210
5	8' North of South Bay Front, crack injection	1	LF					$70.00	$70
6	8' North of South Bay Front, crack injection	2	LF					$70.00	$140
7	8' North of South Bay Front, crack injection	3	LF					$70.00	$210
8	8' North of South Bay Front, crack injection	4	LF					$70.00	$280
9	8' North of South Bay Front, crack injection	1	LF					$70.00	$70
10	13' North of South Bay Front, crack injection	3	LF					$70.00	$210
11	16' North of South Bay Front, crack injection	3	LF					$70.00	$210
12	18' North of South Bay Front, crack injection	3	LF					$70.00	$210
14	21' North of South Bay Front, crack injection	2	LF					$70.00	$140
15	21' North of South Bay Front, crack injection	3	LF					$70.00	$210
16	45' North of South Bay Front, crack injection	2	LF					$70.00	$140
17	56' North of South Bay Front, crack injection	1	LF					$70.00	$70
18	67' North of South Bay Front, crack injection	3	LF					$70.00	$210
19	80' North of South Bay Front, sealant repair	6	LF					$25.00	$150
20	80' North of South Bay Front, crack injection	3	LF					$70.00	$210
22	80' North of South Bay Front, crack injection	31	LF					$70.00	$2,170
23	90' North of South Bay Front, crack injection	5	LF					$70.00	$350
24	102' North of South Bay Front, crack injection	4	LF					$70.00	$280
25	114' North of South Bay Front, crack injection	7	LF					$70.00	$490
26	117' North of South Bay Front, crack injection	20	LF					$70.00	$1,400
27	123' North of South Bay Front, crack injection	1	LF					$70.00	$70
28	134' North of South Bay Front, crack injection	6	LF					$70.00	$420
29	147' North of South Bay Front, crack injection	4	LF					$70.00	$280
29	147' North of South Bay Front, spall repair	2	SF					$70.00	$140
30	158' North of South Bay Front, crack injection	4	LF					$70.00	$280
31	170' North of South Bay Front, crack injection	7	LF					$70.00	$490
32	170' North of South Bay Front, crack injection	3	LF					$70.00	$210
33	170' North of South Bay Front, crack injection	5	LF					$70.00	$350
34	185' North of South Bay Front, crack injection	6	LF					$70.00	$420
35	194' North of South Bay Front, sealant repair	6	LF					$25.00	$150

Continued onto next page

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
STREET LOCATION	INSPECTOR: CTM	INSPECTION DATE: Jan 5, 2005	REVISION:
East Bay Front	ASSISTANT:		
Between Park Ave and South Bay Front			

36	240' North of South Bay Front, crack injection	1	LF	$70.00	$70
37	253' North of South Bay Front, crack injection	7	LF	$70.00	$490
38	300' North of South Bay Front, crack injection	3	LF	$70.00	$210
39	303' North of South Bay Front, crack injection	4	LF	$70.00	$280
40	311' North of South Bay Front, sealant repair	6	LF	$25.00	$150
41	311' North of South Bay Front, crack injection	4	LF	$70.00	$280
42	340' North of South Bay Front, crack injection	6	LF	$70.00	$420
43	370' North of South Bay Front, mooring spall	3	EA	$25.00	$75
44	370' North of South Bay Front, crack injection	12	LF	$70.00	$840
45	428' North of South Bay Front, sealant repair	6	LF	$25.00	$150
46	465' North of South Bay Front, spall repair	6	SF	$70.00	$420
47	471' North of South Bay Front, crack injection	3	LF	$70.00	$210
48	General, transverse shrinkage cracking, minor	100	LF	$70.00	$7,000

Subtotal		$21,325
Contingency	20 %	$4,265
Contractor OH & P	10 %	$2,133
City Cost Index	10 %	$2,133
GRAND TOTAL		$29,855

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

CA
CASH & ASSOCIATES ENGINEERING & ARCHITECTURE
(714)895-2012
HUNTINGTON BEACH, CA

Item	Location	Description
1	Grand Canal West at Park Avenue	Leaking through storm drain manhole cover, "whelling through holes"
2	East Bay Front 73 feet South of Grand Canal East	Leak through wall at base
3	East Bay Front 128 ft South of Grand Canal East	Construction joint leak
4	East Bay Front 245 ft South of Grand Canal East	Construction joint leak
5	East Bay Front 326 ft South of Grand Canal East	Construction joint leak and three feet North
6	East Bay Front 80 ft North of South Bay Front	Construction joint leak
7	East Bay Front 8 feet North of South Bay Front	Corner leak and electrical box leaking
8	South Bay Front 12 ft West of East Bay Front	Leaking at cap
9	South Bay Front 129 ft West of East Bay Front	Construction joint leak
10	South Bay Front 13 ft East of Jade	Piping through sidewalk at cap
11	South Bay Front 6 feet East of Jade	Construction joint leak
12	South Bay Front 93 feet East of Abalone	Construction joint leak
13	South Bay Front 48 feet East of Abalone	Piping through sidewalk at cap
14	South Bay Front 24 feet West of Apalone	Construction joint leak
15	South Bay Front 12 ft West of Grand Canal West	Piping through sidewalk at cap
16	South Bay Front 130 ft East of Marine	Leaking at cap
17	South Bay Front 107 feet West of Onyx	Construction joint leak
18	South Bay Front 31 feet West of Coral	Construction joint leak
19	South Bay Front 45 feet West of Sapphire	Construciton joint leak
20	South Bay Front 162 feet West of Sapphire	Construction joint leak
21	South Bay Front 175 feet West of Diamond	Construction joint leak
22	South Bay Front 75 feet West of Ruby	Construction joint leak
23	South Bay Front 16 feet East of Topaz	Construction joint leak
24	South Bay Front 131 feet West of Opal	Leakign through back of sidewalk at "Pilaties by the Sea"
25	South Bay Front 182 feet West of Opal	Construction joint leak and leaking from eletrical box
26	South Bay Front 93 feet West of Pearl	Construction joint leaking sediment present
27	South Bay Front 100 feet West of Garnet	Construction joint leaking at bottom
28	South Bay Front 190 feet West of Emerald	Piping through sidewalk at cap
29	South Bay Front 270 feet West of Emerald	Piping through sidewalk at cap
30	South Bay Front 376 feet West of Emerald	Piping through sidewalk at cap
31	South Bay Front 406 feet West of Emerald	Piping through sidewalk at cap
32	South Bay Front 444 feet West of Emerald	Piping through sidewalk at cap
33	South Bay Front 460 feet West of Emerald	Crack leaking at cap
34	South Bay Front 490 feet West of Emerald	Construction joint leaking + 20 feet east of Park Avenue leaking at construction joint and sidewalk
35	North Bay Front Collins Island Bridge abutments	Leakign on north side of bridge abutments
36	North Bay Front 90 feet East of Park	Construction joint leaking

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

37	North Bay Front 209 feet East of Park	Construction joint at sidewalk leaking

Grand Canal West at Park Avenue

Grand Canal West at Park Avenue

East Bay Front, 73 feet South of Grand Canal

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

East Bay Front, 128 feet South of Grand Canal

East Bay Front, 245 feet South of Grand

East Bay Front, 326 feet South of Grand Canal

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

East Bay Front, 80 feet North of South Bay Front

East Bay Front, at South Bay Front

East Bay Front, at South Bay Front

East Bay Front, at South Bay Front

East Bay Front, 20 ft North of South Bay

South Bay Front, 12 feet West of East Bay Front .

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

South Bay Front, 129 feet West of East Bay Front

South Bay Front, 13 feet East of Jade

South Bay Front, 13 feet East of Jade

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

South Bay Front, 6 feet East of Jade

South Bay Front, 93 feet East of Abalone

South Bay Front, 48 feet East of Abalone

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

South Bay Front, 12 feet West of Grand Canal

South Bay Front, 130 feet East of Marine

South Bay Front, 107 feet West of Onyx

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

South Bay Front, 31 feet West of Coral

South Bay Front, 45 feet West of Sapphire

South Bay Front, 162 feet West of Sapphire

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2006	REVISION:

South Bay Front, 175 feet West of Diamond

South Bay Front, 75 feet West of Ruby

South Bay Front, 131 feet West of Opal

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

South Bay Front, 131 feet West of Opal

South Bay Front, 182 feet West of Opal

South Bay Front, 93 feet West of Pearl

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

South Bay Front, 17 feet East of Garnet

South Bay Front, 100 feet West of Garnet

South Bay Front, 190 feet West of Emerald

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

South Bay Front, 270 feet West of Emerald

South Bay Front, 376 feet West of Emerald

South Bay Front, 406 feet West of Emerald

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

South Bay Front, 444 feet West of Emerald

South Bay Front, 450 feet West of Emerald

South Bay Front, 460 feet West of Emerald

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

South Bay Front, 460 feet West of Emerald

North Bay Front, 8 feet East of Park

North Bay Front, 8 feet East of Park

North Bay Front, 90 feet East of Park

North Bay Front, 209 feet East of Park

North Bay Front, 209 feet East of Park

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection	Engineering and Architecture		
Seawall leaks during extreme high tide			
STREET LOCATION	INSPECTOR:	INSPECTION DATE: January 10, 2005	REVISION:
See Below	ASSISTANT:		

CASH & ASSOCIATES ENGINEERING & ARCHITECTURE (714)895-2072 HUNTINGTON BEACH, CA

		QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
Item	Description	Number	Unit	Unit Cost	Total	Unit Cost	Total	Unit Cost	Total
1	Grand Canal West at Park Avenue								
2	East Bay Front 73 feet South of Grand Canal East								
3	East Bay Front 128 ft South of Grand Canal East								
4	East Bay Front 245 ft South of Grand Canal East								
5	East Bay Front 326 ft South of Grand Canal East								
6	East Bay Front 80 ft North of South Bay Front								
7	East Bay Front 8 feet North of South Bay Front								
8	South Bay Front 12 ft West of East Bay Front								
9	South Bay Front 129 ft West of East Bay Front								
10	South Bay Front 13 ft East of Jade								
11	South Bay Front 6 feet East of Jade								
12	South Bay Front 93 feet East of Abalone								
13	South Bay Front 48 feet East of Abalone								
14	South Bay Front 24 feet West of Apalone								
15	South Bay Front 12 ft West of Grand Canal West								
16	South Bay Front 130 ft East of Marine								
17	South Bay Front 107 feet West of Onyx								
18	South Bay Front 31 feet West of Coral								
19	South Bay Front 45 feet West of Sapphire								
20	South Bay Front 162 feet West of Sapphire								
21	South Bay Front 175 feet West of Diamond								
22	South Bay Front 75 feet West of Ruby								
23	South Bay Front 16 feet East of Topaz								
24	South Bay Front 131 feet West of Opal								
25	South Bay Front 182 feet West of Opal								
26	South Bay Front 93 feet West of Pearl								
27	South Bay Front 100 feet West of Garnet								
28	South Bay Front 190 feet West of Emerald								
29	South Bay Front 270 feet West of Emerald								
30	South Bay Front 376 feet West of Emerald								
31	South Bay Front 406 feet West of Emerald								
32	South Bay Front 444 feet West of Emerald								
33	South Bay Front 460 feet West of Emerald								
34	South Bay Front 490 feet West of Emerald								
35	North Bay Front Collins Island Bridge abutments								
36	North Bay Front 90 feet East of Park								

ACTIVITY	CASH & ASSOCIATES		
Balboa Island Bulkhead Inspection Seawall leaks during extreme high tide	Engineering and Architecture		
STREET LOCATION **See Below**	INSPECTOR: ASSISTANT:	INSPECTION DATE: January 10, 2005	REVISION:

CASH & ASSOCIATES ENGINEERING & ARCHITECTURE
(714)895-3072
HUNTINGTON BEACH, CA

37 North Bay Front 209 feet East of Park

Subtotal		
Contingency	10 %	
Contractor OH & P	10 %	
City Cost Index	10 %	
GRAND TOTAL		

SECTION V. APPENDIX

5.0 Reference Drawings

1. "City of Newport Beach Public Works Department; Balboa Island Bulkhead Repair Near Waters Way", Contract 2525, Drawing Number H-5111-S Sheet 1 through 5. September 15, 1987.

2. "City of Newport Beach, Plan 400 for the Improvement of South Bay Front, North Bay Front, East Bay Front and the East and West Promenades of Grand Canal." Drawing Numbers R-5457-S, Sheets 1 through 12. September 30, 1935.

3. "City of Newport Beach, Plan 359 for the Improvement of Certain Portions of East Promenade and West Promenade of the Grand Canal South Bay Front and North Bay Front in Sections 4 and 5 of Balboa Island in the City of Newport Beach." Drawing Numbers R-5456-S, Sheets 1 through 3. April, 1929.

4. "Plans for Concrete Sheet Pile Bulkhead and Concrete Bridge Tract No 1723 Collins Isle." Drawing Numbers R-4665-S, Sheets 1 through 5. March 30, 1953.

5.1 Repair Methods

5.1.1 Crack Injection

Crack injection should be used on cracks up to 1/4-inch or less in width. High strength epoxy resin adhesive should be used for injection into the cracks. Epoxy injection adhesive shall be by Master Builders Technologies, or an approved equal.

The following are the recommended products and an overview of the work.

1. Clean cracks by blowing with compressed air and removing any loose debris.

2. Create ports along the surface of the crack to allow for maximum penetration of the epoxy resin.

3. Place surface seal (*Master Builders Concresive 1490, Page 65, Master Builders Product Catalog*) along the length of the crack and around ports. The surface seal will keep the injection epoxy contained within the crack during the injection process.

4. Inject the Master Builders Concresive Standard LVI (*Page 70, Master Builders Product Catalog*) into the crack. Begin at one end of the crack and allow epoxy to travel port to port to ensure complete penetration of the epoxy resin. Concresive Standard LVI conforms to ASTM C 881, Type 4, the ASTM designation for structural crack repair, re-bonding of cracked concrete.

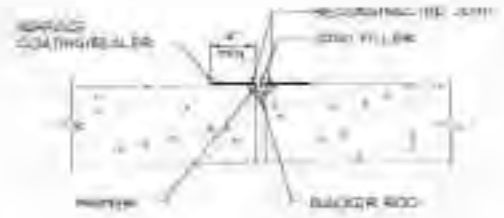
5. After the injection process is complete remove surface seal, ports, epoxy drips, etc.

CRACKS- TYPE C: PRESSURE INJECTION

CRACKS-TYPE C: PRESSURE INJECTION

5.1.2 Sealant Repair

Sealant repair should be used on construction and crack control joints where the existing sealant is cracked and split. The old sealant shall be removed and the backing material between the joined surfaces shall be replaced as necessary. New sealant shall be polyurethane based weather resistant sealant designed to be water tight against a hydrostatic head pressure and flexible over the life of the bulkhead. Master Builders Sonneborn NP 1 or equal



JOINTS-TYPE JL SUBSTRATE FAILURE

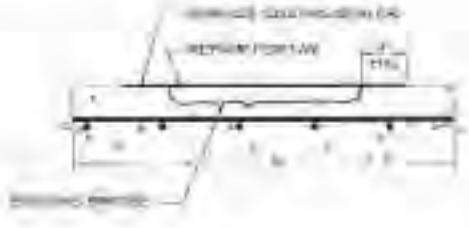
5.1.3 Spall Repair

The choice of patching material will depend on the placement method chosen. Enclosed is a suggested specification that will cover both placement methods. It is safe to assume that two (2) application methods will be necessary:

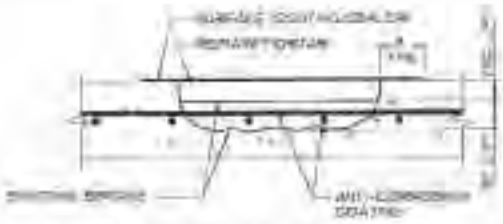
1. Hand Patch on Vertical and Overhead Surfaces. Emaco S-88 Cl (*Page 83, Master Builders Product Catalog).* The advantages are that this material is very low permeability, is resistant to chlorides, is high strength, has excellent bond strengths, and has a similar modulus of elasticity to the host concrete. It will therefore share in carrying the structural load.

2. Form and Pour on Overhead and Vertical Surfaces, or Spalls on Horizontal Surfaces. Masterpatch 240 CR (*Page 88, Master Builders Product Catalog).* This material also has excellent bond strengths, very low permeability, resistant to chlorides, high slump allows for good pumpability and fast placement.

All spall repairs shall be prepared in accordance with International Concrete Repair Institute's "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion" (Guideline No. 03730.).



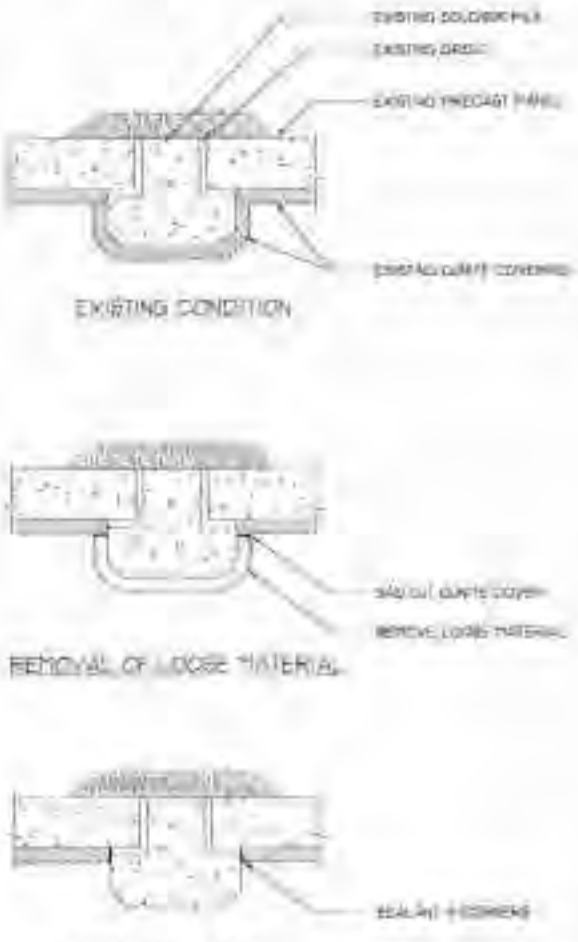
SPALLS TYPE S1 MODERATE



SPALLS-TYPE S2, SEVERE

5.1.4 Shotcrete Repair

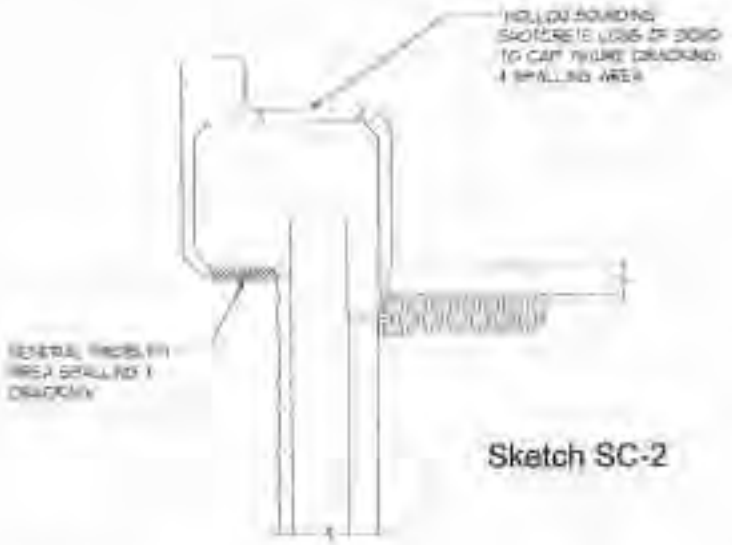
The repair of shotcrete along the Grand Canal shall incorporate the methods described above. In addition, soundings of the wall shall be used to determine if the shotcrete remaining on the bulkhead is bonded to the base material (concrete bulkhead) or if the shotcrete is loose and not bonded to the base material. If the shotcrete is bonded to the base material then crack injection can be used to seal the cracks present. Otherwise, if the shotcrete is not bonded to the base material then all the loose material must be removed as shown in the figure below. The edges of the sound shotcrete must be made neat by saw cutting the shotcrete with a diamond concrete saw and then sealant applied at the interface between the shotcrete and the base material. This sealant will prevent water from intruding behind the shotcrete and causing further delamination of the shotcrete from the base material.



Sketch SC-1

5.1.4.1 Shotcrete Repair, Bulkhead Cap

The Grand Canal bulkhead cap has additional problems associated with it. Hollow sounds were detected during the investigation along the top of the cap. These hollow sounds are due to the concrete cover delaminating from the base material. Outwardly, these areas might not show any signs of failure or perhaps a longitudinal crack along the top of the cap. However, these areas pose the greatest potential for spalling and loss of material. There are several methods of repair for this situation. The first is to take a wait and see approach to the hollow areas. The second approach is to remove the spalled area and replace the material with new concrete. The last approach is to use the crack injection method to bond the exterior shell of the shotcrete to the base material.



Sketch SC-2

5.1.4.2 Shortcrete Repair, Underside of Bulkhead Cap

This general problem area is located under the cap along the Grand Canal. This area is particularly problematic due in part to the overhead placement of the shotcrete, lack of mechanical bonding between the base material and the shotcrete and its proximity to tidal and splash zone. The shotcrete is cracked, spalled and loose should be removed and new material placed per the spall repair section 5.1.3 above.

5.2 Options for Corrosion Protection and Other Considerations

5.2.1 Bonding Agents

Master Builders products do not require any additional bonding agent. For all applications, the most important determinant of bond strength is proper surface preparation. Please see product data sheets for surface preparation considerations. For hand patch or form and pour applications, a scrub coat of the repair material is used.

1. Separate Bonding Agents and Additional Reinforcing Steel Protection. Patching materials by Master Builders offer excellent protection from future reinforcing steel corrosion due to the low permeability and feature an integral corrosion inhibitor. If an additional layer of reinforcing steel protection is desired, Emaco, Page 24 (*Page 76, Master Builders Product Catalog*) can be directly applied to the cleaned surface of the reinforcing steel. This product can also double as a bonding agent.

2. Additional Reinforcing Steel Protection. An additional protection step that can be considered is the use of Emaco Corr-Stops CI (*Page 74, Master Builders Product Catalog*). This product is a galvanic zinc core inside an active proprietary cementitious shell. The anode is easily attached to the rebar using the tie wires. After full installation of the repair, the sacrificial zinc core absorbs corrosion from the surrounding rebar, protecting it from accelerated corrosion. This would probably only be applicable to larger spalls being repaired via the "Form and Pour" method.

5.2.2 Coating of High Voltage Boxes

The rust can be cleaned from the surface and then it can be coated with ThoRoc Zincrich Primer (*Page 6, ThoRoc Product Catalog*).

Appendix 4

URS (2010/2011)

ASSESSMENT OF SEAWALL STRUCTURAL INTEGRITY AND POTENTIAL FOR SEAWALL OVER-TOPPING

for Balboa Island and Little Balboa Island

APPENDICES

Prepared for
City of Newport Beach

Prepared by
Everest International Consultants, Inc.

In association with
Flow Simulation, LLC
URS Corporation

April 21, 2011

EVEREST

ASSESSMENT OF SEAWALL STRUCTURAL INTEGRITY AND POTENTIAL FOR SEAWALL OVER-TOPPING FOR BALBOA ISLAND AND LITTLE BALBOA ISLAND

APPENDICES

Submitted to

City of Newport Beach
Public Works Department
3300 Newport Boulevard
Newport Beach, CA 92663

Contact: Robert Stein, Assistant City Engineer

Submitted by

Everest International Consultants, Inc.
444 West Ocean Boulevard, Suite 1104
Long Beach, California 90802

Contact: Ying-Keung Poon, Project Manager

In association with

Flow Simulation, LLC
5 Twain Street
Irvine, CA 92617

and

URS Corporation
5772 Bolsa Avenue, Suite 100
Huntington Beach, CA 92649

April 21, 2011

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APPENDIX C

BALBOA ISLAND SEAWALLS CONDITION ASSESSMENT STUDY AND REPORT

April 4, 2010

City of Newport Beach
Department of Public Works
3333 Newport Boulevard
Newport Beach, CA 92663

Attention: Mr. Robert Stein

CONDITION ASSESSMENT STUDY AND REPORT
BALBOA ISLAND SEAWALLS
CITY OF NEWPORT BEACH, CALIFORNIA
(URS Reference: 30990248)

Dear Mr. Stein:

URS Corporation (URS) and Everest International Consultants, Inc. (Everest) are pleased to present this draft condition assessment study and report of the Balboa Island seawalls in Newport Beach, California, as commissioned by the City of Newport Beach in the project scope of work (SOW). The purpose of the study was to assess the current structural condition and remaining lifespan of the seawalls and their ability to withstand existing tidal and surge events and future projections of sea level rise. Additionally, concepts for seawall repair and/or replacement and the implementation and phasing of said concepts were to be developed.

EXECUTIVE SUMMARY

Balboa Island (the Island) was formed by building up a Newport Bay sand bar and tidal marsh in the early 20th Century. Since its inception the Island has been plagued by flooding, which forced initial investors and residents to construct a mix of concrete and timber seawalls along the waterfront. In exchange for property taxes from Balboa Island property owners, the City of Newport Beach (City) took the first steps of constructing a proper seawall by designing and building a concrete seawall along much of the Grand Canal in 1929. This culminated in the design of a seawall in 1935 for the remainder of the Island with construction following in 1938 as part of the National Recovery Act.

These seawalls now are between 73 and 82 years of age which is within their predicted useful life of 75 to 100 years. The predicted useful life is based on original design criteria such as rebar type and concrete strength, exposed wall height, and existing condition. A study performed by Cash & Associates (now part of URS) in 1985 revealed that many of the tie-rods, which provide structural stability by connecting the seawall to deadman approximately 8 feet landward of the seawall's outside

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face, were either severely corroded or completely severed. The City constructed rock revetments to improve the integrity of the seawall toe in the worst affected locations. A subsequent study performed by Cash & Associates in 2005 detailed extensive distress in the seawall including cracking and spalling. As discussed in this report, the City appears to have repaired most of the distress noted in the 2005 Report. However, the visual survey conducted to develop the recommendations presented in this report revealed extensive new cracking in the seawall cap as well as de-laminations and voids which are signs of future spalls. To our knowledge soldier piles, concrete panels, and tie-rods remain in their existing condition and have not been repaired or replaced since original construction.

Data associated with the seawall including design details from record documents, existing obstructions and openings (such as private docks, lampposts, and storm drain outlets) have been entered into a spreadsheet database. As part of a future program, this spreadsheet is intended for migration to a database system to facilitate ease of data entry and retrieval. The goal is for this system to expand City-wide to allow the City and its consultants to develop a seawall survey, repair and maintenance, extension, and replacement program.

The measurements taken of the Balboa Island seawalls as part of this report revealed that the top of wall elevations range in height between 7.7 and 9.3 feet NAVD88 (7.88 and 9.48 feet mean lower low water, MLLW, relative to National Tidal Datum Epoch 1983 – 2001) compared to typical Southern California seawall elevations of between 8.8 and 9.8 feet NAVD88 (9.0 and 10.0 feet MLLW NTDE 83-01). A representative sample of sidewalk and residential finish floor elevations along the seawall boardwalk and through the interior of both Big Balboa and Little Balboa islands show all sidewalks and most residences to be below 9.0 feet NAVD88 (9.18 feet MLLW NTDE 83-01). In December 2009, the City of Newport Beach adopted the Base Flood Elevation of 9.0 feet NAVD88 as issued by the Federal Emergency Management Agency (FEMA) for Balboa Island for future construction. Therefore, much of the seawall and most of the Island are below the current Base Flood Elevation.

According to the predicted values for interval years 2025, 2050, and 2100, the likelihood and severity of flooding on the Island will increase over the next 90 years through 2100. FlowSimulation, LLC, using a published U.S. Army Corps of Engineers (USACE) sea level rise equation, developed a model to predict values for mean sea level and highest extreme tide. By 2100, the mean sea level is anticipated to be 7.2 feet NAVD88 and the highest extreme tide (1% of occurrence in a given year) is predicted to be 12.3 feet NAVD88. Values for other interval years are reproduced in Table 1 of this report.

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Given the remaining useful life and the existing condition of the Balboa Island seawalls, existing seawall and Island elevations, and rising sea level predictions, it is our opinion that performing significant retrofits of the seawall, such as reconstructing the cap or installing earth anchors, is a questionable use of public funds. The focus of efforts on the Balboa Island seawalls should be seawall maintenance and development of solutions to intermittent flooding in the short-term, replacement of the seawalls in the near-term, and development of long-term solutions to sea level rise.

URS recommends the City of Newport Beach establish the following long-range program for the Balboa Island seawalls:

Phase 1: Short-term augmentation of the seawall by 6 to 8 inches.

Phase 2: Near-term replacement of the existing publicly-owned Balboa Island seawalls between 10 to 25 years of baseline year 2010. This initial stage will consist of a seawall constructed to 9.82 feet NAVD88 (10.0 feet MLLW NTDE 83-01), which would place the new wall 0.8 foot above the current Base Flood Elevation height of 9.0 feet NAVD88 (9.18 feet MLLW NTDE 83-01) for Balboa Island.

Phase 3: When necessary, extend the seawall by an additional several feet up to an elevation of 14.0 feet NAVD88 (14.18 feet MLLW NTDE 83-01) within 40 to 50 years from baseline year 2010, or as required by rising sea levels.

Phase 4: When necessary, construct a deep well groundwater dewatering system to protect the Island from subsequent high water tables associated with highest extreme tides. If sea levels rise as predicted, then dewatering will be required between 40 to 50 years of baseline year 2010.

Phase 5: Establish appropriate minimum lowest floor elevation in accordance with the federal Base Flood Elevation (BFE). The City of Newport Beach must continue to adhere to this requirement since Balboa Island is in a Flood Insurance Rate Map (FIRM) Zone A, which is considered a Special Flood Hazard Area. If sea levels rise as predicted by the current USACE equation, then the BFE may be higher in year 2100 compared to current BFE = 9.0 feet NAVD88 (9.18 feet MLLW NTDE 83-01) in baseline year 2010. Implementation of alternate long-term solutions also may be required.

Phases 1 and 2 are needed, regardless of sea level rise predictions due to existing flooding issues and seawall conditions. Phases 3 and 4 are based on predictions of sea level rise and, based on the

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incremental approach presented in this report, may be implemented at a later date when the forecast timeline is shorter and scientific and political consensus is reached. Phase 5 is based on implementation of Federal Emergency Management Agency minimum design standards.

The initial cost of Phase 1 is anticipated to be $1.72 (geotextile tubes) and $9.57 million (seawall cap replacement) over 20 years depending on the option chosen. The cost of designing and constructing a replacement seawall for implementation in Phase 2 is estimated to be between $50.2 and $56.8 million depending on the type of wall constructed. Two options are provided in the report. The estimated cost of extending the new seawall several feet up to an elevation of 14.0 feet NAVD88 (14.18 feet MLLW NTDE 83-01) is between $5.3 and $6.6 million. The cost of measures associated with installation of deep groundwater dewatering wells and pump stations cannot be determined at this time since the number of wells and pump stations are dependent on a through geotechnical report and soil permeability testing program. Without the cost for deep well groundwater dewatering, the total program cost (including Ferry Boat Landing and bridge retrofit) is estimated to be between $61.5 and $79.0 million. All values are in 1st quarter 2011 dollars.

The City of Newport Beach also should develop and implement a community awareness program. Holding discussions and information and design sessions engages the community and increases the understanding of obstacles and sacrifices that lie ahead in order to protect the City's vital assets.

If you have any questions or comments concerning this report, please contact URS at (714) 895-2072.

Sincerely,

URS Corporation

Fred Massabki, P.E. (No. C70423)
Senior Engineer

Randy H. Mason, P.E. (No. C30066)
Vice President, Ports & Maritime

Encl/ Report including Figures and Appendices
cc/ Everest International Consultants, Inc.

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URS

CONDITION ASSESSMENT STUDY AND REPORT: BALBOA ISLAND SEAWALLS

CITY OF NEWPORT BEACH, CALIFORNIA

(URS Reference: 30990248)

TABLE OF CONTENTS

1. Introduction

1.1 History

Balboa Island (the Island), which is composed of two islands (Big Balboa Island and Little Balboa Island) separated by the Grand Canal, was built by William S. Collins, who bought the land from James McFadden, in the first decade of the 1900's. It was originally a sandbar and marsh that was constructed into an island using dredge materials from the main channel work performed in Newport Harbor between 1906 and 1909. From its inception, Balboa Island was plagued by flooding problems during high tides. This culminated in the construction of a short wooden seawall in 1910 and its concrete replacement in 1916 along the southern beach of the Island. This wall did not alleviate the flooding problem and along with issues with existing utility services led to an exodus of residents, foreclosures, and the eventual financial collapse of Collins' venture.

Two years after Balboa Island's annexation by the City of Newport Beach (City) in 1916, the remaining residents organized in the form of the Balboa Island Improvement Association (BIIA) to lobby the City for construction of the utility services and infrastructure in return for their new levied property taxes. Installation of these services, including sewers and storm drains, drove up property values resulting in a renewed demand for seawalls. Various walls, including a concrete structure which replaced a previous wooden bulkhead along 2/3 of the Grand Canal, were constructed prior to the Great Depression. This structure, which was designed and built in 1929, remains in place today and is now 81 years old. A seawall around the rest of Balboa Island was designed in 1935 and built in 1938 as part of the federal government's National Recovery Act. This seawall is now approaching 75 years of age.

Collins started a ferry service, as part of his grand venture, to connect the Island with Balboa village (now part of Newport Beach). The ferry operation ceased operations when the Balboa Island venture failed. The City of Newport Beach acquired the rights to the ferry service when it annexed Balboa Island. In 1919, Joseph Allan Beek was awarded a contract to revive the defunct Balboa Island ferry service from the City of Newport Beach. The ferry service is still operated by this family to this day. The support building, which still bears the J.A. Beek name, has been in use since its construction in the early 1930's.

1.2 Background

Under normal present day conditions, flooding still occurs on Balboa Island during extreme high tide events and under storm/ocean swell conditions. The Island residents and the City have employed numerous techniques to mitigate the impact of the flooding. Projects initiated by the City include 1) reconstruction of the waterfront boardwalk to facilitate the flow of surface runoff water away from private property, 2) installation of a storm water collection system along the seawall, 3) installation of gate valves in the storm drain outlets at street ends, 4) maintenance of the seawalls to repair cracks and spalls and to seal leaking joints, and 5) mobilization of Department of Public Works (Public Works) crews to operate the aforementioned gate valves and to deploy mobile storm water pumps during

potential flooding conditions. Various improvements to mitigate flood conditions performed by some residents include: 1) construction of solid walls made of concrete or sealed concrete masonry units (CMU) around their properties 2) sealing openings, such as entry gates, in said walls with "sluice flood gates" under adverse conditions, 3) deployment of sand bags under adverse conditions, and/or 4) construction of new homes with higher finish floor elevations that meet or exceed federal base flood elevation requirements.

1.3 Scope of Work and Report Limitations

This report, the purpose of which was to assess the current structural condition and remaining lifespan of the Balboa Island seawall and its ability to withstand existing tidal and swell events and future projections of sea level rise, is a component of the Balboa Seawall Assessment and Overtopping Study. This report's Scope of Work (SOW) was not intended to include a detailed survey of individual distresses in the seawall, but rather to highlight general conditions for the purpose of determining remaining useful life of the seawall and repair/replacement options. The database included in this report and used as one component in the classification of the condition of the wall is designed to be an all-encompassing system that can be expanded for other waterfront areas in Newport Beach. As previously noted, it is not populated with every distress, obstruction, or opening that can be found along the existing Balboa Island seawall. Finally, the proposed solutions and their associated costs are conceptual in nature and are presented to begin the development process for future action by City officials. Complete and detailed drawings, specifications, cost estimates, and permits are required before implementing any of the proposed recommendations.

1.4 Vertical Datums and Base Flood Elevation

All elevation measurements were performed using the geodetic 1988 North American Vertical Datum (NAVD88). However, most maritime elevations in Southern California use the mean lower low water (MLLW) datum. The National Oceanic and Atmospheric Administration (NOAA) is responsible for developing the various vertical (elevation) datums that are used by the public. NAVD88 was computed by NOAA's National Geodetic Survey (NGS) to refine the previous datum known as National Geodetic Vertical Datum 1929 (NGVD29). NGVD29, also referred to as the Sea Level Datum of 1929, is geodetic survey based on an average of sea levels from 26 tide gauge locations throughout the United States and Canada, while NAVD88 is a gravity-based geodetic survey in which all elevations are fixed to a single point in Quebec, Canada.

MLLW, which is developed by NOAA's National Ocean Service (NGS), is fixed locally (e.g., that MLLW in Newport Harbor is different than MLLW in San Francisco Bay or MLLW in Boston Harbor). Since MLLW is a tidal datum, it is based on the most current National Tidal Datum Epoch (NTDE, i.e. a recent 19-year period over which tide data is collected and computed to determine average values used for tidal datums). A 19-year period is used because this relates to the length of a lunar cycle, and the moon is the primary gravitational influence on tide height. Tides on the west coast of the United States have a diurnal pattern, or two high tides and two low tides per day. The lower of the two daily low tides is used to calculate MLLW. As sea levels change, so do the elevations of the high and low tides relative to a geodetic datum such as NAVD88. Therefore, MLLW is a "relative"

datum, and it can change with each NTDE. For example, the current NTDE (1983 to 2001) has a MLLW datum that is 0.2 feet higher than the previous NTDE (1960 to 1978) for Newport Harbor.

NAVD88 is used as the primary datum for this report since it does not change over time or from city to city. For conversion purposes, 0.0 feet NAVD88 is equal to -0.18 feet MLLW under the most recent 1983 – 2001 NTDE. Therefore, add 0.18 feet to the NAVD88 elevations presented herein to determine the MLLW-equivalent elevations in the baseline year of 2010.

The Federal Emergency Management Agency (FEMA) develops Flood Insurance Rate Maps (FIRMs) to determine the Base Flood Elevation (BFE) in an area and set flood insurance rates accordingly. Balboa Island is in a Special Flood Hazard Area (SFHA) called Zone A, which means the general land elevation is below the BFE. Per FEMA, the lowest floor elevation of structures in an SFHA must be above the BFE. The lowest floor is defined by FEMA as the lowest floor of an enclosed space including the basement area. This requirement is usually applied only to habitable space, so flood-resistant or unfinished areas used for parking, storage, or building access are typically exempted. For Balboa Island, the BFE is 9.0 feet NAVD88 (9.18 feet MLLW NTDE 83-01). On December 3, 2009, the City of Newport Beach adopted this BFE as the minimum top of slab elevation for habitable space for new construction on Balboa Island.

Figure 1 shows how Balboa Island's Base Flood Elevation compares to the NAVD88 and to the Mean Lower Low Water (MLLW) datum.

2. Record Document Review

2.1 Record Drawings

Design drawings from 1929 and 1935 were reviewed. The site plans in these drawings have been stitched together to produce a single sheet showing the entire Island as provided in Figure 2. Cross sections of the two seawalls showing the major components in their construction are shown on Figure 2. Drawings show that in 1929 over 60% of the walls along the Grand Canal, as well as the returns along the north beach of Big Balboa Island (Big Balboa, or Main Island) and the south beaches of both Big Balboa and Little Balboa Island (Little Balboa, or Little Island), were replaced. These walls used a concrete soldier pile and concrete panel design in which soldier piles were driven to a depth of approximately -3.0 feet mean lower low water (MLLW) along the length of the Grand Canal and to approximately -8.0 feet MLLW at the corners as measured in 1929 and in accordance with City of Newport Beach Drawing No. STD-115-L (see Attachment I). Concrete wall panels spanned between the soldier piles as illustrated in Attachment II. This particular wall relies on tie-backs comprised of 1-inch-diameter steel tie-rods attached to 9-foot-long by 10-inch-diameter timber pile deadmen (approximately 8.0 to 8.5 feet back from the face of the outside seawall) and a structural cap to counteract the overturning moment. The tie-rods are shown to be placed at every other soldier pile at 22 feet on-center. This wall is now 82 years old and is approaching the end of its useful service life as discussed in Section 4 – Predicted Lifespan and Remaining Useful Life of Existing Seawalls.

Although the design drawings for the remaining and majority of the seawalls around Balboa Island were dated 1935, construction was not performed until 1938 as part of the National Recovery Act. As shown on the drawings (see Attachment III), these seawalls replaced older substandard walls and tied into the existing seawalls along the Grand Canal and along a 500-foot-long section on the western tip of Big Balboa. The new seawalls, as designed and constructed, used a concrete soldier pile and concrete panel design similar to the seawalls built along the Grand Canal in 1929. Soldier piles were driven to a depth of approximately -5.0 feet MLLW as measured in 1938 and in accordance with City of Newport Beach Drawing No. STD-115-L. However, the new design placed a tie-back at each soldier pile at 11.67 feet on-center, and according to the design, these tie-backs provide all the resistance to counteract overturning. These tie-backs are comprised of 1-1/4-inch-diameter steel tie-rods attached to 10-foot-long by 12-inch-diameter timber pile deadmen (approximately 8.0 to 8.5 feet back from the face of the outside seawall). The cap does not have a structural connection to the solider piles or to the concrete panels and relates to an architectural finish to the seawall structure. Since extending the cap is one of the major considerations to be assessed to mitigate flooding, the fact that there is either no or a substandard connection between the cap and the wall below for the majority of the Balboa Seawall is considered significant. Furthermore, this wall is now approximately 73 years of age and is approaching the end of its lifespan range as well.

The exact year of construction of the aforementioned 500-foot-long section at the western end of Big Balboa is unknown. It is assumed that construction predates the 1935 seawall design drawings since the cap of this 500-foot-long seawall was slated to be replaced in said drawings. The 500-foot-long section of wall on the west end of Big Balboa is a sheet pile design similar to the wall surrounding Collins Island and is assumed to have been constructed in the late 1920's or early 1930's. This design consists of interconnecting vertical concrete sheet piles and a structural concrete cap with tie-backs extending some distance behind the seawall. This section of seawall was upgraded with a rock revetment as a result of the findings in a 1985 report discussed later in this section.

Both sets of drawings show "square" symbols next to the rebar dimensions indicating that the rebar used was of the square, dimpled type, as opposed to deformed round bars currently used in modern construction. The concrete edge distances are shown as 1.5, 2.0, or 2.5 inches for various locations of the structural elements, compared to a modern standard of 3.0 inches for construction in the marine environment. Furthermore, neither drawing construction notes nor specifications were available identifying concrete and/or rebar material type and strength. Based on common practice of design and construction in the late 1920's and 1930's, the following can be assumed:

1. Concrete soldier piles may have been of concrete strength f'c=3,000 psi, while panels and concrete cap may have been constructed of either f'c=3,000 psi or lower strength concrete, possibly as low as 2,000 psi.
2. Square Rebar: 40ksi yield, 16ksi allowable assuming a factor of safety, FS = 2.0

Additionally, in the 1920's and 1930's, the Balboa Island seawalls would not have been designed for seismic resistance or ground liquefaction. The Balboa Island seawalls have survived seismic events despite their design because most of the walls have little exposed height (i.e., difference in elevation between the landside boardwalk and the waterside mudline). As sea level rises and beach is eroded, this exposed height differential will become greater, putting the seawalls at risk. During a major earthquake along the Newport-Inglewood fault, the existing Balboa Island seawalls may be compromised similar to what occurred to the Naples seawalls in the 1933 Long Beach earthquake. This is particularly the case on both sides of the Grand Canal, Collins Island, and the western end of Balboa Island.

2.2 Reports and Studies

Cash & Associates (now part of URS) provided condition survey reports for the Balboa Seawall to the City of Newport Beach in 1985 and 2005. The 1985 Report included the unearthing of selected tie-rods in suspect locations around the Island and discussion of opinions regarding seawall stability. Work performed for the 2005 Report consisted of a visual inspection of the wall for signs of obvious distress as well as suggested repairs.

In the 1985 Report, the tie-rods comprising the seawall tie-back system were unearthed at the west end of Balboa Island and at various locations around Little Balboa. In all cases where tie-rods were uncovered, the rods did not have a corrosion protection system (coatings or wrappings) and all rods showed evidence of at least 50% loss of cross-sectional area, with several rods completely severed. Preliminary calculations noted that the walls around Balboa Island would be stable without tie-rods for gravity loads, if the exposed height of support (i.e., the difference in elevation between top of boardwalk and top of mudline) was no greater than 5 feet.

The 1985 Report prompted the City to stabilize the toe of the seawall at four locations around the Island by constructing rock revetments. These locations are at the three corners of Little Balboa and along the aforementioned 500-foot-long section of seawall at the western end of Big Balboa (see Photo 1). Rock revetments were also installed at the two corners of Big Balboa that form the Grand Canal. Observations also noted a separate seawall stabilization project performed along the seawall east of the Balboa Island Ferry Boat Landing. Earth anchors were installed, as shown in Photo 2, and a submerged concrete block revetment was placed at the toe of the seawall.

Photo 1: Rock revetment stabilization at western end of Big Balboa Island

Photo 2: Earth anchors and concrete block revetment (submerged) at Balboa Island Ferry Boat Landing

The City of Newport Beach also pursued a repair and maintenance program in response to the 2005 Report which detailed extensive distress (i.e., cracks and spalls) in the Balboa Island seawalls. Most of the noted distresses in the seawall cap and soldier piles were repaired (see Photo 3 for an example of a typical repair). Work as part of this project included an elastomeric material strictly used to seal the joints in the cap from water intrusion (see Photo 4).

Photo 3: Use of elastomeric filler to seal cracks to prevent seawater intrusion

Photo 4: Use of elastomeric filler at joint

3. Visual Survey, Field Measurements, and Evaluations

3.1 Seawall

A visual survey of seawall conditions and field measurements of seawall characteristic dimensions were conducted as part of the seawall condition evaluation. This primarily consisted of measurement of top of wall, mudline, and boardwalk elevations; visual observation and notation of distress in the exposed portions of the seawall; comparison of the current seawall with record drawings; and cataloguing obstructions, modifications, utility lines, storm drains, gangways, and platforms as they relate to the seawall. Extensive photographs were taken. Selected photographs, which provide insight into the observations and conclusions drawn in this report, have been included herein. No physical or laboratory testing of the concrete or reinforcing was made part of this project.

3.1.1 Seawall Field Measurements

Field measurements were taken of the seawall in 2010 on April 26 and 27, May 3 and 18, and June 6. The top of seawall (TOW) was found to vary between 7.7 and 8.7 feet NAVD88 (7.88 and 8.88 feet MLLW NTDE 83-01) on Big Balboa and between 8.5 and 9.3 feet NAVD88 (8.68 and 9.48 feet MLLW NTDE 83-01) on Little Balboa. Mudline elevations vary between approximately 1 foot below the TOW elevation in locations where the beach sand has been replenished and/or managed, to approximately 7 feet below the TOW elevation, where beach sands have eroded over time. The greatest exposure exists on the west end of Big Balboa (currently protected by a rock revetment), at seawall corners on both Big and Little Balboa (currently protected by rock revetments) and on both sides of the Grand Canal.

The boardwalk elevation along the Big Balboa seawall ranges between 5.0 and 7.3 feet NAVD88 with an average elevation of approximately 6.2 feet NAVD88. The boardwalk elevation low and high of 5.0 feet and 7.3 feet, respectively, are aberrations in the data, since most elevation data points fell between 5.5 and 6.7 feet NAVD88. The boardwalk around Little Balboa is between 6.2 and 6.8 feet NAVD88 with an average elevation of approximately 6.5 feet NAVD88. The sidewalk elevations, taken along three streets traversing the interior of the Island, averaged between 6 and 7 feet NAVD88 with extremes of 5.7 feet NAVD88 and 7.2 feet NAVD88. The streets measured were Pearl and Coral avenues on Big Balboa and Crystal Avenue on Little Balboa. Street surfaces are approximately 6 inches lower than sidewalks.

Residential finish floor elevations were also measured for a portion of houses along the Balboa Island boardwalks and along Pearl, Coral, and Crystal avenues. These elevations were taken at the home entry areas. The residential finish floor elevations ranged from 6.1 feet NAVD88, which is below the top of the seawall, to a maximum of 9.8 feet NAVD88, which is above both the top of wall and the current City of Newport Beach building code elevation for Special Flood Hazard Areas. This City requirement is currently set at 9.0 NAVD88 (9.18 feet MLLW NTDE 83-01). A sampling of

residential finish floor elevations can be seen in Photos 5 through 8. Note that some home entry areas are at sidewalk level.

Photo 5: Residential finish floor transition to sidewalk

Photo 6: Residential finish floor transition to sidewalk

Photo 7: Residential finish floor transition to sidewalk

Photo 8: Residential finish floor transition to sidewalk

3.1.2 Seawall Cap Visual Survey

The stationing developed in the topographic survey was used in the visual surveys of the seawall which were conducted in 2010 on May 25 and June 6. This visual survey documented an extension added to the seawall cap around Little Balboa as shown in Photo 9. This extension raised the TOW elevation by between 6 to 12 inches depending on location (a 12-inch extension is shown in Photo 9). Although this extension provides a defense against high water events, the limited remaining useful life and the existing condition of the underlying seawall make further extensions questionable.

Photo 9: Little Balboa seawall cap extension

The visual survey also found universal distress in the cap, specifically multiple cracks, coinciding with the locations of the soldier piles. The development of these cracks at the specific locations of the soldier piles is likely due to a reduced structural cross-section and a concentration of load ultimately relating to concrete stress. Despite a concentration of cracks at the soldier piles, cracking also can be found at many locations along the concrete cap including the structural cap along the Grand Canal. Coupled with similar cracks found on the exposed portions of the soldier piles and panels, the evidence portends to universal distress throughout the seawall. The shot-creted piles and panels along the Grand Canal walls (see Photo 10) are of particular concern because the condition of the original concrete is hidden by the shot-crete repairs. As noted in Section 2.2 – Reports and Studies, other cracks in the cap have been repaired over the years. As shown in Photos 11 through 13, the quality of the repair and the degree of distress have varied.

Photo 10: Shot-crete on Grand Canal seawall

Photo 12: Successful spall repairs

Photo 11: Typical spall and crack repairs

Photo 13: Crack repairs with corroding rebar

Another common and continuous distress point along the seawall is parallel to and approximately 2 to 4 inches above the boardwalk. As part of the drainage mitigation project performed in the 1980's, the boardwalk was lowered several inches to between 2.0 and 2.5 feet below the TOW in order to facilitate drainage away from private properties. This placed the boardwalk below the bottom of the existing cap and it is assumed a patch was done to fill the gap between the boardwalk and the cap. Therefore, the continuous crack appears to be non-structural and related to the patchwork as shown in Photos 14 through 16. This assumption should be confirmed as part of a subsequent study.

In addition to visual observations, we utilized what is known as a "chain-drag" test by impacting the concrete with a heavy metal object to detect holidays, which are voids caused by concrete chemical reactions or rebar corrosion, and de-laminations in the structure. A hollow sound, typically associated with de-laminations and holidays was heard throughout the cap on both islands, but were particularly

evident along the portion of the Grand Canal seawall constructed in 1929. Weathering, settling, and seismic events coupled with porous concrete elements have allowed seawater to seep into the seawall and corrode the rebar within. As the rebar corrodes, the rust expands putting pressure on the concrete from within causing voids and separation, or de-lamination of the concrete from the rebar, thus weakening the structure. These actions lead to cracks and breaking off of chunks of concrete, known as spalling.

Although many major cracks and spalls have been repaired over the past several years by the City, the "chain-drag" test found additional locations needing repair. The results were noted in the field survey, and should be confirmed as part of a subsequent investigation through the use of more invasive testing procedures.

Photo 14: Crack along sidewalk separation from seawall

Photo 15: Sidewalk separation from seawall

Photo 16: Close-up of Photo 15 (above)

3.1.3 Modifications

It appears that the wall was designed with lampposts cast into the seawall concrete cap at approximately 100-foot intervals as shown in Photos 17 and 18. At some point in time, every other lamppost was removed from the seawall, leaving only the lampposts at the street ends as well as a few intermittent locations. A junction box exists in the boardwalk adjacent to each lamppost, with a

conduit bending through the cap into the base of said lamppost. Lamppost locations and details would need to be part of any new plans to repair or replace the Balboa Island seawalls.

Photo 17: Lamppost on seawall

Photo 18: Lamppost base and junction box

Storm drain outlets that drain through the seawall and into Newport Bay (see Photo 19) have existed for decades at the street ends of Balboa Island, based on the 1935 record drawings and the recent visual survey. In the 1980's as part of the boardwalk reconstruction, a storm water drainage system with 4- to 6-inch diameter drains was constructed landward of and parallel to the seawall. These drains connect to the City's storm drain system outlets at the street ends and were designed to keep water from ponding along the seawall and from spilling onto private property.

This drainage system would not have functioned without the installation of gate valves at all storm water outlets on Balboa Island, as shown in Photos 20 and 21. These valves are closed during high water events to prevent seawater from flooding low lying spots on the Island. Prior to the valve installation, the storm drain outlets were a major source of flooding during high water events.

Photo 19: Storm drain outlet through seawall

Photo 20: Hand-operated gate valve in storm drain manhole

Photo 21: Actuated gate valve in storm drain vault

Private modifications have also been performed on the seawall cap. The most prominent modifications are dock gangways, piers, and platforms attached or abutted to the cap using various methods as shown on Photo 22. Utilities serving these docks such as water and electricity are provided via private pipes and conduits penetrating the seawall as shown on Photo 9. Homeowners have also built steps on the cap to facilitate access from the boardwalk, over the cap, and onto the beach and various gangways, piers, and platforms. The City owns and maintains four public docks on Big Balboa and one public dock on Little Balboa.

3.1.4 Database

A master database was created for entering information regarding the Balboa Island seawalls. This information includes measurements taken of the wall, record drawing dimensions, information collected form the visual surveys, and other pertinent data. Microsoft Excel was used for this database with the ultimate goal of transferring the data to Microsoft Access as part of a future project. Database software such as Microsoft Access is considered an appropriate program for storing and sorting large and sophisticated sets of information and includes user-friendly features to generate reports of stored data. The master database is attached in Attachment IV. The following are components of this master database:

A. Zones
   1. Deficiencies
   2. Obstructions
   3. Openings
   4. Useful Life
   5. Surcharge

B. Benchmarks

C. Documents

D. Features
   1. Soldier Piles
   2. Sheets/Panels
   3. Caps
   4. Extensions
   5. Tie-backs
   6. Footings
   7. Anchors

There are key fields in the “Zones”, “Documents”, “Benchmarks” and “Features” databases which tie them together. There are additional fields which connect the child databases with the two respective parent databases (“Zones” and “Features”) allowing for detailed searches of all seawall characteristics.

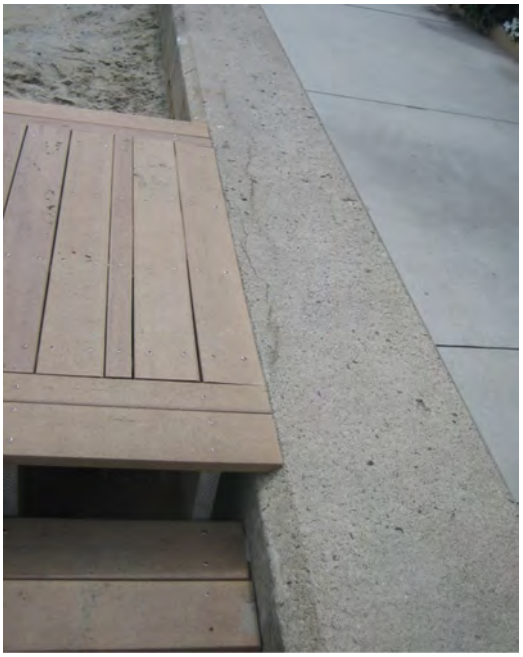


Photo 22: Private dock abutment

3.2 Bridges and Ferry Boat Landing

In addition to the visual survey and measurements of the Balboa Island seawall, special attention was given to the Balboa Island Ferry Boat Landing and its surroundings and the three bridges on the Island. The bridges are:

1. The Marine Avenue bridge, which links Balboa Island to the mainland
2. The Park Avenue Bridge, which spans the Grand Canal and connects Big Balboa and Little Balboa, and
3. The Collins Island Bridge, which extends Park Avenue on Big Balboa over a small channel onto privately-owned Collins Island.

If an extension or reconstruction of the existing seawall is to be performed, then these four areas need to be modified to prevent them from acting as openings in an otherwise solid seawall fortification around the Island.

3.2.1 Marine and Park Avenue Bridges

The Marine and Park Avenue bridges have solid concrete parapet (side) walls with top of wall elevations at the seawall interface of elevations 13.8 and 14.1 feet NAVD88, respectively. The roadway elevations for the Marine Avenue Bridge at the seawall interface and at its peak are at elevations 10.5 and over 16 feet NAVD88, respectively. The roadway elevations for the Park Avenue Bridge at the seawall interface and at its peak are 11.0 and 12.4 feet NAVD88, respectively. Any openings in the two bridges that would allow an avenue for seawater to seep onto the roadway should be sealed, and waterproofing should be performed on surfaces exposed to rising sea level. Any reconstruction or modification of the existing bridges should include minor modifications to ensure a waterproof structure. The goal is to allow water to escape but not to enter the fortified Island. The Marine Avenue Bridge is shown in Photos 23 and 24, and the Park Avenue Bridge is shown in Photos 25 and 26.

Photo 23: Marine Avenue Bridge as viewed from Big

Photo 24: Marine Avenue Bridge interface at Big Balboa

Balboa seawall

Photo 25: Park Avenue Bridge interface at Big Balboa seawall

Photo 26: Park Avenue Bridge as viewed from Big Balboa

3.2.2 Collins Island Bridge

The Collins Island Bridge cuts through the seawall, has an open metal rail wall (as seen in Photo 27) and a peak roadway elevation of 7.3 feet NAVD88. This bridge will require thorough waterproofing as well as solid concrete parapet (side) walls sealed to the seawall to prevent it from becoming a source of flooding. The seawalls on Collins Island will need to be retrofitted or replaced in concert with Balboa Island, to prevent flooding of that island and to prevent seawater from flanking the Balboa Island barriers (see Figure 4). The Collins Island Bridge is shown in Photos 27 and 28.

Photo 27: Collins Island Bridge interface at seawall abutment

Photo 28: Collins Island Bridge as viewed from Big Balboa

3.2.3 Balboa Island Ferry Boat Landing

The approach to the Balboa Island Ferry Boat Landing also breaches the seawall, as shown in Photo 29, allowing a path for water to enter the Island. In addition, the Ferry Boat Launch Ramp is particularly low in its current configuration as shown in Photo 30. The approach elevation is 6.6 feet NAVD88 (6.78 feet MLLW NTDE 83-01) at the seawall opening and 7.0 feet NAVD88 (7.18 feet MLLW NTDE 83-01) at the ramp leading to the ferry boat dock. During high water events, the launch ramp must be shut-down until water recedes.

Photo 29: Balboa Island Ferry Boat Landing approach

Photo 30: Balboa Island Ferry Boat Landing as viewed from side

If the dock and launch ramp are left in their basic current location, a major effort would be required to raise the launch ramp and the approach street, Agate Avenue. This would impact adjacent buildings and the intersecting boardwalk as shown on Figure 5. Two options are shown. Option 1 blocks the boardwalk at the intersection with the proposed ferry boat landing approach ramp. Pedestrians have to travel an additional 200 feet around the approach ramp to get from one side of the boardwalk to the other side. Option 1 only allows one-way traffic from the ferry to the intersection of the approach ramp and alleyway. Existing grade-level sidewalk and delivery access are maintained on Agate Avenue.

Option 2 allows continuous boardwalk access by constructing 5% grade ramps on either side of the approach ramp. These ramps are ADA-compliant and do not require handrails. However, the ramps do extend 76 feet in both directions beyond the Agate Avenue right-of-way and impact access to six waterfront properties. The proposed approach ramp and adjacent sidewalks are widened to the full right-of-way width allowing for two-way traffic on Agate but blocking access to two structures on Agate.

It is hard to envision this work without requiring the reconstruction of the two buildings on either side of Agate Ave in the approach to the Launch Ramp, one of which, the J.A. Beek Building, may be considered a historic structure. Despite the impacts to surrounding properties and pedestrian access, these two options are land-based and only require the ferry launch ramp and float to be raised in concert with the new approach ramp. Additionally, these options do not impact existing navigation in the main channel.

Another solution (shown as Option 3 on Figure 6) shifts the launch ramp further into the main channel, so that existing properties can remain unchanged. To account for the effect of sea level rise to the Balboa Peninsula and to show the full extent of anticipated channel width reduction, Figure 6 also depicts a similar redevelopment of the ferry landing and launch ramp on the Balboa Peninsula side of the channel. After some assessment of navigational clearances, which included incursions on both sides of the channel, the proposal appears feasible, although additional study would be necessary as well as discussions with the City of Newport Beach Harbor Resources Department, the U.S. Coast Guard, California Coastal Commission, California Fish & Game, and the U.S. Army Corps of Engineers (USACE). Such a shift would likely require a similar extension of the adjacent fuel dock, which is shown in Photo 31, to prevent any reduction to ingress and egress into this facility. These changes would affect the existing pierhead lines.

Any reconstruction of this facility, regardless of the type, will take time. The facility could be inactive for 9 months or more during construction of a new approach and launch ramp including installation, testing, and activation of all utility and mechanical systems. Furthermore, if this channel-ward approach were taken, a similar structure should be required on the Balboa Peninsula.

Photo 31: Fuel dock adjacent to Balboa Island Ferry Boat Landing

4. Predicted Lifespan and Remaining Useful Life of Existing Seawalls

The lifespan of structural concrete is based on many parameters and is dictated based on design, construction, quality control and environmental conditions of the structure. Based on a review of the construction documents and an understanding of design and construction practices in the 1920's and 1930's, the lifespan of a reinforced concrete structure would be judged, by today's standards, to have a realistic lifespan of between 75 to 100 years.

The condition of the Big Balboa seawall is somewhat better than the condition of the Little Balboa seawall. Little Balboa, which is aligned with the main channel and harbor entrance, is particularly susceptible to ocean swell and long period waves. The long fetch also allows for larger waves to impact Little Balboa seawalls during storm events. Big Balboa is somewhat more sheltered and has a shorter fetch, except for its exposed western tip.

Erosion, another destructive force on the seawalls, can result from wave activity, longshore sediment transport, and strong tidal currents. Waves continuously batter the aforementioned exposed areas on Little Balboa and Big Balboa causing erosion of their beaches. Groins have been constructed over the years to combat the longshore sediment transport process. The Grand Canal also experiences strong erosion forces at the corners of both islands. Erosion began to compromise the toe of the seawalls in the affected areas and was discussed in the 1985 Report. This resulted in the placement of rock revetments to stabilize the toe and counteract the erosive forces.

The marine environment is corrosive. Salt water corrodes steel reinforcing causing concrete to crack and spall, thus degrading structural strength. The City has repaired cracks and spalls throughout the history of the Balboa Island seawall. However, there is no record of repairs to primary structural components (i.e., soldier piles, sheet piles, tie-rods and deadmen).

Therefore, the sections of seawall supporting greater gravity loads due to erosion and dredging (i.e., greater exposed seawall height) and exposed to greater wave and swell activity are expected to have a lifespan closer to the lower end of the range, or between 75 and 90 years. Those sections of the seawall protected by beaches and fronting calmer waters are expected to have a lifespan closer to the upper end of the range, or between 85 and 100 years. Since the seawalls are in a marine environment, none are expected to have a lifespan exceeding much more than 100 years.

In summation, it is the opinion of URS that the remaining useful life of the Balboa Island seawalls is between 10 and 25 years, depending on location.

5. Sea Level Rise

In 2009, the U.S. Army Corps of Engineers (USACE) developed a protocol for incorporating sea level rise into the design of coastal structures (USACE EC 1165-2-211). FlowSimulation, LLC (FlowSim) used equations from this protocol along with tidal data from National Oceanographic and Atmospheric Administration (NOAA) Station 9410660 (Los Angeles Harbor) to calculate projected mean sea levels and highest extreme tides in Newport Bay for interval years 2025, 2050, and 2100. To confirm the validity of the model and results, FlowSim checked the results for the baseline year 2010 against the present NTDE's mean sea level in Los Angeles Harbor as provided by NOAA. The model compared favorably, producing values of 2.65 feet and 7.71 feet NAVD88 for mean sea level (MSL) and highest extreme tide (HET) versus the current values of 2.62 feet and 7.62 feet NAVD88, respectively, retrieved from NOAA's website. The methodology and complete results are provided in Appendix C.

The predicted HET for interval years 2025, 2050, and 2100 are 8.11 feet, 9.09 feet, and 12.31 feet NAVD88, respectively, and have a 1% chance of occurring in the interval year. The impact of these increasing HET levels relative to the existing seawall, boardwalk, and typical residential finish floor elevations is shown on Figure 7. It should be noted that the risk of equaling or exceeding an interval year's HET in a given year grows as the years advance from the interval year. For example, the chance of HET = 8.11 feet NAVD88 occurring in 2045 is higher than in 2025, or higher than 1%. For the purpose of this study and report, HET is more important that predicted MSL, since HET coupled with storm waves are the main source of wave overtopping and flooding.

Data from the U.S. Geological Service (USGS) shows the water table on Balboa Island to be approximately 3 feet below ground elevation. The water table is assumed to lag the tide by 3 feet. It is recommended that a geotechnical investigation be performed in the future to confirm these water table elevation assumptions. As shown in Table 1, sea level is predicted to rise gradually until 2015, then increase at a higher rate until interval year 2100. In 2100, MSL is predicted to be 7.25 feet NAVD88 which is equal to or higher than the existing boardwalk and sidewalk elevations on Balboa Island. This means that water is predicted to percolate through the finished surfaces inundating streets and flooding buildings with a finish floor elevation below the predicted water table.

Table 1: Sea Level and Annual Maximum Tide Height Projections through 2100

	MSL (ft) NAVD88	*p*=0.5 height (ft) NAVD88 (+4.52 ft)	*p*=0.1 height (ft) NAVD88 (+4.76 ft)	*p*=0.01 height (ft) NAVD88 (+5.06 ft)	Projected Sea Level Rise (ft)
2010	2.65	7.17	7.41	7.71	-
2025	3.05	7.57	7.81	8.11	0.40
2050	4.03	8.55	8.79	9.09	1.38
2100	7.25	11.77	12.01	12.31	4.60

Note: Data noted in column "p=0.01 height" was used for all graphics provided in this Report, and relate to the highest extreme tide predictions of sea level rise.

6. Flood Damage

Wave overtopping and flooding of Balboa Island can cause extensive damage to residences, businesses, vehicles, public infrastructure and the environment. Damage to homes includes but is not limited to loss of personal property and effects, cosmetic and structural damage, and mold growth. Businesses are prone to the same damage as homes in addition to loss of inventory and business interruptions. Vehicles may be flooded damaging their interiors and possibly their mechanical parts. Fuel tanks, home natural gas connections, and vehicles may leak petrochemical products into the environment. Public infrastructure will also be impacted. After a flood, streets and sidewalks need to be cleared of debris. Fire stations, police precincts, post offices, schools, parks, and other public structures will suffer similar property and material damage as businesses and residences on the Island.

Public utilities may also be damaged during a flood. Sewers and storm drains are the most susceptible utilities. When streets become flooded, water infiltrates the sewer system, which then causes sewage to spill out in an event called a "sanitary sewer overflow" (SSO). People and the environment are thereby exposed to raw sewage. An example of an SSO is shown in Photos 32 and 33. Areas impacted by SSOs, including beaches and harbor waters, would need to be closed to direct human contact for a period of time to prevent disease. Such closures impact daily life and the economy. To prevent damage to both storm drain and sewer systems. During high water events, the City closes the storm drain outlets to Newport Bay to prevent sea water from flowing backwards through the storm water outlets and inundating Balboa Island. City personnel mobilize to pump out water that collects at the storm drain outlet junction structures located at bay-front street ends as seen in Photo 34.

Photo 32: Example of Sanitary Sewer Overflow

Photo 33: Example of Sanitary Sewer Overflow

Photo 34: City of Newport Beach Personnel pumping flood water back into the Bay

The preceding photograph was taken during a high water event in December 2010. The following are additional photos from this event depicting wave overtopping of the Balboa Island seawall and the resulting damage. As seen in Photos 35 through 37 water poured over the seawall flooding the boardwalk at Turquoise and South Bay Front. Flood waters spilled into adjacent streets as seen in Photo 38. Some businesses were inundated as can be seen in Photo 39. After the tide ebbed and the flood waters drained, the boardwalk was covered with sand and debris as shown in Photo 40, clogging the boardwalk drainage system.

Photo 35: Waves splashing over the Balboa Island seawall at Turquoise and South Bay Front

Photo 36: Seawater pouring over the seawall

Photo 37: Bay waters overtopping the seawall as City personnel struggle to keep pace

Photo 38: Street Flooding

Photo 39: Flooded Businesses

Photo 40: After the tide ebbs, the boardwalk is covered with sand and debris which to be cleaned up

Photo 41 shows the repairs being performed to a flood damaged house. The waterlogged portions of drywall had to be removed. Photo 42 shows the aftermath of a flooded car interior.

Balboa Island requires a short-term plan addressing current over-topping issues as well as a long-term mitigation plan if such damage and cleanup scenarios are to be avoided.


Photo 41: Example of flood-damaged home repairs


Photo 42: Example of flood-damaged car interior

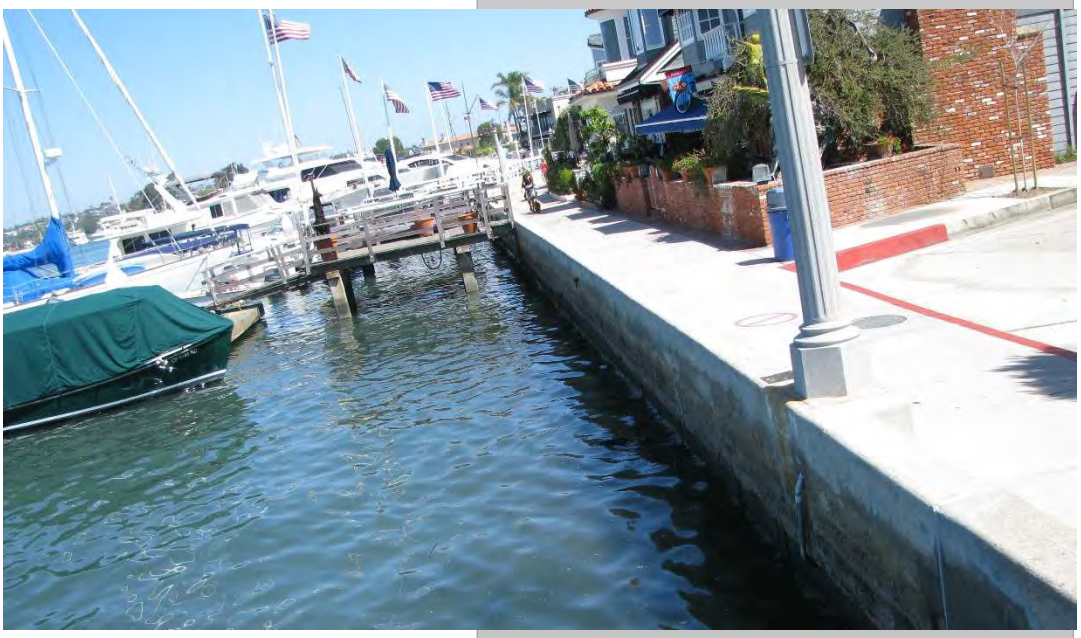
Appendix 5

COWI (2016)

DRAFT

Condition Assessment Inspection Report
West End Seawall, Balboa Island

September 2016



City of Newport Beach

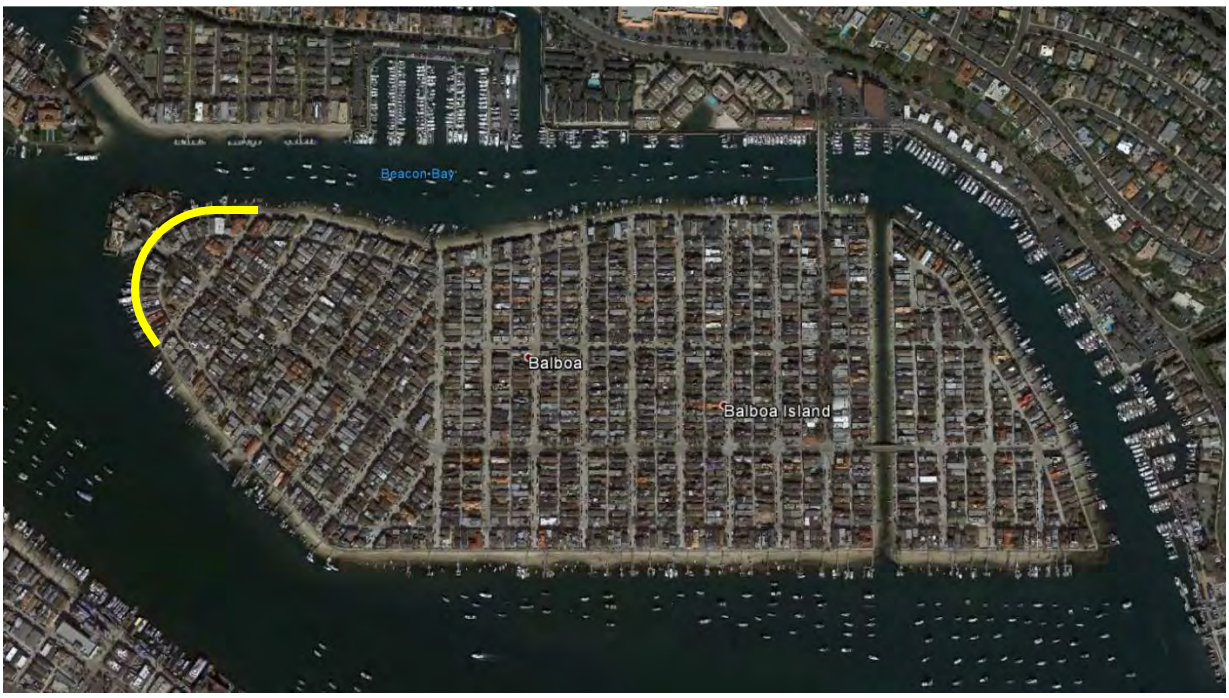
100 Civic Center Drive
Newport Beach, CA 92660

by:
COWI Marine North America
3780 Kilroy Airport Way, Ste 200
Long Beach, CA 90806

Table of Contents

EXECUTIVE SUMMARY

The City of Newport Beach retained COWI North America (COWI) to perform a Condition Assessment Inspection of the bulkhead wall at the West End of Balboa Island, City of Newport Beach Contract No. 8088-1. The reach of the wall extended from Emerald Avenue at North Bay Front, west and south, then southeast to Emerald Avenue at South Bay Front as indicated by the highlighted area in the figure below.



Area of Investigation at Balboa Island - Bulkhead Wall at West End from Emerald Ave to Emerald Ave

According a Cash & Associates Report (C&A 2005), the bulkhead wall was originally built of timber in 1909. Subsequent improvements to the wall were completed including a partial replacement with a concrete barrier in 1912, and a complete rebuild in 1922. The current bulkhead for the majority of the perimeter of the island was rebuilt yet again circa 1935 (Newport Beach 1935) utilizing precast soldier concrete piles and precast concrete panels. The soldier piles were restrained at the top with 1¼" steel tie-back rods anchored to Douglas Fir timber pile dead men.

An older section of wall from just south of the Collins Island Bridge at Park Avenue to the east edge of Emerald Avenue is composed of driven precast concrete panels, believed to be 10 inches thick, without the use of soldier piles. An investigation by Cash & Associates (C&A 1985) found the tiebacks from the tops of these panels to be corroded and no longer effective. Rather than replacing the tiebacks, a project was initiated to place rock rip rap along the bulkhead to restrain it from moving (Newport Beach 1988).

The stretch of wall subject to this investigation contains both types of construction. The soldier pile construction capped by cast-in-place "Type B" coping runs from Emerald Avenue at North Bay Front, west to approximately 20 feet south of the Collins Island bridge; then the all-panel construction topped by cast-in-place "Type D" coping runs from that point south and east to Emerald Avenue at South Bay Front.

These wall reaches are referred to as "North" from Collins Island Bridge at Park Avenue, to the centerline of Emerald Avenue, and "South" from Collins Island Bridge to the centerline of Emerald Avenue at South Bay Front. (Note: The stationing shown on the drawings and defect tables is approximate and not intended to be interpreted as "surveyed.")

South Wall findings:

- Minor weathering, small pock marks, hairline cracks, and marine growth are typical along the length of the wall. These are minor and not specifically called out by location.
- The wall panels and soffit of the coping are eroded from approximately Dock 39 to Emerald Avenue due to greater exposure to wave action. Aggregate is exposed but no major damage was noted due to this condition.
- There are 4 occurrences of open, closed, or impact spalls on the waterside face of the coping or wall panels.

- There is a horizontal offset in the bulkhead wall of approximately 1½" at the wall type transition roughly 20 feet south of the Collins Island Bridge.
- Although not integral to the bulkhead wall, there are hairline cracks throughout the sidewalk (not noted by location), and larger cracking which is noted in our findings.
- Construction joints in the coping, joints between the wall panels, and the joint between the top of the panels and coping, have been sealed by a variety of methods. A cementitious grout at the vertical joint between precast panels is used in some locations, and an elastomeric sealant in other locations. Elastomeric sealant is used in some locations at the joint between the wall panels and coping, and to repair previously addressed cracks in the coping. At some locations this sealant is cracking.
- Reinforcing in the precast wall panels was estimated to consist of vertical bars at 3 inch spacing and horizontal bars at 6 inch spacing. The cover to these bars ranged from 2 to 2¼ inches. Measurements were taken with a metal detection device.

The profile of the rock rip rap installed in 1988 was consistent with the project drawings. A jet probe was used to determine the depth of the rock beneath the mud that has shoaled over it since its placement.

North Wall findings:

- Minor weathering, small pock marks, hairline cracks, and marine growth are typical along the length of the wall. These are not specifically called out by location.
- There are typical, moderate to major, recurring cracks in the Type B coping directly above the precast piles at 26 locations.
- There are 8 occurrences of open, closed, or impact spalls on the waterside face of the coping or wall panels.

- Construction joints in the coping, and the joint between the top of the panels and coping, have been sealed with an elastomeric sealant in some, but not all locations. At some locations, this sealant is cracking.
- Reinforcing in the precast wall panels was measured to consist of vertical bars at 12 inch spacing and horizontal bars at 6 inch spacing, consistent with drawings from the original construction period. Electronically measured cover to these bars ranged from 3 to 3¼ inches.

Jet probing of the wall panels indicated that the bottoms of the panels were approximately 12 feet below Mean Lower Low Water (MLLW). Four of five attempts were successful, with one attempt hitting an obstruction which prevented further penetration.

The last assessment of the wall was performed by Cash & Associates in 2005 (C&A 2005). In their report, the wall was assessed to be in Fair to Satisfactory condition with some minor to moderate deterioration in structural elements.

Based on our findings, we determined that the walls are in Fair to Satisfactory condition overall. Most do not appear to be overstressed under normal loading and the defects noted are caused by corrosion of rebar and small differential movements between adjacent wall section. Also, vertical cracks, mostly located in line with the precast wall panels along the Southern Wall, have propagated through the "Type "D" coping. This is likely due to the development of "hoop stress" in the coping, as walls in a circular arc arrangement lean outward due to deterioration and failure of the steel tie-back rods, as noted in the 1985 Cash and Associates report (C&A 1985).

The most pressing issue we observed is the continuing corrosion of reinforcing within the wall. With the recommended repairs, we would expect the overall rating to increase to Satisfactory and the next inspection would occur in 5 years.

Otherwise, the next inspection should be in 3 years.[1] These repairs are anticipated to be completed with the cap raise project currently being designed.

1 INTRODUCTION

1.1 Background

The City of Newport Beach retained COWI North America (COWI) to perform a Condition Assessment Inspection of the bulkhead wall at the West End of Balboa Island, City of Newport Beach Contract No. 8088-1. The reach of the wall extended from Emerald Avenue at North Bay Front, west and south to the Collins Island Bridge at the end of Park Avenue, then southeast to Emerald Avenue at South Bay, Figure 1.

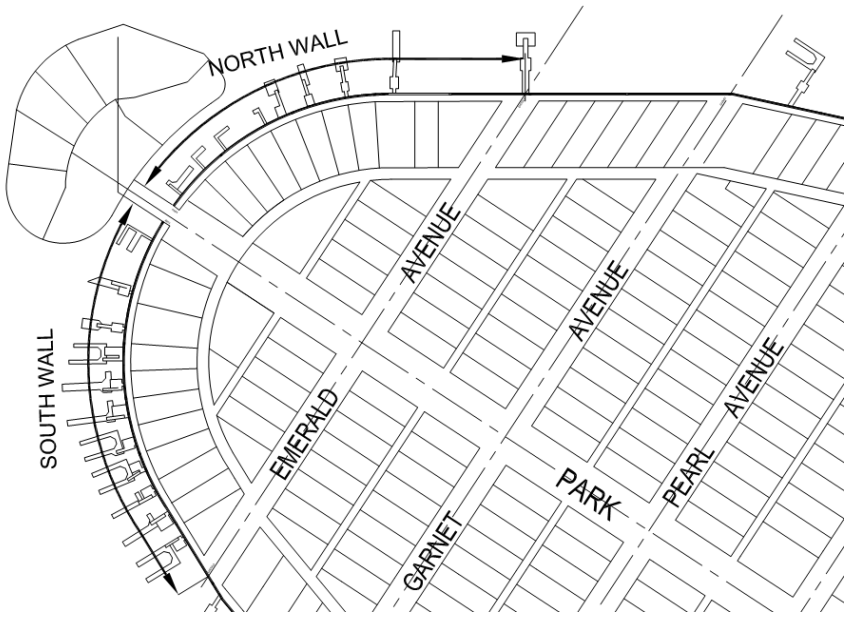


Figure 1 - Inspection Location and Limits, West End of Balboa Island, Newport Beach, CA

[1] Ratings and inspection intervals per MOP 130 (ASCE 2015).

These wall reaches are referred to as "North" from Collins Island Bridge at Park Avenue, to the centerline of Emerald Avenue, and "South" from Collins Island Bridge to the centerline of Emerald Avenue at South Bay Front. (Note: The stationing shown on the drawings and defect tables is approximate and not intended to be interpreted as "surveyed.")

The purpose of this report is to describe our inspection methodology and observations; and provide a condition assessment, immediate repair recommendations, and estimate of immediate repair costs. A structural analysis was not included in the scope of work.

We performed the inspection from July 20 through July 22, 2016. The inspection was performed in compliance with ASCE's MOP 130 – Waterfront Facilities Inspection and Assessment manual (ASCE 2015). Local stationing was used for the inspection north and south of the Collins Island bridge and converted to stationing employed in a current coping repair project for continuity. The stationing was measured utilizing a surveyor's wheel approximately 1 to 2 feet inside of the wall. Thus the stationing is approximate, and not represented to be formally surveyed.

We have rated the defects found following ASCE MOP 130 standards based on Table 2-6 of the guidelines for reinforced concrete elements. The rating reflects the condition of the defect at an individual element only and is independent of the defect's location of individual element's structural importance. The overall condition assessment rating and recommended actions are based on Table 2-14 and 2-16 of the guidelines. The tables are reproduced in Appendix C.

The inspection was a Level I, visual and non-destructive. The walls were relatively free of heavy marine growth and we were able to assess the surface condition without conducting Level II cleaning protocols.

1.2 History

A Balboa Island bulkhead wall was originally built of timber in 1909 (URS/Everest 2011). Subsequent improvements to the wall were completed, including a partial replacement with a concrete barrier in 1912, and a complete rebuild in 1922. The current bulkhead for the majority of the perimeter of the island was rebuilt yet again circa 1935 utilizing precast soldier concrete piles with grooves on each side, which received precast concrete panels placed within the grooves. The soldier piles were restrained at the top with 1¼" steel tie-back rods anchored to Douglas Fir timber pile dead men. Drawings of this wall type are available.

There remains an older section of wall from just south of the Collins Island Bridge to the east edge of Emerald Ave. This section is composed of driven precast concrete panels believed to be 10 inches thick without the use of soldier piles. A 1985 investigation by Cash & Associates (C&A 1985) found the tiebacks from the tops of these panels to be corroded and no longer effective. Rather than replacing the tiebacks, a project was initiated to place rock rip rap along the bulkhead (Newport Beach 1988). This changed the performance of the wall panels from "fixed below the mudline and pinned at the top" end conditions to "cantilevered from below the mudline to a free top" conditions. It also changed the location of the tension and compression zones within the wall panels in the upper portion of the panels. The capacity of the wall in the cantilever configuration was checked in the 1985 report but a separate independent calculation has not be made. Various methods have been utilized to seal the joint between panels in this section of wall. Original construction drawings for this wall type have not been located.

The stretch of wall subject to this investigation contains both types of construction. The soldier pile construction capped by cast-in-place "Type B" coping along the North Wall, west to approximately 20 feet south of the Collins Island bridge, then the all-panel construction topped by cast-in-place "Type D" coping from that point along the South Wall.

2 INSPECTION PROCEDURE

The COWI project manager was Warren Stewart, P.E., S.E. (CA). Jim Kearney, P.E. (CA) and Gabriel Verdugo, P.E. (CA) completed the inspection from July 20-July 22, 2016. Associated Pacific Contractors provided assistance to COWI by providing a boat and jet probing equipment.

2.1 Key Personnel

Bob Stein, Project Manager, City of Newport Beach

Warren Stewart, P.E., S.E., Project Manager, COWI

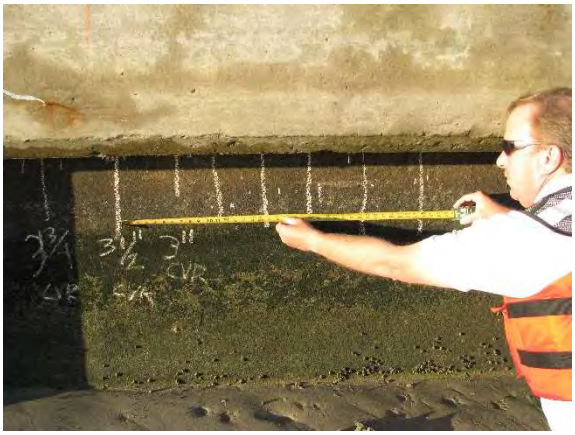
Gabriel Verdugo, P.E., Above Water Inspector, COWI

Jim Kearney, P.E., Above Water Inspector, COWI

2.2 Above water inspection – waterside

For the waterside inspection, a walk-along of the wall was performed starting at the public dock at Emerald Avenue and North Bay Front and proceeding to Emerald Avenue and South Bay Front. We inspected the conditions of the coping and precast wall panels, as well as construction joints and utility penetrations. The profiles of the sand, mud, and rip rap along the walls were measured. Notes were recorded and photographs taken.

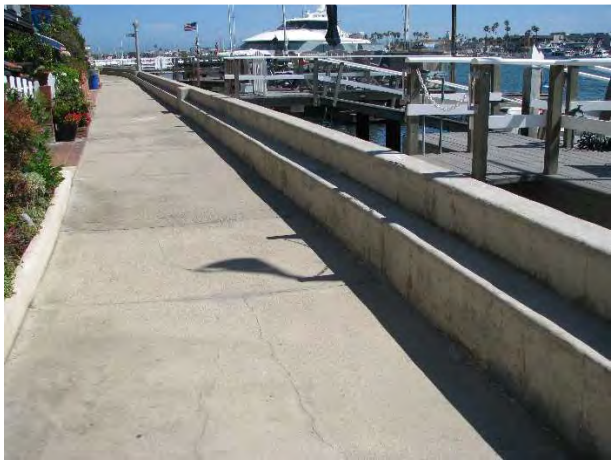
Measurements to determine the spacing and depth of cover to rebar were conducted in this phase.



Associated Pacific Constructors supplied two workers and a boat, along with jet probing equipment, to assist in measuring profiles of the soil and rip rap perpendicular to the walls, and to determine the elevation of the bottom of the wall panels along the North Wall.

2.3 Above water inspection – island-side

For the island-side inspection, a walk-along of the wall/coping was performed from North and South Walls. We inspected the conditions of the coping and sidewalk, as well as construction joints. Notes were recorded and photos taken.

3 OBSERVED CONDITIONS

3.1 Above water findings

The following represents a summary of the types of defects noted along the walls. A complete list of the defects is presented Appendix B and shown in the drawings in Appendix A.

South Wall Findings:

- Minor weathering, small pockmarks, hairline cracks, and marine growth are typical along the length of the wall. These are minor and not specifically called out by location.
- The wall panels and soffit of the coping are eroded from approximately Dock 39 to Emerald Avenue due to greater exposure to wave action. Aggregate is exposed but no major damage was noted due to this condition.
- There are 4 occurrences of open, closed, or impact spalls on the waterside face of the coping or wall panels.
- There is a horizontal offset in the bulkhead wall of approximately 1½" at the wall type transition roughly 20 feet south of the Collins Island Bridge. The Older portion of the wall appears to have displaced toward the water.
- Although not integral to the bulkhead wall, there are hairline cracks throughout the sidewalk, which are not noted by location, and larger cracks which are noted in our findings.
- Construction joints in the coping, joints between the wall panels, and the joint between the top of the panels and coping have been sealed by a variety of methods. A cementitious grout at the vertical joint between precast panels is used in some locations, and an elastomeric sealant in some locations. No sealing of any kind is employed at some vertical joints. Elastomeric sealant is used at some locations at the joint between the wall panels and coping, and to repair previously addressed cracks in the coping. At some locations this sealant is cracking.
- Reinforcing in the precast wall panels was estimated to consist of vertical bars at 3 inch spacing and horizontal bars at 6 inch spacing. The cover to these bars ranged from 2 to 2¼ inches. Measurements were taken with a metal detection device.

In general, the wall and coping conditions are Fair, with isolated defects rated minor to major.

North Wall findings:

The North Wall contains typical defects throughout.

- Minor weathering, small pockmarks, hairline cracks, and marine growth are typical along the length of the wall. These are not specifically called out by location.
- There are typical, moderate to major, recurring cracks in the Type B coping directly above the precast piles at 26 locations.
- There are 8 occurrences of open, closed, or impact spalls on the waterside face of the coping or wall panels.
- Construction joints in the coping, and the joint between the top of the panels and coping, have been sealed with an elastomeric sealant in some, but not all locations. At some locations, this sealant is cracking.
- Reinforcing in the precast wall panels was measured to consist of vertical bars at 12 inch spacing and horizontal bars at 6 inch spacing, consistent with drawings from the original construction period. Electronically measured cover to these bars ranged from 3 to 3¼ inches, which is consistent with the centerline location of the reinforcing in a 7-inch thick panel.

In general, the wall condition is in Fair condition and the coping is in Fair condition, with isolated defects rated minor to major.

3.1.1 Typical Defects

The following are examples of typical defects found throughout the wall. Stations are approximate. A complete list of defects is provdied in Appendix B – Inspection Data.

Photo 1 – Example of hairline cracks, not individually called out in defect tables

Photo 2 – Erosion of wall and coping from station S0-09 to S0+31

Photo 3 – Previous cementitious repair exhibiting rust stains at bent S2+92

Photo 4 – Rusted plug at wall, with flexible sealant at joints, at station S3+08

Photo 5 – Coping spalled, both sides, above precast wall panel joint. Joint previously sealed with cementitious grout and flexible sealant. Station S3+62

Photo 6 – Typical cementitious precast panel joint sealing south of Collins Island Bridge

Photo 7 – Minor to Moderate cracking over soldier pile, with partial previous repair. Station N1+54

Photo 8 - Major cracking over soldier pile, with rust staining and previous repair. Station N2+70

Photo 9 – Photo showing flexible sealant present in some locations, but not all.

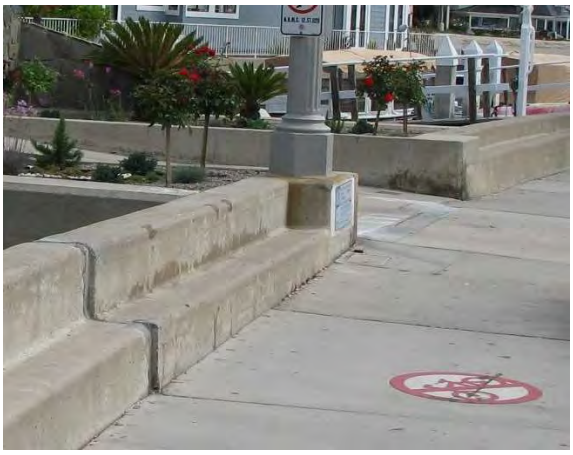


Photo 10 – Offset in wall at change in bulkhead construction. Station S+74

Photo 10 – Major cracks in sidewalk. Station S4+21

Photo 11 – Moderate crack in sidewalk. Station S2+16

3.2 Below water findings

3.2.1 Jet Probe Findings

The jet probe equipment was used to find the bottom of the existing wall panels along the North Wall at 5 locations. Four of these attempts were successful (see Figure 2), with one attempt hitting an obstruction which prevented further penetration. The bottom of the wall panels were found to be consistently at approximately -12 feet, MLLW. This is significantly lower than shown on the original drawings.

The jet probe also determined that the rip rap along the South Wall was at the approximate elevation shown on the 1987 project drawings 16 feet away from the wall. The jet probe was necessary, since mud has shoaled in and covered the rip rap from approximate 8-10 feet from the wall and out.

3.2.2 Jet Probe Findings - Discussion

The discovery of deeper panels along the North Wall was not expected, as precast wall panels necessary for this depth are not shown on the 1935 plans. As Figure 2[2] indicates, the depth of the wall shown on the 1935 drawings is approximately 0.3 ft below MLLW (1935)[3]; MLLW being at project elevation 99.11 and the bottom of the panel at 98.8. At a depth of -12 ft below current MLLW, the panels are approximately 11 ft lower than shown. The drawings indicate that wall panel Type "B" was to be used at this location, which is only 7'-3" high. The panel actually used would need to have been about 18 ft tall. Type "B" piles were also specified for this

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[2] Stationing is according to 1935 drawings. Approximate equation to the stationing used in the data tables and drawings in this report is STA 0.0 = STA 27.50 (1935)

[3] Mean Lower Low Water (MLLW) has increased over the 80+ years from 1935 to 2016. According to the NOAA historical tidal data for station 9410580 Newport Beach, CA (NOAA 2016), the average rise is about 2.22 ± 1.04 mm/year, or 182 ± 85 mm = 7.2 ± 3.3 in. ≈ 0.6 ± 0.3 ft. A correction value of +0.6 ft has been used in this study.

location. Per details on sheet 9, these piles are only 12'-3" long. To be effective, they would also need to be increased in length.

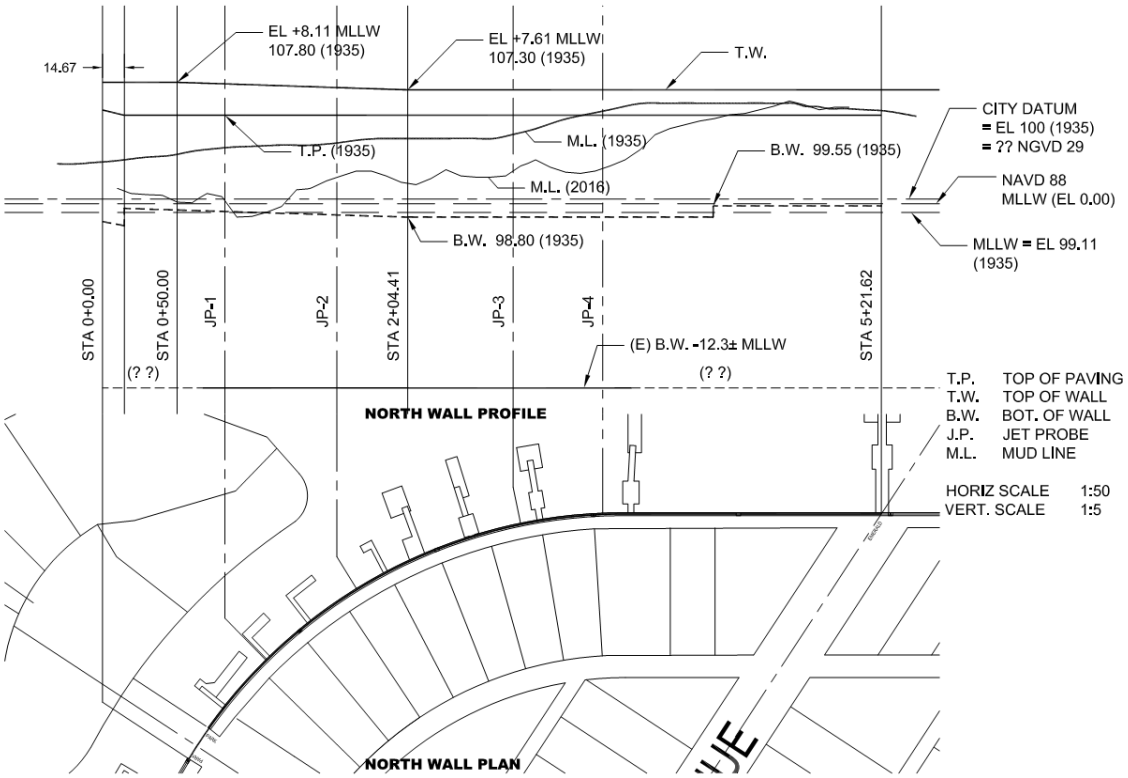

Figure 2 - Plan and Profile of Existing Wall North of Collins Island

To understand this situation better, historical aerial photographs were ordered for Balboa Island and Newport Harbor (UCSB 1927 - 1945). Available flight dates were: ?/1927, 10/1/1928, 5/22/1931, 5/23/1938, 11/1/1945, and later. Three photos before the circa 1935 construction and two after were ordered and examined. The photos varied in quality, graininess, and scale. They were provided as large format electronic TIFF files which were downloaded, cropped, converted, and assembled into a PDF file. The current image from Google Earth was also included. The photos were resized and registered (visual approximation) to the centerlines of Park, Emerald, and Garnet avenues for easy comparison. Also an oblique aerial photo from 1921 from the Spence Air Photo collection was reviewed (Wikipedia 1921). The photos are provided in Appendix D.

All of the photos show a clean smooth circular shoreline around the west end of Balboa Island with a clear and sharp distinction between water and land. This is indicative of a seawall structure being in place before 1921. The type construction is not known north of Park Ave, although the 1921 oblique photo shows the north and south walls being virtually continuous. The 1935 drawings incorporate the existing concrete seawall south of Park into the project, but not the north wall.

The photos prior to 1935 show a smooth curve in the North Wall up to about ½ the distance from Park to Emerald (the 1921 oblique photo also suggests an ending of the north wall in this vicinity). Here, an angle point in the alignment is clearly seen on three photos, as indicated. This angle point disappears in the 1938 and later photos. One possible explanation for this is that the new wall in the area was constructed outside the old wall. In so doing, the alignment was smoothed out and the angle point disappeared. The old wall could have been abandoned in place, or later removed if thought necessary. Another possibility is that the top of the existing wall was cut down to just below the mudline, and the new wall was constructed on top. The 1935 drawings are silent on the matter.

The time of day of the various flights is unknown, thus the tide level cannot be determined. But generally, there is no sand buildup along the west end of the wall as there is along north towards the east. Thus, the mudline shown for the North wall near Park Ave. was drawn too high. It should have been more like the mudline shown on the profile for the existing wall south of Park.

Under the scenario developed above, the contractor approaching the deeper mudline probably requested a design change, which was implemented but never recorded back to the drawings. The details of the construction remain unknown.

3.2.3 Profiles

Profiles along the wall and perpendicular to the wall for the North and South walls were developed from the soundings taken. These are provided in Appendix A.

4 REPAIR RECOMMENDATIONS

The following are our recommendations for repairs, listed by priority.

4.1 Immediate repairs

1. None. No defects were found that require immediate repairs.

4.2 Priority repairs, within a year

1. As soon as possible, cracks and spalls exhibiting rust staining should be repaired to seal off and prevent further corrosion of the reinforcing within the wall.
2. Major cracks, with or without rust staining should be sealed.
3. Closed and open spalls without rust staining should be repaired to restore cover to the reinforcing within the walls.
4. Although not an integral part of the bulkhead wall, the sidewalk south of Park Avenue could be repaired to help to slow the flow of water island-side of the wall at high tide. The grade beneath the damaged areas of sidewalk should be thoroughly compacted to provide a solid base for the new concrete.

It is anticipated that these repairs will be completed with the seawall cap raise project currently under design and permitting.

4.3 Future repairs

We recommend monitoring the walls every three to five years, for progression of minor and moderate cracking to major, or severe conditions. If the above repairs are done within the suggested timeframe, the next inspection should take place five years hence. If the recommended repairs cannot be completed within the proposed

timeframe, an inspection in 3 years should be undertaken to determine the status of items listed above with respect to further deterioration.

5 STRUCTURAL CAPACITY RATING

Structural analysis and capacity ratings are beyond the scope of this report. However, nothing was found that would invalidate the analyses done by Cash and Associates in 2005. Almost all of the defects observed are due to corrosion of reinforcing, impact, or erosion. The offset of the wall of approximately 1½ inches just south of the Collins Island Bridge does suggest that the older section of wall has displaced outward. This displacement is shown, but not quantified, in a photograph in the Cash & Associates report of 2005 (C&A 2005, tab 15, p. 9). The wall does not appear to have moved measurably since then.

Vertical cracks, mostly located in line with the precast wall panels along the Southern Wall, have propagated through the "Type "D" coping. This is likely due to the development of "hoop stress" in the coping, as walls in a circular arc arrangement lean outward due to deterioration and failure of the steel tie-back rods, as noted in the 1985 Cash and Associates report (C&A 1985). Cracking will continue to occur even if all were repaired. These cracks, while deleterious to the coping and reinforcing over time, do not pose an imminent structural hazard.

Seismic performance of the walls has not been evaluated.

6 REPAIR COST ESTIMATES

Repair costs are incidental to the work included in the cap raise project under design by COWI at this writing, and thus not separately itemized herein. As noted in Section 4 above, urgent repairs to the seawall are not required.

7 REFERENCES

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APPENDIX A – Plans

C:\! JWK Temp\A078496 Balboa Island West End\NBLogo.jpg

CONDITION ASSESSMENT
INSPECTION REPORT
BALBOA ISLAND, WEST END
2016

DRAWING INDEX

Notes Regarding Stationing: Stationing as shown here is approximate, sufficient to locate the deficiencies cited, but not represented to be "surveyed." Stationing designates approximate center of wide (along the length of wall) defects.

Nomenclature

Deterioration	Abrassion, Bearing, Checking, Clamp, Cracks, Damaged Wrap, Delamination, Exposed Timber, Fire Damage, Lag screws, Loose bolts, Loose wedge, Mechanical, Missing, Missing bolts, Missing lag bolts, Missing wrap, None, Rust, Scour, Section loss, Shell peelinng, Split, Teredo, Void, Open Spall, Closed Spall, Etc. as noted
Bent1	N/A
Bent2	N/A
Station	Balboa Island Stationing
Waterside/IslandSide	WS/IS denotes whether damage is located on the waterside or Island side of the Wall
RowLocation	N/A
Dist from Top of Coping	Distance from top of coping is approximate to the center of the defect for locating purposes
DefectID	Defect identification number
MinorityElement	Superstructure (Blocking, Brace, Deck, Diag Strap, Fire Line, Gas Line, Light Pole, Long. Bracing, Pile Cap, Strap, Stringer, Trans. Bracing or Utility)
Zone	Timber Pile Zone: ATM = Atmospheric zone — Area above the upper limit of the splash zone, which remains consistently dry. However, the area may be subject to salt-laden air. SZ = Splash zone — Area above the high water mark (MHHW, MHW, MHWS, etc.) that is subject to constant wetting and drying due to splashing of water. TZ = Tidal zone — Area between the low water mark (MLW, MLLW, MLWS, etc.) and the lower limit of the splash zone. TOP = Top of pile — Area at top of pile ML = Mudline — At mudline elevation FH = Full Height — From mudline to top of pile WT = Wrap top — Concrete encasement, If applicable
Rating	Severe, Major, Moderate, Minor, No Defects
Length	Length of defect
Width	Width of defect
Depth	Depth of defect
Comment	Additional information on the defect

TITLE SHEET SCALE N.T.S.

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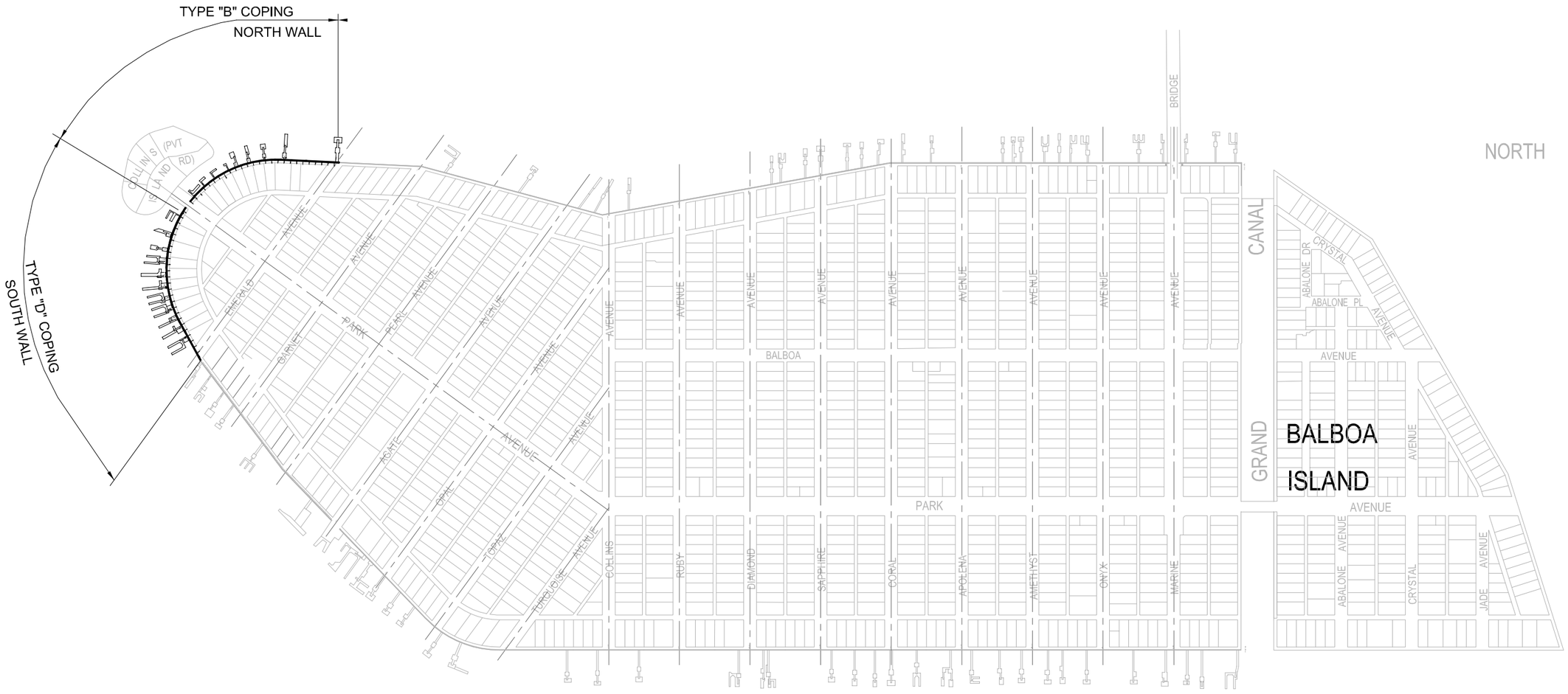

OVERALL PLAN

SCALE
N.T.S.

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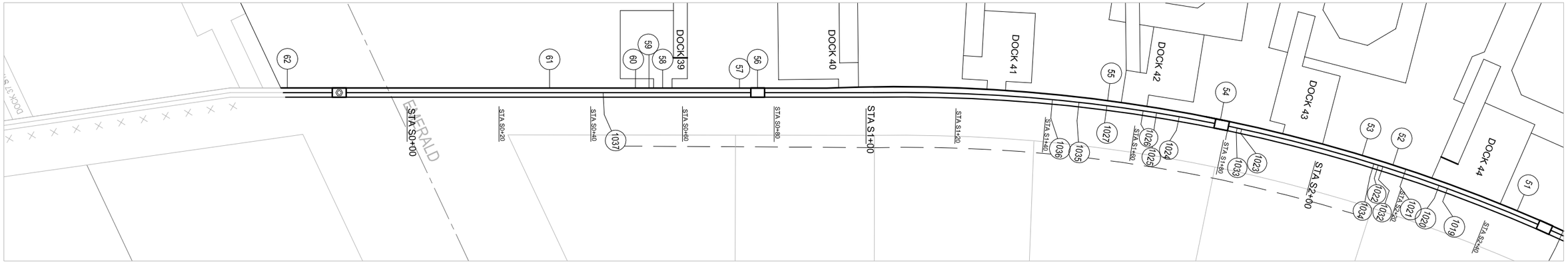
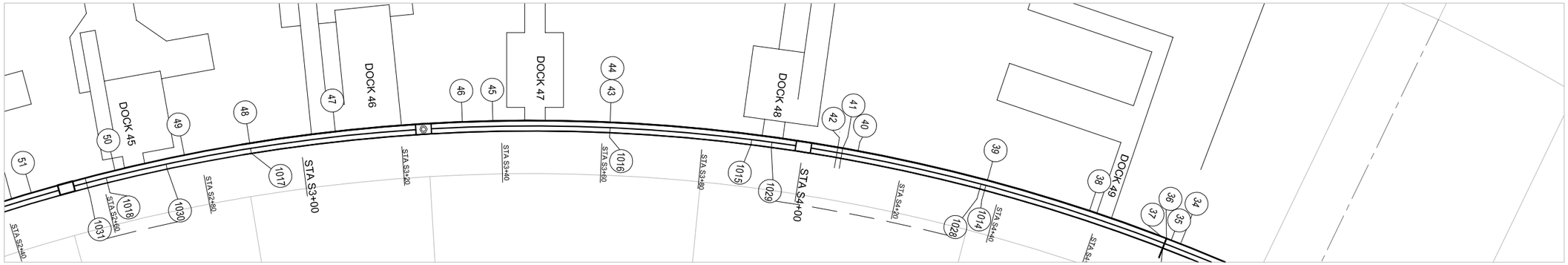


EMERALD AVE. - Dock 44 (SOUTH BAY FRONT)

Deterioration	Station	Waterside/ Islandside	Distance from Top of Coping	DefectID	MinorityElement	Super Element*	Zone	Rating	Length	Width	Depth	Comment
Expansion Joint	-S0+27	WS	40	62	Coping Type C	Wall	TZ	ND				JUST TO NOTE THE APPROXIMATE LIMIT OF THE DIFFERENT WALL CONSTRUCTION TYPE. WALL TRANSISTIONS BACK TO DRIVEN PRECAST PILES.
Erosion	S0+31	WS	40	61	Coping Type D	Wall	TZ	Minor				EROSION AT BOTTOM OF ORIGINAL COPING FROM ~STA SOUTH 04+62 TO 05+10. PROBABLY DUE TO WASHUP OF WAVES.
Cracks	S0+43	IS		1037	Sidewalk	Sidewalk	ATM	Moderate				END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 38+31
Erosion	S0+50	WS	60	60	Coping Type D	Wall	TZ	Minor				EROSION POSSIBLY DUE TO GREATER EXPOSER, NO BOATS, FROM STA S 04+43 TO PAST EMERALD AVE. FINES HAVE BEEN WASHED AWAY EXPOSING AGGREGATE.
Voids	S0+53	WS	45	59	Coping Type D	Wall	TZ	Minor	4	2	1/2	2 VOIDS IN THE CONCRETE. MAY BE ORIGINAL. NO RUST STAINING, BUT REDUCING COVER TO REINFORCING.
Impact Spall	S0+56	WS	40	58	Coping Type D	Wall	TZ	Minor	6	2	1	IMPACT SPALLS AT PANEL EDGES. NO RUST STAINS OR EXPOSED REINFORCING
Cracks	S0+73	WS	30	57	Coping Type D	Wall	TZ	Moderate	38	1/8		VERTICAL CRACK TO JUST ABOVE THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. PREVIOUSLY REPAIRED.
Cracks	S0+77	WS	30	56	Coping Type D	Wall	TZ	Moderate	36	1/8		VERTICAL CRACK TO JUST ABOVE THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. PREVIOUSLY REPAIRED.
Cracks	S1+48	IS		1035	Sidewalk	Sidewalk	ATM	Major		1/4		END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 38+83
Cracks	S1+54	WS	20	55	Coping Type D	Wall	TZ	Moderate	50	1/8		"Y" SHAPED VERTICAL CRACK THROUGH ORIGINAL SLAB CAP AND TYPE D COPING. PARTIAL PREVIOUS REPAIR. SLIGHT RUST STAINING
Cracks	S1+54	IS	12	1027	Coping Type D	Wall	ATM	Major	48	20		CRACKS AND SPALLS THROUGH WALL
Cracks	S1+62	IS		1036	Sidewalk	Sidewalk	ATM	Moderate				BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 37+12
Cracks	S1+62	IS	12	1026	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S1+65	IS	12	1025	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACKED CONSTRUCTION JOINT
Cracks	S1+70	IS	12	1024	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S1+79	WS	20	54	Coping Type D	Wall	TZ	Moderate	40	1/8		VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REPAIRED.
Cracks	S1+83	IS		1033	Sidewalk	Sidewalk	ATM	Moderate	60	1/8		CRACK IN SIDEWALK
Cracks	S1+84	IS	12	1023	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+11	WS	20	53	Coping Type D	Wall	TZ	Moderate	48	1/8		DIAG/VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REAPIRS, REAPIR FAILING.
Cracks	S2+14	IS		1034	Sidewalk	Sidewalk	ATM	Major		1/4		BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 38+17
Cracks	S2+15	IS	12	1022	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+16	IS		1032	Sidewalk	Sidewalk	ATM	Moderate	48	1/8		CRACK IN SIDEWALK
Cracks	S2+18	WS	20	52	Coping Type D	Wall	TZ	Minor	40	1/16		VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REPAIRED, REPAIR FAILING.
Cracks	S2+21	IS	12	1021	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+29	IS	12	1020	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+31	IS	12	1019	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+47	WS	30	51	Coping Type D	Wall	TZ	Moderate	20	1/8		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING. PREVIOUSLY REPAIRED.

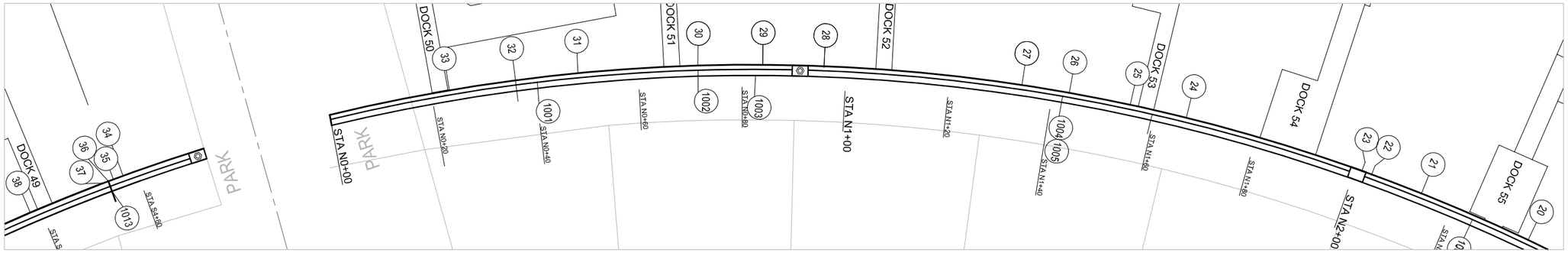
DEFECT PLANS

SCALE 1"=10'-0"



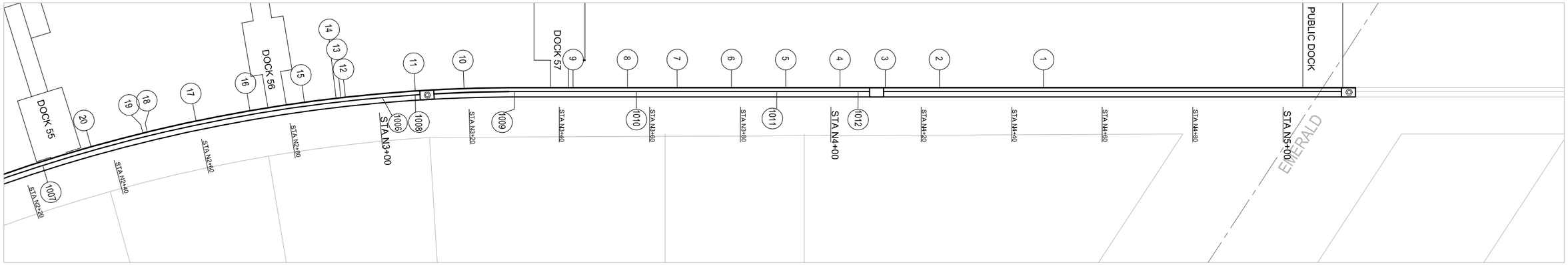
DOCK 44 - DOCK 49 (SOUTH BAY FRONT)

Cracks	S2+47	WS	30	51	Coping Type D	Wall	TZ	Moderate	20	1/8	VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING. PREVIOUSLY REPAIRED.
Cracks	S2+58	IS		1031	Sidewalk	Sidewalk	ATM	Moderate			END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 39+43
Spall	S2+62	IS	12	1018	Coping Type D	Wall	ATM	Major	48	36	FAILING REPAIR, CRACKS AND SPALLS THROUGH WALL
Cracks	S2+64	WS	20	50	Coping Type D	Wall	TZ	Moderate	40	1/8	VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REPAIRED, REPAIR FAILING.
Cracks	S2+74	IS		1030	Sidewalk	Sidewalk	ATM	Moderate			BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 39+27
Cracks	S2+78	WS	30	49	Original Wall Slab	Wall	TZ	Moderate	20	1/8	VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING. PREVIOUSLY REPAIRED.
Spall	S2+91	IS	12	1017	Coping Type D	Wall	ATM	Major	48	12	CRACKS AND SPALLS THROUGH WALL
Rust	S2+92	WS	24	48	Coping Type D	Wall	TZ	Moderate	30	4	VERTICAL RUST STAINED PATCH. POSSIBLY DUE TO REPAIR GROUT NOT BEING NON-METALLIC.
Rust	S3+08	WS	36	47	Original Wall Slab	Wall	TZ	Moderate	2	2	3 RUSTED PLUGS OR FITTINGS LOCATED IN THE FACE OF THE ORIGINAL WALL COPING. NO SPALLING ASSOCIATED WITH THE RUST.
Closed Spall	S3+33	WS	40	46	Original Wall Slab	Wall	TZ	Moderate	10	5	2 CLOSED SPALL APPARENTLY FROM IMPACT. PREVIOUSLY REPAIRED, RECRACKING AT REPAIR.
Closed Spall	S3+39	WS	40	45	Original Wall Slab	Wall	TZ	Moderate	10	3	2 CLOSED SPALL APPARENTLY FROM IMPACT. PREVIOUSLY REPAIRED, RECRACKING AT REPAIR.
Cracks	S3+62	WS	30	44	Original Wall Slab	Wall	TZ	Moderate	40	1/8	VERTICAL CRACK, PREVIOUSLY REPAIRED, EXTENDING FROM PANEL JOINT TO TOP OF COPING.
Spall	S3+62	WS	30	43	Coping Type D	Wall	TZ	Moderate	48	10	2 LARGE SPALL AT BOTTOM OF ORIGINAL SLAB COPING CENTERED ON VERTICAL SLAB JOINT. NO EXPOSED REINFORCING.
Spall	S3+62	IS	12	1016	Coping Type D	Wall	ATM	Major	48	12	CRACKS AND SPALLS THROUGH WALL
Cracks	S3+90	IS	12	1015	Coping Type D	Wall	ATM	Moderate	48	1/8	CRACK THROUGH COPING
Cracks	S3+94	IS		1029	Sidewalk	Sidewalk	ATM	Moderate			END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 41+05
Cracks	S4+02	WS	0	42	Coping Type D	Wall	ATM	Minor	48	1/16	MINOR CRACKS AT TOP OF PREVIOUS PATCH
Cracks	S4+08	WS	36	41	Coping Type D	Wall	TZ	Minor	30	1/16	VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Cracks	S4+11	WS	36	40	Coping Type D	Wall	TZ	Minor	24	1/16	VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Cracks	S4+36	IS		1028	Sidewalk	Sidewalk	ATM	Moderate			BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 40+63
Cracks	S4+37	WS	36	39	Coping Type D	Wall	TZ	Moderate	30	1/8	VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Cracks	S4+37	IS	12	1014	Coping Type D	Wall	ATM	Moderate	48	1/8	CRACK PREVIOSULY REPAIRED
Cracks	S4+58	WS	36	38	Coping Type D	Wall	TZ	Moderate	24	1/8	VERTICAL CRACK ON BOTTOM HALF OF THE TYPE D COPING. NO RUST STAINS APPARENT.
	S4+73	WS	40	37	Coping Type D	Wall	TZ	ND	24	8	2 REPAIRED SPALL AT WEST END OF NEW (ALL PANEL, NO PILE) WALL TYPE COPING.
Expansion Joint	S4+74	IS	12	1013	Coping Type B	Wall	ATM	Moderate			EXPANSION JOINT OFFEST APPROX 1-1/2"
	S4+74	WS		36	Expansion Joint	Wall	TZ	ND			NO DAMAGE HERE. NOTE TO IDENTIFY TRANSISTION OF WALL TYPE.
Open Spall	S4+75	WS	30	35	Coping Type B	Wall	TZ	Moderate	9	5	3 SPALL AT END OF PRECAST PILE AND SLAB BULKHEAD
Spall	S4+77	WS	48	34	Wall Panel	Wall	TZ	Moderate	12	6	DELAMINATION 1 FT BELOW BOTTOM OF COPING



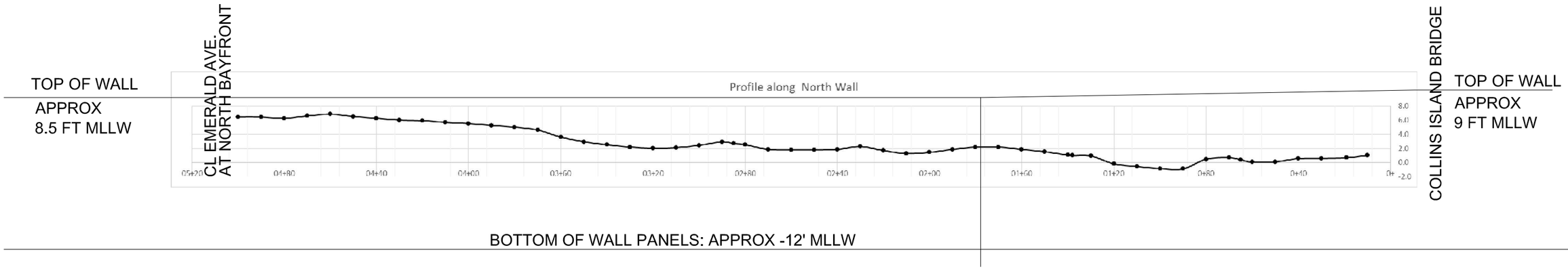
DOCK 40 - PARK AVE. - DOCK 55 (NORTH BAY FRONT)

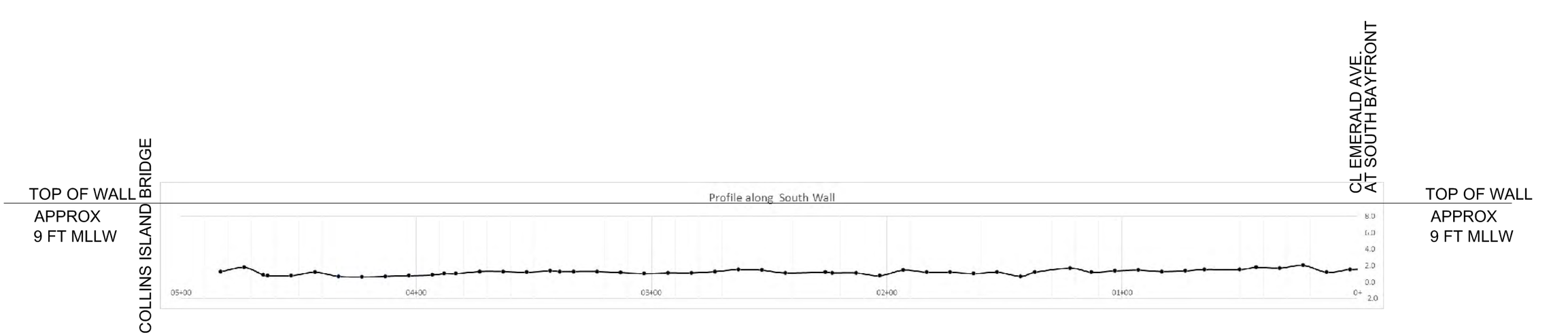
Spall	S4+77	WS	48	34	Wall Panel	Wall	TZ	Moderate	12	6		DELAMINATION 1 FT BELOW BOTTOM OF COPING
Cracks	N0+24	WS	12	33	Coping Type B	Wall	TZ	Minor	24	1/8		TYPICAL CRACK, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N0+36	WS	16	32	Coping Type B	Wall	TZ	Moderate	144	1/8		MULTIPLE TYPICAL CRACKS, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Total length of cracks estimated) Runs beyond repair to next pile at Sta 00+24).
Cracks	N0+40	IS	0	1001	Coping Type B	Wall	ATM	Minor	216	1/16		LONGITUDINAL CRACK ALONG TOP OF COPING.
Cracks	N0+48	WS	12	31	Coping Type B	Wall	TZ	Minor	42	1/8		TYPICAL CRACK, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N0+71	WS	18	30	Coping Type B	Wall	TZ	Moderate	6	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR
Cracks	N0+71	IS	0	1002	Coping Type B	Wall	ATM	Minor	132	1/16		LONGITUDINAL CRACK ALONG TOP OF COPING.
Expansion Joint	N0+82	IS	0	1003	Coping Type B	Wall	ATM	Minor				SEALING AT EXPANSION JOINT IS CRACKING
Cracks	N0+83	WS	19	29	Coping Type B	Wall	TZ	Major	36	1/8		CRACKS WITH HEAVY RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Expansion Jt. at Approx Sta 00+82)
Cracks	N0+95	WS	12	28	Coping Type B	Wall	TZ	Moderate	24	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N1+33	WS	15	27	Coping Type B	Wall	TZ	Major	48	1/8		CRACKS WITH HEAVY RUST STAINING IN COPING LOCATED MOSTLY NORTH OF CONCRETE PILE. PREVIOUS REPAIR PRESENT. SMALL CLOSED SPALL PRESENT.
Closed Spall	N1+41	IS	9	1004	Coping Type B	Wall	ATM	Moderate	12	4		PREVIOUS CRACKS REPAIR FAILING, RESULTING IN CLOSED SPALL ON LOWER STEP OF COPING.
Cracks	N1+41	IS	12	1005	Coping Type B	Wall	ATM	ND	12			THREE CRACKS THROUGH TOP OF COPING. PREVIOUSLY REPAIRED.
Cracks	N1+42	WS	15	26	Coping Type B	Wall	TZ	Minor	60	1/16		2 TYP CRACKS WITH RUST IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR (Length is approx)
Cracks	N1+54	WS	19	25	Coping Type B	Wall	TZ	Minor	36	1/16		TYPICAL CRACK WITH NO STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N1+65	WS	12	24	Coping Type B	Wall	TZ	Minor	120	1/8		3 TYPICALLY SHAPED CRACKS WITH MINIMAL RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Length is approx)
Cracks	N2+00	WS	18	23	Coping Type B	Wall	TZ	Moderate	24	1/8		TYPICAL CRACK WITH SLIGHT RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT. EXPANSION JOINT AT STA 01+99
Open Spall	N2+02	WS	23	22	Coping Type B	Wall	TZ	Moderate	12	5	2	SPALL AT CONDUIT EGRESS
Cracks	N2+12	WS	14	21	Coping Type B	Wall	TZ	Moderate	18	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N2+23	IS	12	1007	Coping Type B	Wall	ATM	ND	6	1/32		CRACK PREVIOUSLY REPAIRED
Cracks	N2+35	WS	20	20	Coping Type B	Wall	TZ	Moderate	18	1/8		NOT A TYPICAL CRACK - IT BEGINS AT THE BOTTOM OF THE COPING AND EXTENDS SOUTHWARD AND UPWARD.



DOCK 55 - PUBLIC DOCK AT EMERALD AVENUE (NORTH BAY FRONT)

Cracks	N2+23	IS	12	1007	Coping Type B	Wall	ATM	ND	6	1/32		CRACK PREVIOUSLY REPAIRED
Cracks	N2+35	WS	20	20	Coping Type B	Wall	TZ	Moderate	18	1/8		NOT A TYPICAL CRACK - IT BEGINS AT THE BOTTOM OF THE COPING AND EXTENDS SOUTHWARD AND UPWARD.
Closed Spall	N2+46	WS	18	19	Coping Type B	Wall	TZ	Major	24	12		CLOSED SPALL FROM MIDHEIGHT TO BOTTOM OF FACE OF COPING
Cracks	N2+47	WS	12	18	Coping Type B	Wall	TZ	Major	56	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N2+58	WS	15	17	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N2+70	WS	15	16	Coping Type B	Wall	TZ	Major	60	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR
Cracks	N2+82	WS	18	15	Coping Type B	Wall	TZ	Minor	54	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Impact Spall	N2+89	WS	21	14	Coping Type B	Wall	TZ	Moderate	2	2	1/2	SMALL IMPACT SPALL AT WATERSIDE FACE OF COPING
Closed Spall	N2+90	WS	21	13	Coping Type B	Wall	TZ	Moderate	6	2 1/2		CLOSED SPALL AT BOTT CORNER OF COPINGWATERSIDE.
Impact Spall	N2+91	WS	21	12	Coping Type B	Wall	TZ	Moderate	1	1	1/2	SMALL IMPACT SPALL AT WATERSIDE FACE OF COPING
Expansion Joint	N2+99	IS	12	1006	Coping Type B	Wall	ATM	Minor				SEALING AT EXPANSION JOINT IS CRACKING
Impact Spall	N3+06	WS	12	11	Coping Type B	Wall	TZ	Major	4	3	1/2	OPEN SPALL AT FACE OF COPING. SMALL (1/8" DIA) VOID AT CENTER OF SPALL.
Rust	N3+06	IS	12	1008	Coping Type B	Wall	ATM	Minor	42	4		RUST STAINS EMINATING FROM FACE OF CONCRETE. NO SPALLING. NO EXPOSED STEEL.
Cracks	N3+17	WS	16	10	Coping Type B	Wall	TZ	Minor	30	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. CRACK STOPS AT EXPANSION/CONSTRUCTION JOINT AT 03+16 +/-
Closed Spall	N3+28	IS	9	1009	Coping Type B	Wall	ATM	Moderate	12	4		PREVIOUS CRACKS REPAIR FAILING, RESULTING IN CLOSED SPALL ON LOWER STEP OF COPING.
Cracks	N3+41	WS	18	9	Coping Type B	Wall	TZ	Minor	18	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N3+53	WS	12	8	Coping Type B	Wall	TZ	Minor	48	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N3+55	IS	12	1010	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.
Cracks	N3+64	WS	16	7	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N3+76	WS	16	6	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N3+86	IS	12	1011	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.
Cracks	N3+88	WS	12	5	Coping Type B	Wall	TZ	Minor	50	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N4+00	WS	16	4	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N4+04	IS	12	1012	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.
Cracks	N4+10	WS	14	3	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. CLOSED SPALL
Cracks	N4+22	WS	14	2	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N4+45	WS	14	1	Coping Type B	Wall	TZ	Moderate	36	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE





GROUND PROFILES ALONG WALLS

SCALE
NTS

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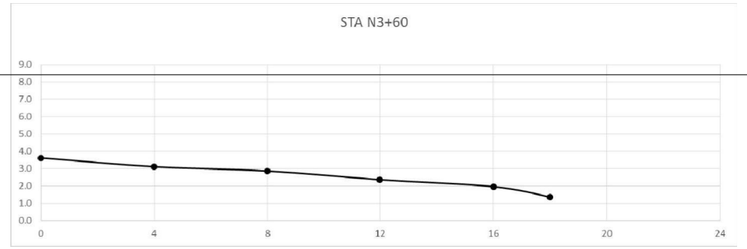
TOP OF WALL

APPROX
8.5 FT MLLW



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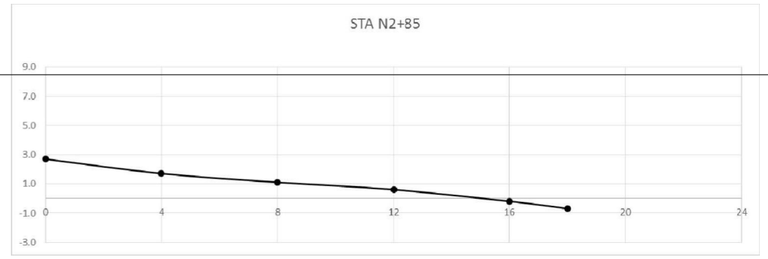

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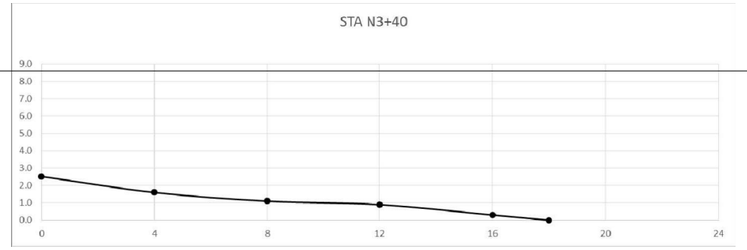

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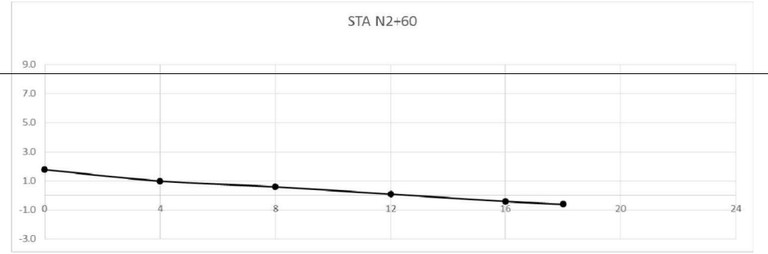

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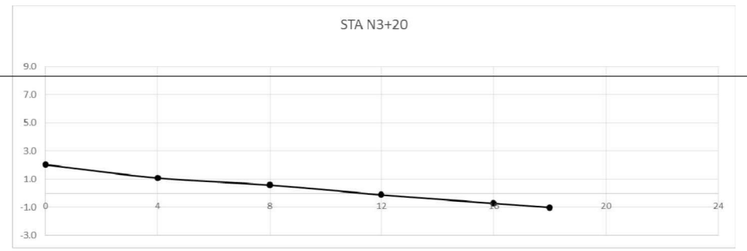

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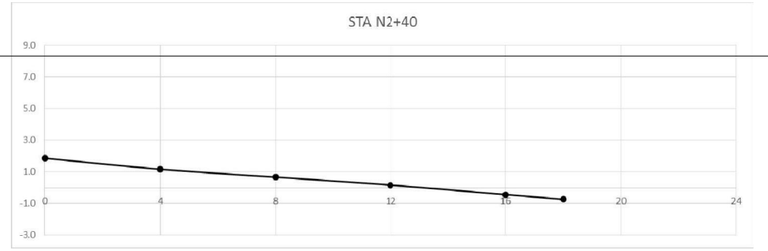

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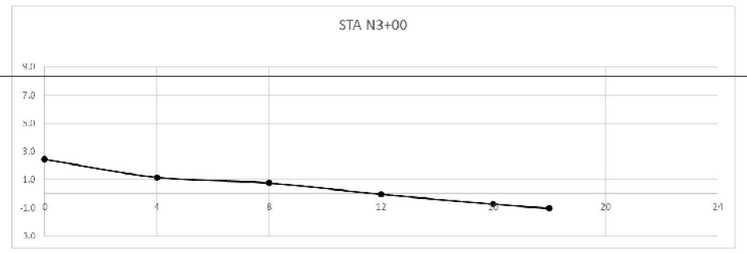

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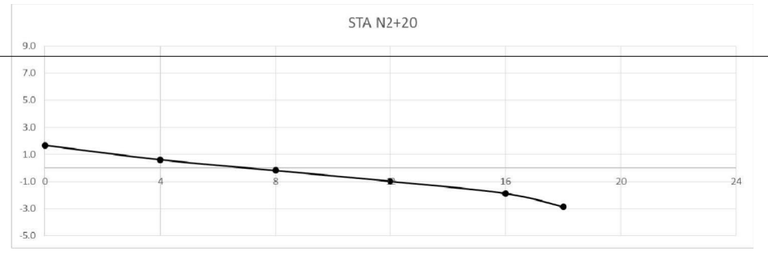
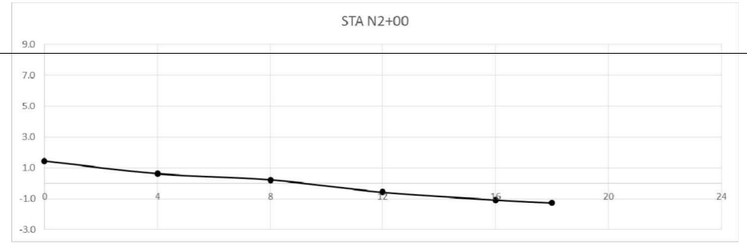


GROUND PROFILES PERPENDICULAR
TO NORTH WALL

SCALE
NTS

TOP OF WALL

APPROX
8.5 FT MLLW



TOP OF WALL

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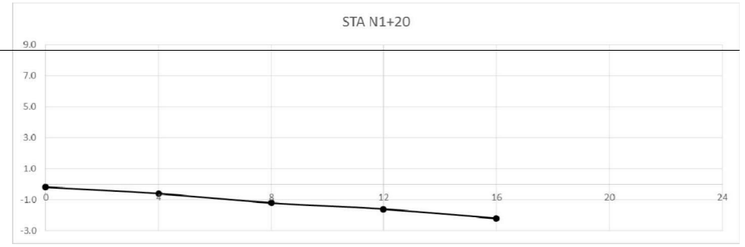
8.66 FT MLLW



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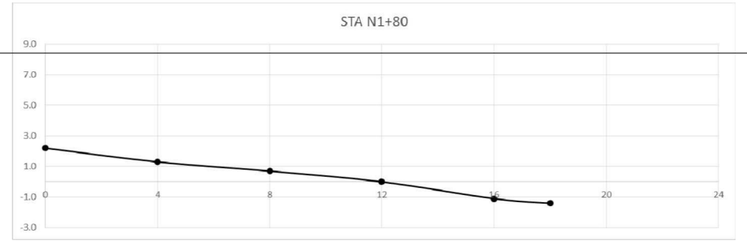

TOP OF WALL

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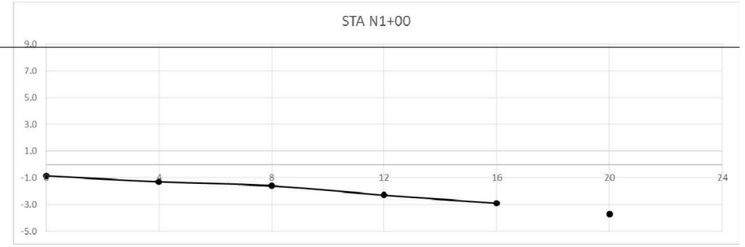
8.7 FT MLLW



TOP OF WALL

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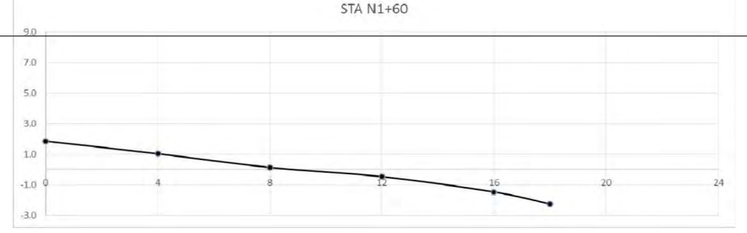

TOP OF WALL

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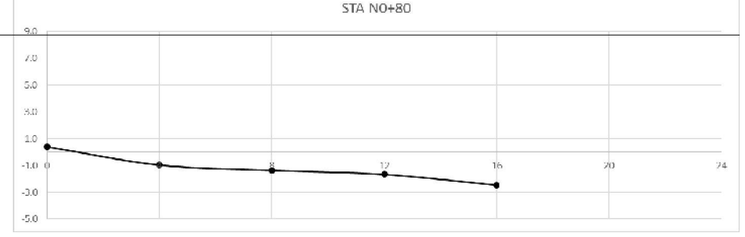

TOP OF WALL

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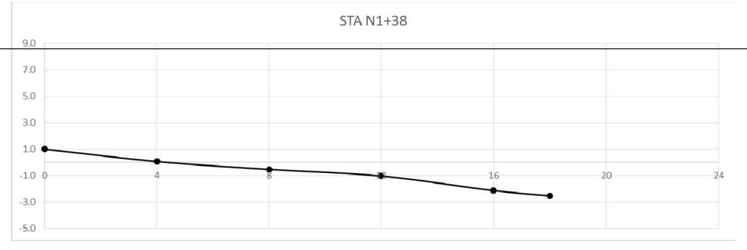

TOP OF WALL

APPROX
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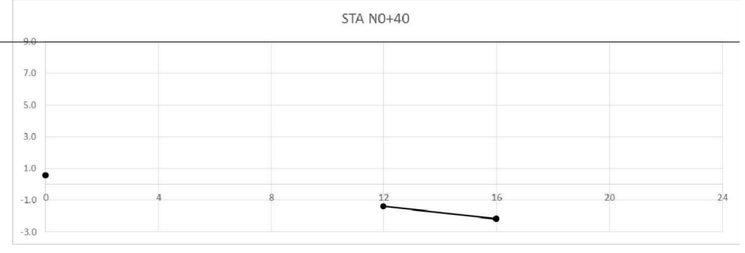
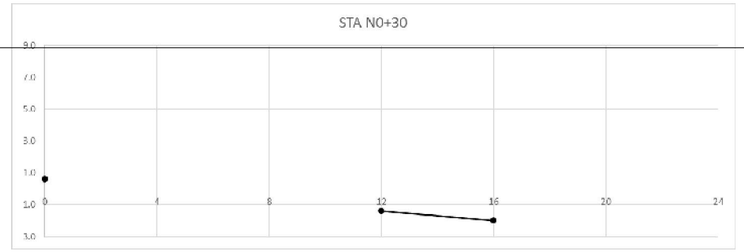


GROUND PROFILES PERPENDICULAR
TO NORTH WALL

SCALE
NTS

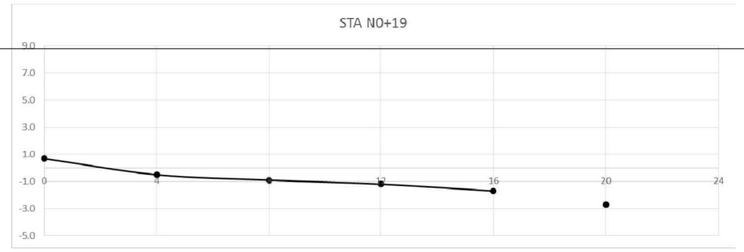
TOP OF WALL

APPROX
8.9 FT MLLW



TOP OF WALL

APPROX
8.92 FT MLLW



TOP OF WALL

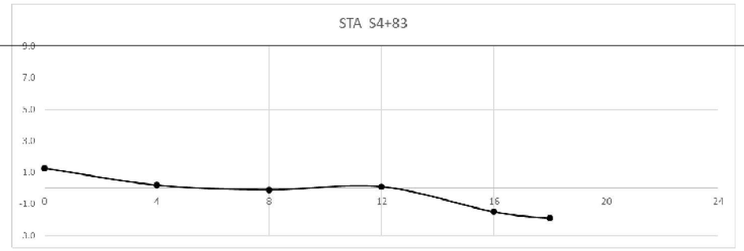
APPROX
8.94 FT MLLW

GROUND PROFILES PERPENDICULAR
TO NORTH WALL

SCALE
NTS

TOP OF WALL

APPROX
9 FT MLLW



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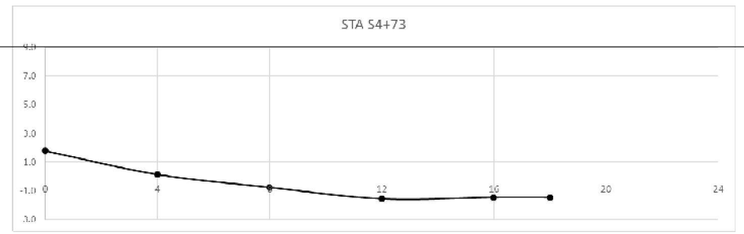

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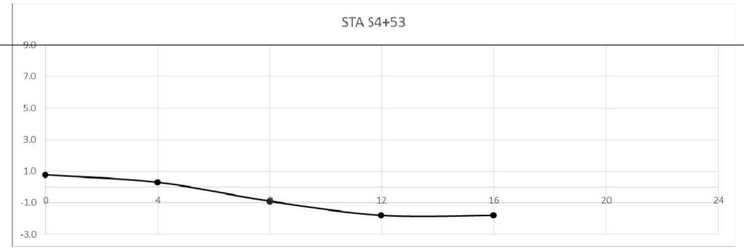

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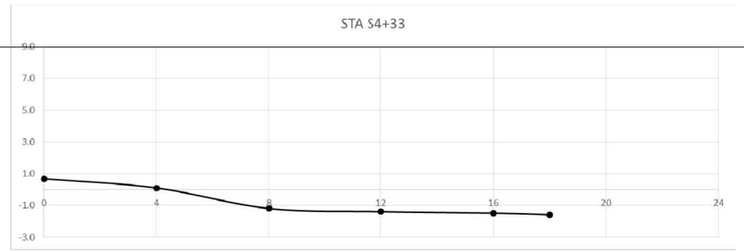

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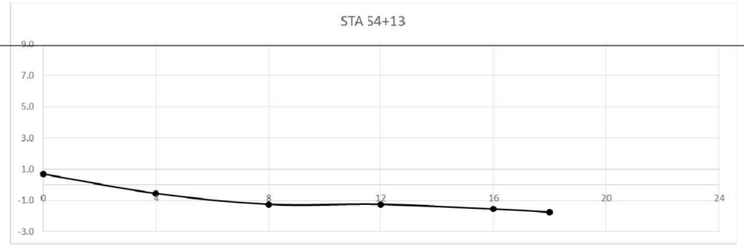

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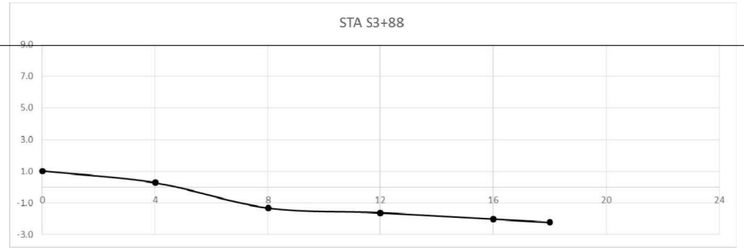

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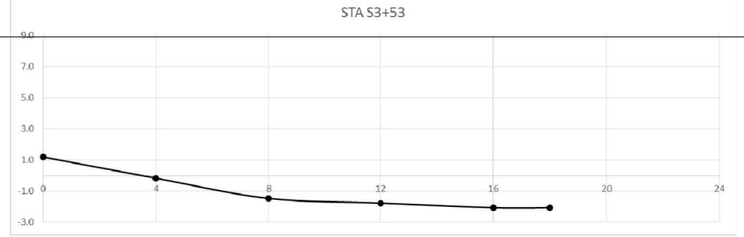

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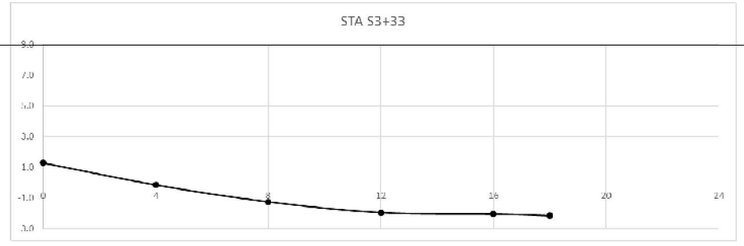
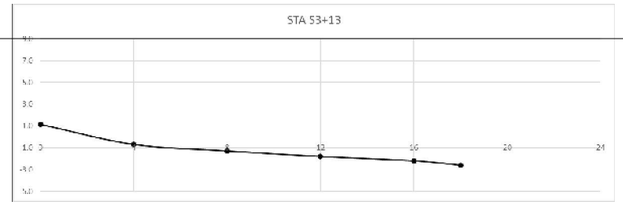


GROUND PROFILES PERPENDICULAR
TO SOUTH WALL

SCALE
NTS

TOP OF WALL

APPROX
9 FT MLLW



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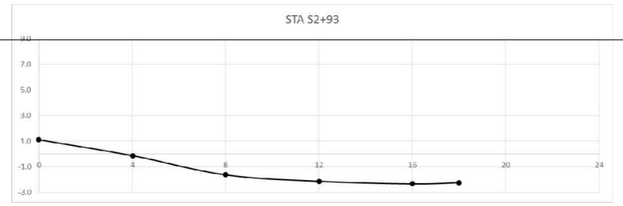

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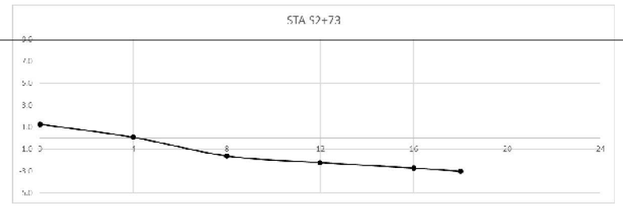

TOP OF WALL

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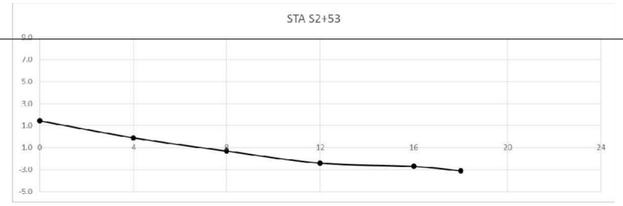

TOP OF WALL

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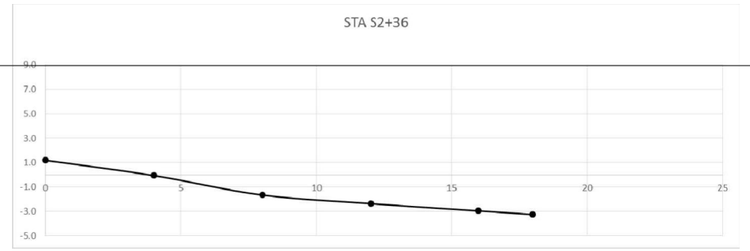

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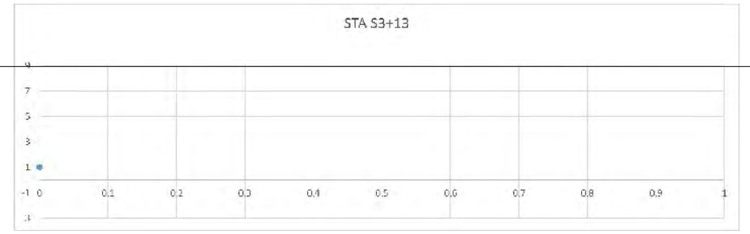

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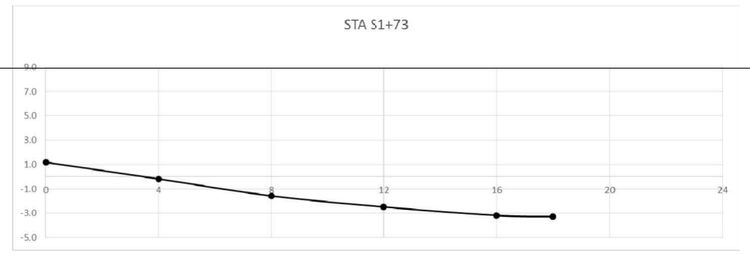
APPROX
9 FT MLLW

TOP OF WALL

APPROX
9 FT MLLW

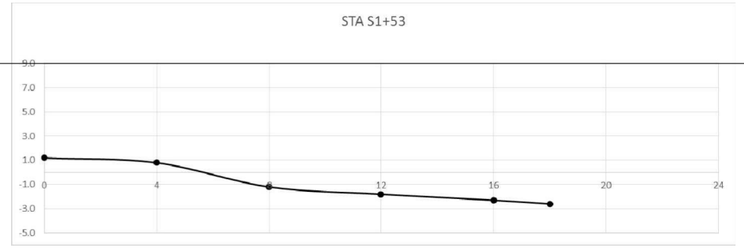


GROUND PROFILES PERPENDICULAR
TO SOUTH WALL

SCALE
NTS

TOP OF WALL

APPROX
9 FT MLLW



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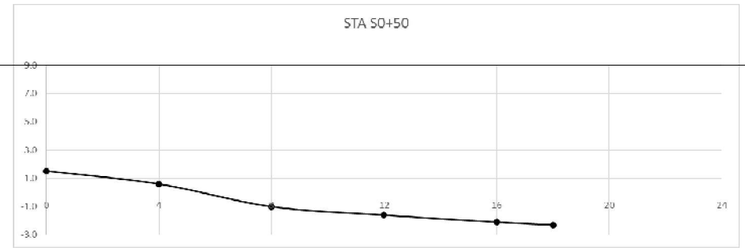

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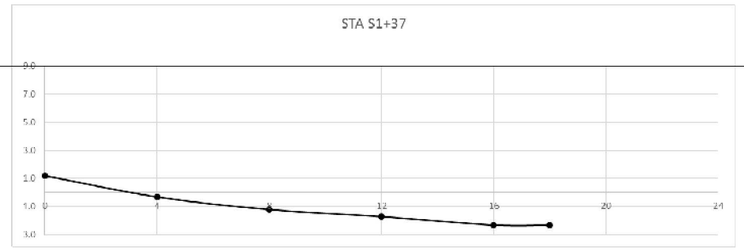

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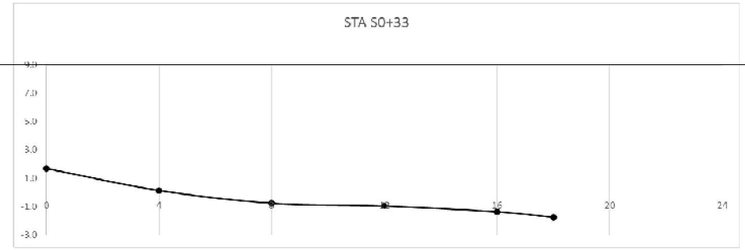

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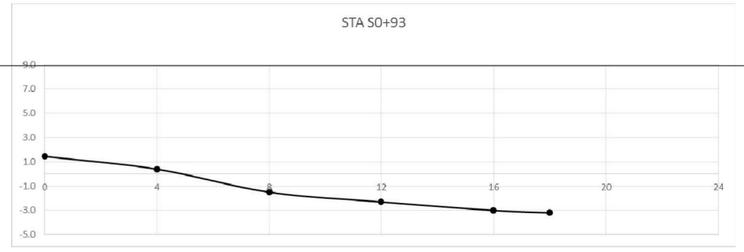

TOP OF WALL

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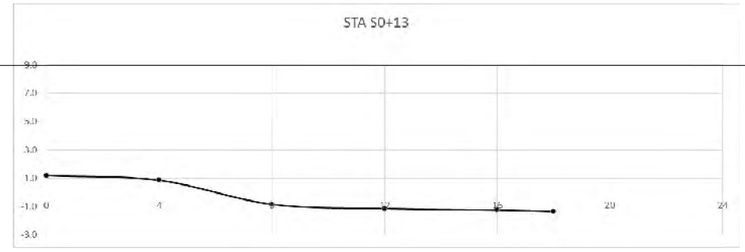

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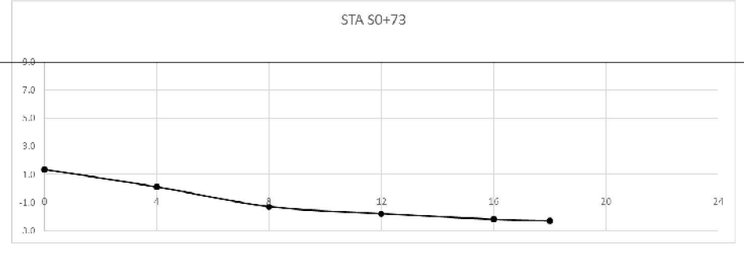

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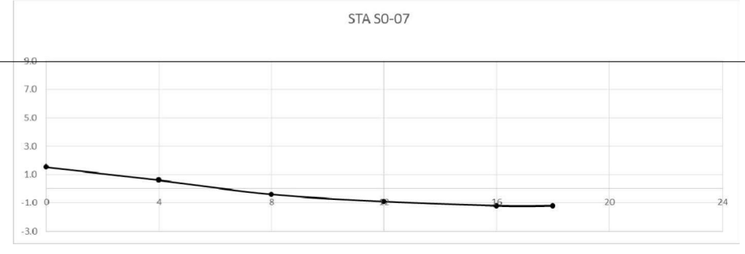


GROUND PROFILES PERPENDICULAR
TO SOUTH WALL

SCALE
NTS

APPENDIX B – Inspection Data

Deterioration	Station	Waterside/ Islandside	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Expansion Joint	-S0+27	WS	40	62	Coping Type C	Wall	TZ	ND				JUST TO NOTE THE APPROXIMATE LIMIT OF THE DIFFERENT WALL CONSTRUCTION TYPE. WALL TRANSISTIONS BACK TO DRIVEN PRECAST PILES.
Erosion	S0+31	WS	40	61	Coping Type D	Wall	TZ	Minor				EROSION AT BOTTOM OF ORIGINAL COPING FROM ~STA SOUTH 04+62 TO 05+10. PROBABLY DUE TO WASHUP OF WAVES.
Cracks	S0+43	IS		1037	Sidewalk	Sidewalk	ATM	Moderate				END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 38+31
Erosion	S0+50	WS	60	60	Coping Type D	Wall	TZ	Minor				EROSION POSSIBLY DUE TO GREATER EXPOSER, NO BOATS, FROM STA S 04+43 TO PAST EMERALD AVE. FINES HAVE BEEN WASHED AWAY EXPOSING AGGREGATE.
Voids	S0+53	WS	45	59	Coping Type D	Wall	TZ	Minor	4	2	1/2	2 VOIDS IN THE CONCRETE. MAY BE ORIGINAL. NO RUST STAINING, BUT REDUCING COVER TO REINFORCING.
Impact Spall	S0+56	WS	40	58	Coping Type D	Wall	TZ	Minor	6	2	1	IMPACT SPALLS AT PANEL EDGES. NO RUST STAINS OR EXPOSED REINFORCING
Cracks	S0+73	WS	30	57	Coping Type D	Wall	TZ	Moderate	38	1/8		VERTICAL CRACK TO JUST ABOVE THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. PREVIOUSLY REPAIRED.
Cracks	S0+77	WS	30	56	Coping Type D	Wall	TZ	Moderate	36	1/8		VERTICAL CRACK TO JUST ABOVE THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. PREVIOUSLY REPAIRED.
Cracks	S1+48	IS		1035	Sidewalk	Sidewalk	ATM	Major		1/4		END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 38+83
Cracks	S1+54	WS	20	55	Coping Type D	Wall	TZ	Moderate	50	1/8		"Y" SHAPED VERTICAL CRACK THROUGH ORIGINAL SLAB CAP AND TYPE D COPING. PARTIAL PREVIOUS REPAIR. SLIGHT RUST STAINING
Cracks	S1+54	IS	12	1027	Coping Type D	Wall	ATM	Major	48	20		CRACKS AND SPALLS THROUGH WALL
Cracks	S1+62	IS		1036	Sidewalk	Sidewalk	ATM	Moderate				BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 37+12
Cracks	S1+62	IS	12	1026	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S1+65	IS	12	1025	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACKED CONSTRUCTION JOINT
Cracks	S1+70	IS	12	1024	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S1+79	WS	20	54	Coping Type D	Wall	TZ	Moderate	40	1/8		VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REPAIRED.
Cracks	S1+83	IS		1033	Sidewalk	Sidewalk	ATM	Moderate	60	1/8		CRACK IN SIDEWALK
Cracks	S1+84	IS	12	1023	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+11	WS	20	53	Coping Type D	Wall	TZ	Moderate	48	1/8		DIAG/VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REAPIRS, REAPIR FAILING.
Cracks	S2+14	IS		1034	Sidewalk	Sidewalk	ATM	Major		1/4		BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 38+17
Cracks	S2+15	IS	12	1022	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+16	IS		1032	Sidewalk	Sidewalk	ATM	Moderate	48	1/8		CRACK IN SIDEWALK
Cracks	S2+18	WS	20	52	Coping Type D	Wall	TZ	Minor	40	1/16		VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REPAIRED, REPAIR FAILING.
Cracks	S2+21	IS	12	1021	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+29	IS	12	1020	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING

Deterioration	Station	Waterside/ Islandside	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Cracks	S2+31	IS	12	1019	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+47	WS	30	51	Coping Type D	Wall	TZ	Moderate	20	1/8		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING. PREVIOUSLY REPAIRED.
Cracks	S2+58	IS		1031	Sidewalk	Sidewalk	ATM	Moderate				END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 39+43
Spall	S2+62	IS	12	1018	Coping Type D	Wall	ATM	Major	48	36		FAILING REPAIR, CRACKS AND SPALLS THROUGH WALL
Cracks	S2+64	WS	20	50	Coping Type D	Wall	TZ	Moderate	40	1/8		VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REPAIRS, REPAIR FAILING.
Cracks	S2+74	IS		1030	Sidewalk	Sidewalk	ATM	Moderate				BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 39+27
Cracks	S2+78	WS	30	49	Original Wall Slab	Wall	TZ	Moderate	20	1/8		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING. PREVIOUSLY REPAIRED.
Spall	S2+91	IS	12	1017	Coping Type D	Wall	ATM	Major	48	12		CRACKS AND SPALLS THROUGH WALL
Rust	S2+92	WS	24	48	Coping Type D	Wall	TZ	Moderate	30	4		VERTICAL RUST STAINED PATCH. POSSIBLY DUE TO REPAIR GROUT NOT BEING NON-METALLIC.
Rust	S3+08	WS	36	47	Original Wall Slab	Wall	TZ	Moderate	2	2		3 RUSTED PLUGS OR FITTINGS LOCATED IN THE FACE OF THE ORIGINAL WALL COPING. NO SPALLING ASSOCIATED WITH THE RUST.
Closed Spall	S3+33	WS	40	46	Original Wall Slab	Wall	TZ	Moderate	10	5	2	CLOSED SPALL APPARENTLY FROM IMPACT. PREVIOUSLY REPAIRED, RECRACKING AT REPAIR.
Closed Spall	S3+39	WS	40	45	Original Wall Slab	Wall	TZ	Moderate	10	3	2	CLOSED SPALL APPARENTLY FROM IMPACT. PREVIOUSLY REPAIRED, RECRACKING AT REPAIR.
Cracks	S3+62	WS	30	44	Original Wall Slab	Wall	TZ	Moderate	40	1/8		VERTICAL CRACK, PREVIOUSLY REPAIRED, EXTENDING FROM PANEL JOINT TO TOP OF COPING.
Spall	S3+62	WS	30	43	Coping Type D	Wall	TZ	Moderate	48	10	2	LARGE SPALL AT BOTTOM OF ORIGINAL SLAB COPING CENTERED ON VERTICAL SLAB JOINT. NO EXPOSED REINFORCING.
Spall	S3+62	IS	12	1016	Coping Type D	Wall	ATM	Major	48	12		CRACKS AND SPALLS THROUGH WALL
Cracks	S3+90	IS	12	1015	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S3+94	IS		1029	Sidewalk	Sidewalk	ATM	Moderate				END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 41+05
Cracks	S4+02	WS	0	42	Coping Type D	Wall	ATM	Minor	48	1/16		MINOR CRACKS AT TOP OF PREVIOUS PATCH
Cracks	S4+08	WS	36	41	Coping Type D	Wall	TZ	Minor	30	1/16		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Cracks	S4+11	WS	36	40	Coping Type D	Wall	TZ	Minor	24	1/16		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Cracks	S4+36	IS		1028	Sidewalk	Sidewalk	ATM	Moderate				BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 40+63

Deterioration	Station	Waterside/ Islandside	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Cracks	S4+37	WS	36	39	Coping Type D	Wall	TZ	Moderate	30	1/8		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Cracks	S4+37	IS	12	1014	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK PREVIOSULY REPAIRED
Cracks	S4+58	WS	36	38	Coping Type D	Wall	TZ	Moderate	24	1/8		VERTICAL CRACK ON BOTTOM HALF OF THE TYPE D COPING. NO RUST STAINS APPARENT.
	S4+73	WS	40	37	Coping Type D	Wall	TZ	ND	24	8	2	REPAIRED SPALL AT WEST END OF NEW (ALL PANEL, NO PILE) WALL TYPE COPING.
Expansion Joint	S4+74	IS	12	1013	Coping Type B	Wall	ATM	Moderate				EXPANSION JOINT OFFEST APPROX 1-1/2"
	S4+74	WS		36	Expansion Joint	Wall	TZ	ND				NO DAMAGE HERE. NOTE TO IDENTIFY TRANSISTION OF WALL TYPE.
Open Spall	S4+75	WS	30	35	Coping Type B	Wall	TZ	Moderate	9	5	3	SPALL AT END OF PRECAST PILE AND SLAB BULKHEAD
Spall	S4+77	WS	48	34	Wall Panel	Wall	TZ	Moderate	12	6		DELAMINATION 1 FT BELOW BOTTOM OF COPING
Cracks	N0+24	WS	12	33	Coping Type B	Wall	TZ	Minor	24	1/8		TYPICAL CRACK, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N0+36	WS	16	32	Coping Type B	Wall	TZ	Moderate	144	1/8		MULTIPLE TYPICAL CRACKS, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Total length of cracks estimated) Runs beyond repair to next pile at Sta 00+24).
Cracks	N0+40	IS	0	1001	Coping Type B	Wall	ATM	Minor	216	1/16		LONGITUDINAL CRACK ALONG TOP OF COPING.
Cracks	N0+48	WS	12	31	Coping Type B	Wall	TZ	Minor	42	1/8		TYPICAL CRACK, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N0+71	WS	18	30	Coping Type B	Wall	TZ	Moderate	6	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR
Cracks	N0+71	IS	0	1002	Coping Type B	Wall	ATM	Minor	132	1/16		LONGITUDINAL CRACK ALONG TOP OF COPING.
Expansion Joint	N0+82	IS	0	1003	Coping Type B	Wall	ATM	Minor				SEALING AT EXPANSION JOINT IS CRACKING
Cracks	N0+83	WS	19	29	Coping Type B	Wall	TZ	Major	36	1/8		CRACKS WITH HEAVY RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Expansion Jt. at Approx Sta 00+82)
Cracks	N0+95	WS	12	28	Coping Type B	Wall	TZ	Moderate	24	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N1+33	WS	15	27	Coping Type B	Wall	TZ	Major	48	1/8		CRACKS WITH HEAVY RUST STAINING IN COPING LOCATED MOSTLY NORTH OF CONCRETE PILE. PREVIOUS REPAIR PRESENT. SMALL CLOSED SPALL PRESENT.
Closed Spall	N1+41	IS	9	1004	Coping Type B	Wall	ATM	Moderate	12	4		PREVIOUS CRACKS REPAIR FAILING, RESULTING IN CLOSED SPALL ON LOWER STEP OF COPING.
Cracks	N1+41	IS	12	1005	Coping Type B	Wall	ATM	ND	12			THREE CRACKS THROUGH TOP OF COPING. PREVIOUSLY REPAIRED.
Cracks	N1+42	WS	15	26	Coping Type B	Wall	TZ	Minor	60	1/16		2 TYP CRACKS WITH RUST IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR (Length is approx)
Cracks	N1+54	WS	19	25	Coping Type B	Wall	TZ	Minor	36	1/16		TYPICAL CRACK WITH NO STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N1+65	WS	12	24	Coping Type B	Wall	TZ	Minor	120	1/8		3 TYPICALLY SHAPED CRACKS WITH MINIMAL RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Length is approx)
Cracks	N2+00	WS	18	23	Coping Type B	Wall	TZ	Moderate	24	1/8		TYPICAL CRACK WITH SLIGHT RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT. EXPANSION JOINT AT STA 01+99

Deterioration	Station	Waterside/ Islandside	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Open Spall	N2+02	WS	23	22	Coping Type B	Wall	TZ	Moderate	12	5	2	SPALL AT CONDUIT EGRESS
Cracks	N2+12	WS	14	21	Coping Type B	Wall	TZ	Moderate	18	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N2+23	IS	12	1007	Coping Type B	Wall	ATM	ND	6	1/32		CRACK PREVIOUSLY REPAIRED
Cracks	N2+35	WS	20	20	Coping Type B	Wall	TZ	Moderate	18	1/8		NOT A TYPICAL CRACK - IT BEGINS AT THE BOTTOM OF THE COPING AND EXTENDS SOUTHWARD AND UPWARD.
Closed Spall	N2+46	WS	18	19	Coping Type B	Wall	TZ	Major	24	12		CLOSED SPALL FROM MIDHEIGHT TO BOTTOM OF FACE OF COPING
Cracks	N2+47	WS	12	18	Coping Type B	Wall	TZ	Major	56	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N2+58	WS	15	17	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N2+70	WS	15	16	Coping Type B	Wall	TZ	Major	60	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR
Cracks	N2+82	WS	18	15	Coping Type B	Wall	TZ	Minor	54	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Impact Spall	N2+89	WS	21	14	Coping Type B	Wall	TZ	Moderate	2	2	1/2	SMALL IMPACT SPALL AT WATERSIDE FACE OF COPING
Closed Spall	N2+90	WS	21	13	Coping Type B	Wall	TZ	Moderate	6	2 1/2		CLOSED SPALL AT BOTT CORNER OF COPINGWATERSIDE.
Impact Spall	N2+91	WS	21	12	Coping Type B	Wall	TZ	Moderate	1	1	1/2	SMALL IMPACT SPALL AT WATERSIDE FACE OF COPING
Expansion Joint	N2+99	IS	12	1006	Coping Type B	Wall	ATM	Minor				SEALING AT EXPANSION JOINT IS CRACKING
Impact Spall	N3+06	WS	12	11	Coping Type B	Wall	TZ	Major	4	3	1/2	OPEN SPALL AT FACE OF COPING. SMALL (1/8" DIA) VOID AT CENTER OF SPALL.
Rust	N3+06	IS	12	1008	Coping Type B	Wall	ATM	Minor	42	4		RUST STAINS EMINATING FROM FACE OF CONCRETE. NO SPALLING. NO EXPOSED STEEL.
Cracks	N3+17	WS	16	10	Coping Type B	Wall	TZ	Minor	30	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. CRACK STOPS AT EXPANSION/CONSTRUCTION JOINT AT 03+16 +/-
Closed Spall	N3+28	IS	9	1009	Coping Type B	Wall	ATM	Moderate	12	4		PREVIOUS CRACKS REPAIR FAILING, RESULTING IN CLOSED SPALL ON LOWER STEP OF COPING.
Cracks	N3+41	WS	18	9	Coping Type B	Wall	TZ	Minor	18	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N3+53	WS	12	8	Coping Type B	Wall	TZ	Minor	48	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N3+55	IS	12	1010	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.
Cracks	N3+64	WS	16	7	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N3+76	WS	16	6	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N3+86	IS	12	1011	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.
Cracks	N3+88	WS	12	5	Coping Type B	Wall	TZ	Minor	50	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N4+00	WS	16	4	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N4+04	IS	12	1012	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.
Cracks	N4+10	WS	14	3	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. CLOSED SPALL
Cracks	N4+22	WS	14	2	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE

Deterioration	Station	Waterside/ Islandside	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Cracks	N4+45	WS	14	1	Coping Type B	Wall	TZ	Moderate	36	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE

Notes Regarding Stationing: Stationing as shown here is approximate, sufficient to locate the deficiencies cited, but not represented to be "surveyed."
Stationing designates approximate center of wide (along the length of wall) defects.

Nomenclature

Deterioration	Abrassion, Bearing, Checking, Clamp, Cracks, Damaged Wrap, Delamination, Exposed Timber, Fire Damage, Lag screws, Loose bolts, Loose wedge, Mechanical, Missing, Missing bolts, Missing lag bolts, Missing wrap, None, Rust, Scour, Section loss, Shell peelinng, Split, Teredo, Void, Open Spall, Closed Spall, Etc. as noted		
Bent1	N/A		
Bent2	N/A		
Station	Balboa Island Stationing		
Waterside/IslandSide	WS/IS denotes whether damage is located on the waterside or Island side of the Wall		
RowLocation	N/A		
Dist from Top of Coping	Distance from top of coping is approximate to the center of the defect for locating purposes		
DefectID	Defect identification number		
MinorityElement	Superstructure (Blocking, Brace, Deck, Diag Strap, Fire Line, Gas Line, Light Pole, Long. Bracing, Pile Cap, Strap, Stringer, Trans. Bracing or Utility) Wrapped Timber Pile		
Zone	Timber Pile Zone:		
	ATM	= Atmospheric zone	Area above the upper limit of the splash zone, which remains consistently dry. However, the area may be subject to salt-laden air.
	SZ	= Splash zone	Area above the high water mark (MHHW, MHW, MHWS, etc.) that is subject to constant wetting and drying due to splashing of
	TZ	= Tidal zone	Area between the low water mark (MLW, MLLW, MLWS, etc.) and the lower limit of the splash zone.
	TOP	= Top of pile	Area at top of pile
	ML	= Mudline	At mudline elevation
	FH	= Full Height	From mudline to top of pile
	WT	= Wrap top	Concrete encasement, If applicable
Rating	Severe, Major, Moderate, Minor, No Defects		
Length	Length of defect		
Width	Width of defect		
Depth	Depth of defect		
Comment	Additional information on the defect		

Deterioration	Station	Waterside/ Islandside2	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Cracks	N4+22	WS	14	2	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N4+10	WS	14	3	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. CLOSED SPALL
Impact Spall	N3+06	WS	12	11	Coping Type B	Wall	TZ	Major	4	3	1/2	OPEN SPALL AT FACE OF COPING. SMALL (1/8" DIA) VOID AT CENTER OF SPALL.
Cracks	N2+70	WS	15	16	Coping Type B	Wall	TZ	Major	60	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR
Cracks	N2+58	WS	15	17	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N2+47	WS	12	18	Coping Type B	Wall	TZ	Major	56	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Closed Spall	N2+46	WS	18	19	Coping Type B	Wall	TZ	Major	24	12		CLOSED SPALL FROM MIDHEIGHT TO BOTTOM OF FACE OF COPING
Cracks	N1+33	WS	15	27	Coping Type B	Wall	TZ	Major	48	1/8		CRACKS WITH HEAVY RUST STAINING IN COPING LOCATED MOSTLY NORTH OF CONCRETE PILE. PREVIOUS REPAIR PRESENT. SMALL
Cracks	N0+83	WS	19	29	Coping Type B	Wall	TZ	Major	36	1/8		CRACKS WITH HEAVY RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Expansion Jt. at Approx
Spall	S3+62	IS	12	1016	Coping Type D	Wall	ATM	Major	48	12		CRACKS AND SPALLS THROUGH WALL
Spall	S2+91	IS	12	1017	Coping Type D	Wall	ATM	Major	48	12		CRACKS AND SPALLS THROUGH WALL
Spall	S2+62	IS	12	1018	Coping Type D	Wall	ATM	Major	48	36		FAILING REPAIR, CRACKS AND SPALLS THROUGH WALL
Cracks	S1+54	IS	12	1027	Coping Type D	Wall	ATM	Major	48	20		CRACKS AND SPALLS THROUGH WALL
Cracks	S2+14	IS		1034	Sidewalk	Sidewalk	ATM	Major		1/4		BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS
Cracks	S1+48	IS		1035	Sidewalk	Sidewalk	ATM	Major		1/4		END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 38+83
Cracks	N3+88	WS	12	5	Coping Type B	Wall	TZ	Minor	50	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N3+53	WS	12	8	Coping Type B	Wall	TZ	Minor	48	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N3+41	WS	18	9	Coping Type B	Wall	TZ	Minor	18	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N3+17	WS	16	10	Coping Type B	Wall	TZ	Minor	30	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. CRACK STOPS AT EXPANSION/CONSTRUCTION JOINT AT 03+16 +/-
Cracks	N2+82	WS	18	15	Coping Type B	Wall	TZ	Minor	54	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N1+65	WS	12	24	Coping Type B	Wall	TZ	Minor	120	1/8		3 TYPICALLY SHAPED CRACKS WITH MINIMAL RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Length is approx)
Cracks	N1+54	WS	19	25	Coping Type B	Wall	TZ	Minor	36	1/16		TYPICAL CRACK WITH NO STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N1+42	WS	15	26	Coping Type B	Wall	TZ	Minor	60	1/16		2 TYP CRACKS WITH RUST IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR (Length is approx)
Cracks	N0+48	WS	12	31	Coping Type B	Wall	TZ	Minor	42	1/8		TYPICAL CRACK, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT

Deterioration	Station	Waterside/ Islandside2	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Cracks	N0+24	WS	12	33	Coping Type B	Wall	TZ	Minor	24	1/8		TYPICAL CRACK, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	S4+11	WS	36	40	Coping Type D	Wall	TZ	Minor	24	1/16		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Cracks	S4+08	WS	36	41	Coping Type D	Wall	TZ	Minor	30	1/16		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Cracks	S4+02	WS	0	42	Coping Type D	Wall	ATM	Minor	48	1/16		MINOR CRACKS AT TOP OF PREVIOUS PATCH
Cracks	S2+18	WS	20	52	Coping Type D	Wall	TZ	Minor	40	1/16		VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REAPIRED, REPAIR FAILING.
Impact Spall	S0+56	WS	40	58	Coping Type D	Wall	TZ	Minor	6	2	1	IMPACT SPALLS AT PANEL EDGES. NO RUST STAINS OR EXPOSED REINFORCING
Voids	S0+53	WS	45	59	Coping Type D	Wall	TZ	Minor	4	2	1/2	2 VOIDS IN THE CONCRETE. MAY BE ORIGINAL. NO RUST STAINING, BUT REDUCING COVER TO REINFORCING.
Erosion	S0+50	WS	60	60	Coping Type D	Wall	TZ	Minor				EROSION POSSIBLY DUE TO GREATER EXPOSER, NO BOATS, FROM STA S 04+43 TO PAST EMERALD AVE. FINES HAVE BEEN WASHED AWAY EXPOSING AGGREGATE.
Erosion	S0+31	WS	40	61	Coping Type D	Wall	TZ	Minor				EROSION AT BOTTOM OF ORIGINAL COPING FROM ~STA SOUTH 04+62 TO 05+10. PROBABLY DUE TO WASHUP OF WAVES.
Cracks	N0+40	IS	0	1001	Coping Type B	Wall	ATM	Minor	216	1/16		LONGITUDINAL CRACK ALONG TOP OF COPING.
Cracks	N0+71	IS	0	1002	Coping Type B	Wall	ATM	Minor	132	1/16		LONGITUDINAL CRACK ALONG TOP OF COPING.
Expansion Joint	N0+82	IS	0	1003	Coping Type B	Wall	ATM	Minor				SEALING AT EXPANSION JOINT IS CRACKING
Expansion Joint	N2+99	IS	12	1006	Coping Type B	Wall	ATM	Minor				SEALING AT EXPANSION JOINT IS CRACKING
Rust	N3+06	IS	12	1008	Coping Type B	Wall	ATM	Minor	42	4		RUST STAINS EMINATING FROM FACE OF CONCRETE. NO SPALLING. NO EXPOSED STEEL.
Cracks	N4+45	WS	14	1	Coping Type B	Wall	TZ	Moderate	36	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N4+00	WS	16	4	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N3+76	WS	16	6	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N3+64	WS	16	7	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Impact Spall	N2+91	WS	21	12	Coping Type B	Wall	TZ	Moderate	1	1	1/2	SMALL IMPACT SPALL AT WATERSIDE FACE OF COPING
Closed Spall	N2+90	WS	21	13	Coping Type B	Wall	TZ	Moderate	6	2 1/2		CLOSED SPALL AT BOTT CORNER OF COPINGWATERSIDE.
Impact Spall	N2+89	WS	21	14	Coping Type B	Wall	TZ	Moderate	2	2	1/2	SMALL IMPACT SPALL AT WATERSIDE FACE OF COPING
Cracks	N2+35	WS	20	20	Coping Type B	Wall	TZ	Moderate	18	1/8		NOT A TYPICAL CRACK - IT BEGINS AT THE BOTTOM OF THE COPING AND EXTENDS SOUTHWARD AND UPWARD.
Cracks	N2+12	WS	14	21	Coping Type B	Wall	TZ	Moderate	18	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Open Spall	N2+02	WS	23	22	Coping Type B	Wall	TZ	Moderate	12	5	2	SPALL AT CONDUIT EGRESS

Deterioration	Station	Waterside/ Islandside2	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Cracks	N2+00	WS	18	23	Coping Type B	Wall	TZ	Moderate	24	1/8		TYPICAL CRACK WITH SLIGHT RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT. EXPANSION JOINT AT STA 01+99
Cracks	N0+95	WS	12	28	Coping Type B	Wall	TZ	Moderate	24	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N0+71	WS	18	30	Coping Type B	Wall	TZ	Moderate	6	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR
Cracks	N0+36	WS	16	32	Coping Type B	Wall	TZ	Moderate	144	1/8		MULTIPLE TYPICAL CRACKS, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Total length of cracks estimated) Runs beyond repair to next pile at Sta 00+24).
Spall	S4+77	WS	48	34	Wall Panel	Wall	TZ	Moderate	12	6		DELAMINATION 1 FT BELOW BOTTOM OF COPING
Open Spall	S4+75	WS	30	35	Coping Type B	Wall	TZ	Moderate	9	5	3	SPALL AT END OF PRECAST PILE AND SLAB BULKHEAD
Cracks	S4+58	WS	36	38	Coping Type D	Wall	TZ	Moderate	24	1/8		VERTICAL CRACK ON BOTTOM HALF OF THE TYPE D COPING. NO RUST STAINS APPARENT.
Cracks	S4+37	WS	36	39	Coping Type D	Wall	TZ	Moderate	30	1/8		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Spall	S3+62	WS	30	43	Coping Type D	Wall	TZ	Moderate	48	10	2	LARGE SPALL AT BOTTOM OF ORIGINAL SLAB COPING CENTERED ON VERTICAL SLAB JOINT. NO EXPOSED REINFORCING.
Cracks	S3+62	WS	30	44	Original Wall Slab	Wall	TZ	Moderate	40	1/8		VERTICAL CRACK, PREVIOUSLY REPAIRED, EXTENDING FROM PANEL JOINT TO TOP OF COPING.
Closed Spall	S3+39	WS	40	45	Original Wall Slab	Wall	TZ	Moderate	10	3	2	CLOSED SPALL APPARENTLY FROM IMPACT. PREVIOUSLY REPAIRED, RECRACKING AT REPAIR.
Closed Spall	S3+33	WS	40	46	Original Wall Slab	Wall	TZ	Moderate	10	5	2	CLOSED SPALL APPARENTLY FROM IMPACT. PREVIOUSLY REPAIRED, RECRACKING AT REPAIR.
Rust	S3+08	WS	36	47	Original Wall Slab	Wall	TZ	Moderate	2	2		3 RUSTED PLUGS OR FITTINGS LOCATED IN THE FACE OF THE ORIGINAL WALL COPING. NO SPALLING ASSOCIATED WITH THE RUST.
Rust	S2+92	WS	24	48	Coping Type D	Wall	TZ	Moderate	30	4		VERTICAL RUST STAINED PATCH. POSSIBLY DUE TO REPAIR GROUT NOT BEING NON-METALLIC.
Cracks	S2+78	WS	30	49	Original Wall Slab	Wall	TZ	Moderate	20	1/8		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING. PREVIOUSLY REPAIRED.
Cracks	S2+64	WS	20	50	Coping Type D	Wall	TZ	Moderate	40	1/8		VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REAPIRS, REPAIR FAILING.
Cracks	S2+47	WS	30	51	Coping Type D	Wall	TZ	Moderate	20	1/8		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING. PREVIOUSLY REPAIRED.
Cracks	S2+11	WS	20	53	Coping Type D	Wall	TZ	Moderate	48	1/8		DIAG/VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REAPIRS, REPAIR FAILING.

Deterioration	Station	Waterside/ Islandside2	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Cracks	S1+79	WS	20	54	Coping Type D	Wall	TZ	Moderate	40	1/8		VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REAPIRED.
Cracks	S1+54	WS	20	55	Coping Type D	Wall	TZ	Moderate	50	1/8		"Y" SHAPED VERTICAL CRACK THROUGH ORIGINAL SLAB CAP AND TYPE D COPING. PARTIAL PREVIOUS REPAIR. SLIGHT RUST STAINING
Cracks	S0+77	WS	30	56	Coping Type D	Wall	TZ	Moderate	36	1/8		VERTICAL CRACK TO JUST ABOVE THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. PREVIOUSLY REPAIRED.
Cracks	S0+73	WS	30	57	Coping Type D	Wall	TZ	Moderate	38	1/8		VERTICAL CRACK TO JUST ABOVE THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. PREVIOUSLY REPAIRED.
Closed Spall	N1+41	IS	9	1004	Coping Type B	Wall	ATM	Moderate	12	4		PREVIOUS CRACKS REAPIR FAILING, RESULTING IN CLOSED SPALL ON LOWER STEP OF COPING.
Closed Spall	N3+28	IS	9	1009	Coping Type B	Wall	ATM	Moderate	12	4		PREVIOUS CRACKS REAPIR FAILING, RESULTING IN CLOSED SPALL ON LOWER STEP OF COPING.
Expansion Joint	S4+74	IS	12	1013	Coping Type B	Wall	ATM	Moderate				EXPANSION JOINT OFFEST APPROX 1-1/2"
Cracks	S4+37	IS	12	1014	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK PREVIOSULY REPAIRED
Cracks	S3+90	IS	12	1015	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+31	IS	12	1019	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+29	IS	12	1020	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+21	IS	12	1021	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+15	IS	12	1022	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S1+84	IS	12	1023	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S1+70	IS	12	1024	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S1+65	IS	12	1025	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACKED CONSTRUCTION JOINT
Cracks	S1+62	IS	12	1026	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S4+36	IS		1028	Sidewalk	Sidewalk	ATM	Moderate				BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 40+63
Cracks	S3+94	IS		1029	Sidewalk	Sidewalk	ATM	Moderate				END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 41+05
Cracks	S2+74	IS		1030	Sidewalk	Sidewalk	ATM	Moderate				BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 39+27
Cracks	S2+58	IS		1031	Sidewalk	Sidewalk	ATM	Moderate				END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 39+43
Cracks	S2+16	IS		1032	Sidewalk	Sidewalk	ATM	Moderate	48	1/8		CRACK IN SIDEWALK
Cracks	S1+83	IS		1033	Sidewalk	Sidewalk	ATM	Moderate	60	1/8		CRACK IN SIDEWALK
Cracks	S1+62	IS		1036	Sidewalk	Sidewalk	ATM	Moderate				BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 37+12
Cracks	S0+43	IS		1037	Sidewalk	Sidewalk	ATM	Moderate				END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 38+31
	S4+74	WS		36	Expansion Joint	Wall	TZ	ND				NO DAMAGE HERE. NOTE TO IDENTIFY TRANSISTION OF WALL TYPE.
	S4+73	WS	40	37	Coping Type D	Wall	TZ	ND	24	8	2	REPAIRED SPALL AT WEST END OF NEW (ALL PANEL, NO PILE) WALL TYPE COPING.
Expansion Joint	-S0+27	WS	40	62	Coping Type C	Wall	TZ	ND				JUST TO NOTE THE APPROXIMATE LIMIT OF THE DIFFERENT WALL CONSTRUCTION TYPE. WALL TRANSISTIONS BACK TO DRIVEN PRECAST PILES.

Deterioration	Station	Waterside/ Islandside2	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Cracks	N1+41	IS	12	1005	Coping Type B	Wall	ATM	ND	12			THREE CRACKS THROUGH TOP OF COPING. PREVIOUSLY REPAIRED.
Cracks	N2+23	IS	12	1007	Coping Type B	Wall	ATM	ND	6	1/32		CRACK PREVIOUSLY REPAIRED
Cracks	N3+55	IS	12	1010	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.
Cracks	N3+86	IS	12	1011	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.
Cracks	N4+04	IS	12	1012	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.

Notes Regarding Stationing: Stationing as shown here is approximate, sufficient to locate the deficiencies cited, but not represented to be "surveyed."
Stationing designates approximate center of wide (along the length of wall) defects.

Nomenclature

Deterioration	Abrassion, Bearing, Checking, Clamp, Cracks, Damaged Wrap, Delamination, Exposed Timber, Fire Damage, Lag screws, Loose bolts, Loose wedge, Mechanical, Missing, Missing bolts, Missing lag bolts, Missing wrap, None, Rust, Scour, Section loss, Shell peelinng, Split, Teredo, Void, Open Spall, Closed Spall, Etc. as noted		
Bent1	N/A		
Bent2	N/A		
Station	Balboa Island Stationing		
Waterside/IslandSide	WS/IS denotes whether damage is located on the waterside or Island side of the Wall		
RowLocation	N/A		
Dist from Top of Coping	Distance from top of coping is approximate to the center of the defect for locating purposes		
DefectID	Defect identification number		
MinorityElement	Superstructure (Blocking, Brace, Deck, Diag Strap, Fire Line, Gas Line, Light Pole, Long. Bracing, Pile Cap, Strap, Stringer, Trans. Bracing or Utility) Wrapped Timber Pile		
Zone	Timber Pile Zone:		
	ATM	= Atmospheric zone	Area above the upper limit of the splash zone, which remains consistently dry. However, the area may be subject to salt-laden air.
	SZ	= Splash zone	Area above the high water mark (MHHW, MHW, MHWS, etc.) that is subject to constant wetting and drying due to splashing of
	TZ	= Tidal zone	Area between the low water mark (MLW, MLLW, MLWS, etc.) and the lower limit of the splash zone.
	TOP	= Top of pile	Area at top of pile
	ML	= Mudline	At mudline elevation
	FH	= Full Height	From mudline to top of pile
	WT	= Wrap top	Concrete encasement, If applicable
Rating	Severe, Major, Moderate, Minor, No Defects		
Length	Length of defect		
Width	Width of defect		
Depth	Depth of defect		
Comment	Additional information on the defect		

Deterioration	Station	Waterside/ Islandside2	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Cracks	N4+45	WS	14	1	Coping Type B	Wall	TZ	Moderate	36	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N4+22	WS	14	2	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N4+10	WS	14	3	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. CLOSED SPALL
Cracks	N4+00	WS	16	4	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N3+88	WS	12	5	Coping Type B	Wall	TZ	Minor	50	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N3+76	WS	16	6	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N3+64	WS	16	7	Coping Type B	Wall	TZ	Moderate	60	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N3+53	WS	12	8	Coping Type B	Wall	TZ	Minor	48	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N3+41	WS	18	9	Coping Type B	Wall	TZ	Minor	18	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N3+17	WS	16	10	Coping Type B	Wall	TZ	Minor	30	1/16		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. CRACK STOPS AT EXPANSION/CONSTRUCTION JOINT AT 03+16 +/-
Impact Spall	N3+06	WS	12	11	Coping Type B	Wall	TZ	Major	4	3	1/2	OPEN SPALL AT FACE OF COPING. SMALL (1/8" DIA) VOID AT CENTER OF SPALL.
Impact Spall	N2+91	WS	21	12	Coping Type B	Wall	TZ	Moderate	1	1	1/2	SMALL IMPACT SPALL AT WATERSIDE FACE OF COPING
Closed Spall	N2+90	WS	21	13	Coping Type B	Wall	TZ	Moderate	6	2 1/2		CLOSED SPALL AT BOTT CORNER OF COPINGWATERSIDE.
Impact Spall	N2+89	WS	21	14	Coping Type B	Wall	TZ	Moderate	2	2	1/2	SMALL IMPACT SPALL AT WATERSIDE FACE OF COPING
Cracks	N2+82	WS	18	15	Coping Type B	Wall	TZ	Minor	54	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE
Cracks	N2+70	WS	15	16	Coping Type B	Wall	TZ	Major	60	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR
Cracks	N2+58	WS	15	17	Coping Type B	Wall	TZ	Major	48	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N2+47	WS	12	18	Coping Type B	Wall	TZ	Major	56	1/4		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Closed Spall	N2+46	WS	18	19	Coping Type B	Wall	TZ	Major	24	12		CLOSED SPALL FROM MIDHEIGHT TO BOTTOM OF FACE OF COPING
Cracks	N2+35	WS	20	20	Coping Type B	Wall	TZ	Moderate	18	1/8		NOT A TYPICAL CRACK - IT BEGINS AT THE BOTTOM OF THE COPING AND EXTENDS SOUTHWARD AND UPWARD.
Cracks	N2+12	WS	14	21	Coping Type B	Wall	TZ	Moderate	18	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Open Spall	N2+02	WS	23	22	Coping Type B	Wall	TZ	Moderate	12	5	2	SPALL AT CONDUIT EGRESS
Cracks	N2+00	WS	18	23	Coping Type B	Wall	TZ	Moderate	24	1/8		TYPICAL CRACK WITH SLIGHT RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT. EXPANSION JOINT AT STA 01+99
Cracks	N1+65	WS	12	24	Coping Type B	Wall	TZ	Minor	120	1/8		3 TYPICALLY SHAPED CRACKS WITH MINIMAL RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Length is approx)
Cracks	N1+54	WS	19	25	Coping Type B	Wall	TZ	Minor	36	1/16		TYPICAL CRACK WITH NO STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT

Deterioration	Station	Waterside/ Islandside2	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Cracks	N1+42	WS	15	26	Coping Type B	Wall	TZ	Minor	60	1/16		2 TYP CRACKS WITH RUST IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR (Length is approx)
Cracks	N1+33	WS	15	27	Coping Type B	Wall	TZ	Major	48	1/8		CRACKS WITH HEAVY RUST STAINING IN COPING LOCATED MOSTLY NORTH OF CONCRETE PILE. PREVIOUS REPAIR PRESENT. SMALL CLOSED SPALL PRESENT.
Cracks	N0+95	WS	12	28	Coping Type B	Wall	TZ	Moderate	24	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N0+83	WS	19	29	Coping Type B	Wall	TZ	Major	36	1/8		CRACKS WITH HEAVY RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Expansion Jt. at Approx Sta 00+82)
Cracks	N0+71	WS	18	30	Coping Type B	Wall	TZ	Moderate	6	1/8		TYPICAL CRACK WITH RUST STAINING IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR
Cracks	N0+48	WS	12	31	Coping Type B	Wall	TZ	Minor	42	1/8		TYPICAL CRACK, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Cracks	N0+36	WS	16	32	Coping Type B	Wall	TZ	Moderate	144	1/8		MULTIPLE TYPICAL CRACKS, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT (Total length of cracks estimated) Runs beyond repair to next pile at Sta 00+24).
Cracks	N0+24	WS	12	33	Coping Type B	Wall	TZ	Minor	24	1/8		TYPICAL CRACK, NO STAINING, IN COPING LOCATED OVER CONCRETE PILE. PREVIOUS REPAIR PRESENT
Spall	S4+77	WS	48	34	Wall Panel	Wall	TZ	Moderate	12	6		DELAMINATION 1 FT BELOW BOTTOM OF COPING
Open Spall	S4+75	WS	30	35	Coping Type B	Wall	TZ	Moderate	9	5	3	SPALL AT END OF PRECAST PILE AND SLAB BULKHEAD
	S4+74	WS		36	Expansion Joint	Wall	TZ	ND				NO DAMAGE HERE. NOTE TO IDENTIFY TRANSISTION OF WALL TYPE.
	S4+73	WS	40	37	Coping Type D	Wall	TZ	ND	24	8	2	REPAIRED SPALL AT WEST END OF NEW (ALL PANEL, NO PILE) WALL TYPE COPING.
Cracks	S4+58	WS	36	38	Coping Type D	Wall	TZ	Moderate	24	1/8		VERTICAL CRACK ON BOTTOM HALF OF THE TYPE D COPING. NO RUST STAINS APPARENT.
Cracks	S4+37	WS	36	39	Coping Type D	Wall	TZ	Moderate	30	1/8		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Cracks	S4+11	WS	36	40	Coping Type D	Wall	TZ	Minor	24	1/16		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Cracks	S4+08	WS	36	41	Coping Type D	Wall	TZ	Minor	30	1/16		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING.
Cracks	S4+02	WS	0	42	Coping Type D	Wall	ATM	Minor	48	1/16		MINOR CRACKS AT TOP OF PREVIOUS PATCH
Spall	S3+62	WS	30	43	Coping Type D	Wall	TZ	Moderate	48	10	2	LARGE SPALL AT BOTTOM OF ORIGINAL SLAB COPING CENTERED ON VERTICAL SLAB JOINT. NO EXPOSED REINFORCING.
Cracks	S3+62	WS	30	44	Original Wall Slab	Wall	TZ	Moderate	40	1/8		VERTICAL CRACK, PREVIOUSLY REPAIRED, EXTENDING FROM PANEL JOINT TO TOP OF COPING.
Closed Spall	S3+39	WS	40	45	Original Wall Slab	Wall	TZ	Moderate	10	3	2	CLOSED SPALL APPARENTLY FROM IMPACT. PREVIOUSLY REPAIRED, RECRACKING AT REPAIR.

Deterioration	Station	Waterside/ Islandside2	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Closed Spall	S3+33	WS	40	46	Original Wall Slab	Wall	TZ	Moderate	10	5	2	CLOSED SPALL APPARENTLY FROM IMPACT. PREVIOUSLY REPAIRED, RECRACKING AT REPAIR.
Rust	S3+08	WS	36	47	Original Wall Slab	Wall	TZ	Moderate	2	2		3 RUSTED PLUGS OR FITTINGS LOCATED IN THE FACE OF THE ORIGINAL WALL COPING. NO SPALLING ASSOCIATED WITH THE RUST.
Rust	S2+92	WS	24	48	Coping Type D	Wall	TZ	Moderate	30	4		VERTICAL RUST STAINED PATCH. POSSIBLY DUE TO REPAIR GROUT NOT BEING NON-METALLIC.
Cracks	S2+78	WS	30	49	Original Wall Slab	Wall	TZ	Moderate	20	1/8		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING. PREVIOUSLY REPAIRED.
Cracks	S2+64	WS	20	50	Coping Type D	Wall	TZ	Moderate	40	1/8		VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REAPIRS, REPAIR FAILING.
Cracks	S2+47	WS	30	51	Coping Type D	Wall	TZ	Moderate	20	1/8		VERTICAL CRACK TO THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. IT ENDS AT THE CONINUOUS HORIZONTAL JOINT WHERE THE TYPE D EXTENSION MEETS THE ORIGINAL CAP/COPING. PREVIOUSLY REPAIRED.
Cracks	S2+18	WS	20	52	Coping Type D	Wall	TZ	Minor	40	1/16		VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REAPIRED, REPAIR FAILING.
Cracks	S2+11	WS	20	53	Coping Type D	Wall	TZ	Moderate	48	1/8		DIAG/VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REAPIRS, REPAIR FAILING.
Cracks	S1+79	WS	20	54	Coping Type D	Wall	TZ	Moderate	40	1/8		VERTICAL CRACK FROM WALL SLAB PANEL JOINT CONTINUING THROUGH ORIGINAL CAP/COPING AND ALL THE WALL TO THE TOP OF "TYPE D" COPING. PREVIOUSLY REAPIRED.
Cracks	S1+54	WS	20	55	Coping Type D	Wall	TZ	Moderate	50	1/8		"Y" SHAPED VERTICAL CRACK THROUGH ORIGINAL SLAB CAP AND TYPE D COPING. PARTIAL PREVIOUS REPAIR. SLIGHT RUST STAINING
Cracks	S0+77	WS	30	56	Coping Type D	Wall	TZ	Moderate	36	1/8		VERTICAL CRACK TO JUST ABOVE THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. PREVIOUSLY REPAIRED.
Cracks	S0+73	WS	30	57	Coping Type D	Wall	TZ	Moderate	38	1/8		VERTICAL CRACK TO JUST ABOVE THE BOTTOM OF THE TYPE D COPING. NO RUST STAINS APPARENT. PREVIOUSLY REPAIRED.
Impact Spall	S0+56	WS	40	58	Coping Type D	Wall	TZ	Minor	6	2	1	IMPACT SPALLS AT PANEL EDGES. NO RUST STAINS OR EXPOSED REINFORCING
Voids	S0+53	WS	45	59	Coping Type D	Wall	TZ	Minor	4	2	1/2	2 VOIDS IN THE CONCRETE. MAY BE ORIGINAL. NO RUST STAINING, BUT REDUCING COVER TO REINFORCING.
Erosion	S0+50	WS	60	60	Coping Type D	Wall	TZ	Minor				EROSION POSSIBLY DUE TO GREATER EXPOSER, NO BOATS, FROM STA S 04+43 TO PAST EMERALD AVE. FINES HAVE BEEN WASHED AWAY EXPOSING AGGREGATE.
Erosion	S0+31	WS	40	61	Coping Type D	Wall	TZ	Minor				EROSION AT BOTTOM OF ORIGINAL COPING FROM ~STA SOUTH 04+62 TO 05+10. PROBABLY DUE TO WASHUP OF WAVES.

Deterioration	Station	Waterside/ Islandside2	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Expansion Joint	-S0+27	WS	40	62	Coping Type C	Wall	TZ	ND				JUST TO NOTE THE APPROXIMATE LIMIT OF THE DIFFERENT WALL CONSTRUCTION TYPE. WALL TRANSISTIONS BACK TO DRIVEN PRECAST PILES.
Cracks	N0+40	IS	0	1001	Coping Type B	Wall	ATM	Minor	216	1/16		LONGITUDINAL CRACK ALONG TOP OF COPING.
Cracks	N0+71	IS	0	1002	Coping Type B	Wall	ATM	Minor	132	1/16		LONGITUDINAL CRACK ALONG TOP OF COPING.
Expansion Joint	N0+82	IS	0	1003	Coping Type B	Wall	ATM	Minor				SEALING AT EXPANSION JOINT IS CRACKING
Closed Spall	N1+41	IS	9	1004	Coping Type B	Wall	ATM	Moderate	12	4		PREVIOUS CRACKS REAPIR FAILING, RESULTING IN CLOSED SPALL ON LOWER STEP OF COPING.
Cracks	N1+41	IS	12	1005	Coping Type B	Wall	ATM	ND	12			THREE CRACKS THROUGH TOP OF COPING. PREVIOUSLY REPAIRED.
Expansion Joint	N2+99	IS	12	1006	Coping Type B	Wall	ATM	Minor				SEALING AT EXPANSION JOINT IS CRACKING
Cracks	N2+23	IS	12	1007	Coping Type B	Wall	ATM	ND	6	1/32		CRACK PREVIOUSLY REPAIRED
Rust	N3+06	IS	12	1008	Coping Type B	Wall	ATM	Minor	42	4		RUST STAINS EMINATING FROM FACE OF CONCRETE. NO SPALLING. NO EXPOSED STEEL.
Closed Spall	N3+28	IS	9	1009	Coping Type B	Wall	ATM	Moderate	12	4		PREVIOUS CRACKS REAPIR FAILING, RESULTING IN CLOSED SPALL ON LOWER STEP OF COPING.
Cracks	N3+55	IS	12	1010	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.
Cracks	N3+86	IS	12	1011	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.
Cracks	N4+04	IS	12	1012	Coping Type B	Wall	ATM	ND	48	1/16		(STA APPROX) CRACKS PREVIOUSLY REPAIRED.
Expansion Joint	S4+74	IS	12	1013	Coping Type B	Wall	ATM	Moderate				EXPANSION JOINT OFFEST APPROX 1-1/2"
Cracks	S4+37	IS	12	1014	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK PREVIOSULY REPAIRED
Cracks	S3+90	IS	12	1015	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Spall	S3+62	IS	12	1016	Coping Type D	Wall	ATM	Major	48	12		CRACKS AND SPALLS THROUGH WALL
Spall	S2+91	IS	12	1017	Coping Type D	Wall	ATM	Major	48	12		CRACKS AND SPALLS THROUGH WALL
Spall	S2+62	IS	12	1018	Coping Type D	Wall	ATM	Major	48	36		FAILING REPAIR, CRACKS AND SPALLS THROUGH WALL
Cracks	S2+31	IS	12	1019	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+29	IS	12	1020	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+21	IS	12	1021	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S2+15	IS	12	1022	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S1+84	IS	12	1023	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S1+70	IS	12	1024	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S1+65	IS	12	1025	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACKED CONSTRUCTION JOINT
Cracks	S1+62	IS	12	1026	Coping Type D	Wall	ATM	Moderate	48	1/8		CRACK THROUGH COPING
Cracks	S1+54	IS	12	1027	Coping Type D	Wall	ATM	Major	48	20		CRACKS AND SPALLS THROUGH WALL
Cracks	S4+36	IS		1028	Sidewalk	Sidewalk	ATM	Moderate				BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 40+63
Cracks	S3+94	IS		1029	Sidewalk	Sidewalk	ATM	Moderate				END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 41+05
Cracks	S2+74	IS		1030	Sidewalk	Sidewalk	ATM	Moderate				BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 39+27
Cracks	S2+58	IS		1031	Sidewalk	Sidewalk	ATM	Moderate				END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 39+43
Cracks	S2+16	IS		1032	Sidewalk	Sidewalk	ATM	Moderate	48	1/8		CRACK IN SIDEWALK
Cracks	S1+83	IS		1033	Sidewalk	Sidewalk	ATM	Moderate	60	1/8		CRACK IN SIDEWALK
Cracks	S2+14	IS		1034	Sidewalk	Sidewalk	ATM	Major		1/4		BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 38+17
Cracks	S1+48	IS		1035	Sidewalk	Sidewalk	ATM	Major		1/4		END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 38+83

Deterioration	Station	Waterside/ Islandside2	Distance from Top of Coping	DefectID	MinorityElement	Super Element	Zone	Rating	Length	Width	Depth	Comment
Cracks	S1+62	IS		1036	Sidewalk	Sidewalk	ATM	Moderate				BEGINNING OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS CONTINUE TO APPROX STA 37+12
Cracks	S0+43	IS		1037	Sidewalk	Sidewalk	ATM	Moderate				END OF CRACKS IN SIDEWALK GREATER THAN 1/16". CRACKS RUN TO HERE FROM APPROX STA 38+31

Notes Regarding Stationing: Stationing as shown here is approximate, sufficient to locate the deficiencies cited, but not represented to be "surveyed."
Stationing designates approximate center of wide (along the length of wall) defects.

Nomenclature

Deterioration	Abrassion, Bearing, Checking, Clamp, Cracks, Damaged Wrap, Delamination, Exposed Timber, Fire Damage, Lag screws, Loose bolts, Loose wedge, Mechanical, Missing, Missing bolts, Missing lag bolts, Missing wrap, None, Rust, Scour, Section loss, Shell peelinng, Split, Teredo, Void, Open Spall, Closed Spall, Etc. as noted		
Bent1	N/A		
Bent2	N/A		
Station	Balboa Island Stationing		
Waterside/IslandSide	WS/IS denotes whether damage is located on the waterside or Island side of the Wall		
RowLocation	N/A		
Dist from Top of Coping	Distance from top of coping is approximate to the center of the defect for locating purposes		
DefectID	Defect identification number		
MinorityElement	Superstructure (Blocking, Brace, Deck, Diag Strap, Fire Line, Gas Line, Light Pole, Long. Bracing, Pile Cap, Strap, Stringer, Trans. Bracing or Utility) Wrapped Timber Pile		
Zone	Timber Pile Zone:		
	ATM	= Atmospheric zone	Area above the upper limit of the splash zone, which remains consistently dry. However, the area may be subject to salt-laden air.
	SZ	= Splash zone	Area above the high water mark (MHHW, MHW, MHWS, etc.) that is subject to constant wetting and drying due to splashing of
	TZ	= Tidal zone	Area between the low water mark (MLW, MLLW, MLWS, etc.) and the lower limit of the splash zone.
	TOP	= Top of pile	Area at top of pile
	ML	= Mudline	At mudline elevation
	FH	= Full Height	From mudline to top of pile
	WT	= Wrap top	Concrete encasement, If applicable
Rating	Severe, Major, Moderate, Minor, No Defects		
Length	Length of defect		
Width	Width of defect		
Depth	Depth of defect		
Comment	Additional information on the defect		

APPENDIX C – Condition Ratings

Table 2-6, sheet 1 of 3

Table 2-6. Damage Ratings for Reinforced Concrete Elements

Damage Rating		Existing Damage[a]	Exclusions [Defects Requiring Elevation to the Next Higher Damage Rating(s)]
NI	Not Inspected	• Not inspected, inaccessible, or passed by[b]	
ND	No Defects	• Good original hard surface, hard material, sound	
MN	Minor	• Mechanical abrasion or impact spalls up to 1 in. in depth • Occasional corrosion stains or small pop-out corrosion spalls • General cracks up to 1/16 in. in width	Minor damage not appropriate if • Structural damage • Corrosion cracks • Chemical deterioration[c]
MD	Moderate	• Structural cracks up to 1/16 in. in width • Corrosion cracks up to 1/4 in. in width • Chemical deterioration: Random cracks up to 1/16 in. in width; "Soft" concrete and/or rounding of corners up to 1 in. deep • Mechanical abrasion or impact spalls greater than 1 in. in depth	Moderate damage not appropriate if • Structural breakage and/or spalls • Exposed reinforcement • Loss of cross section due to chemical deterioration beyond rounding of corner edges

Table 2-6, sheet 2 of 3

MJ	Major	• Structural cracks 1/16 in. to 1/4 in. in width and partial breakage (through section cracking with structural spalls) • Corrosion cracks wider than 1/4 in. and open or closed corrosion spalls (excluding pop-outs) • Multiple cracks and disintegration of surface layer due to chemical deterioration • Mechanical abrasion or impact spalls exposing the reinforcing	Major damage not appropriate if • Loss of cross section exceeding 30% due to any cause
SV	Severe	• Structural cracks wider than 1/4 in. or complete breakage • Complete loss of concrete cover due to corrosion of reinforcing steel with more than 30% of diameter loss for any main reinforcing bar • Loss of bearing and displacement at connections • Loss of concrete cover (exposed steel) due to chemical deterioration • Loss of more 30% of cross section due to any cause	

[a] Any defect listed is sufficient to identify relevant damage grade.
[b] If not inspected due to inaccessibility or passed by, note as such.
[c] Chemical deterioration: Sulfate attack, alkali-silica reaction, alkali-aggregate reaction, alkali-carbonate reaction ettringite distress, or other chemical/concrete deterioration.

Table 2-6, sheet 3 of 3

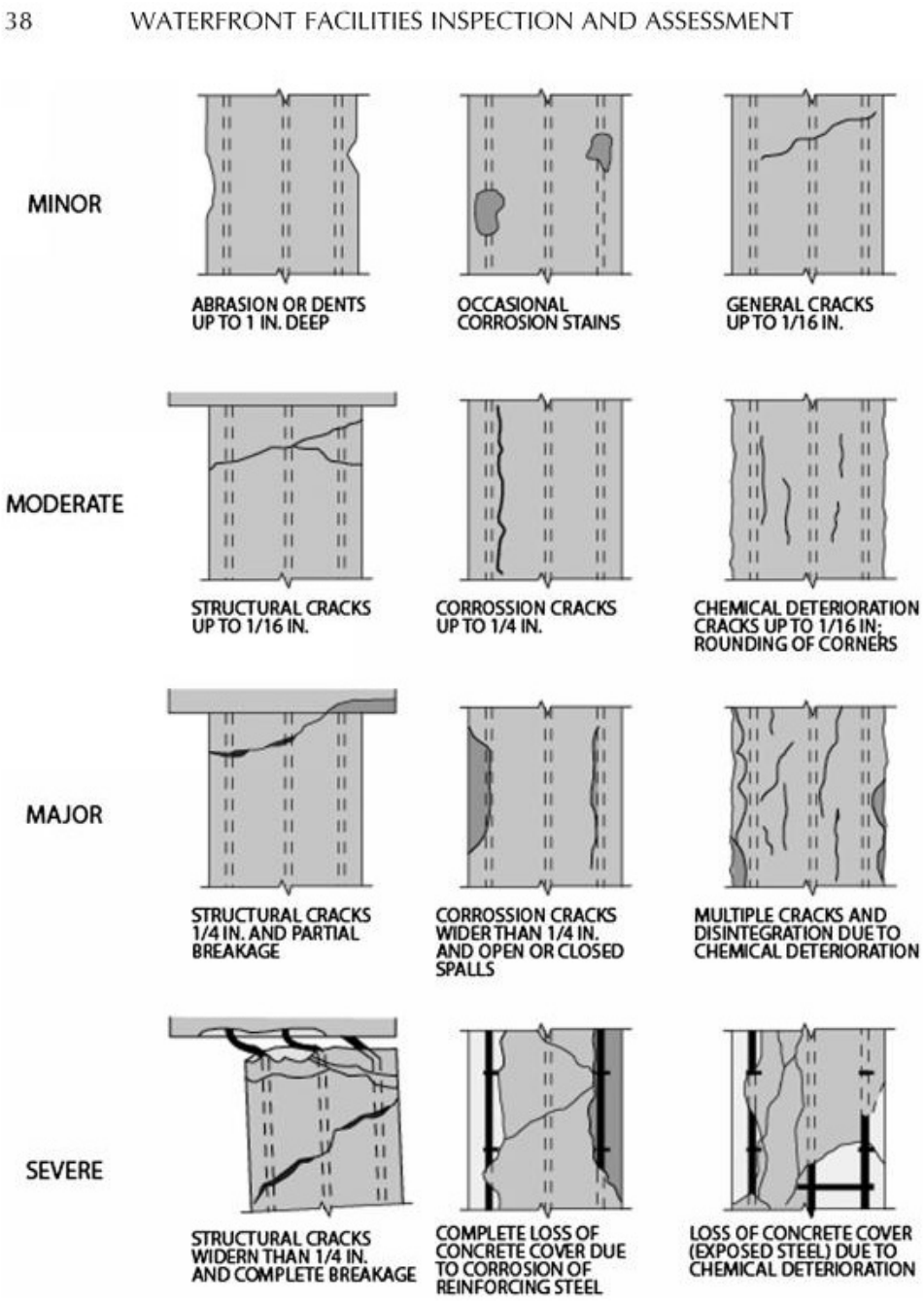


Fig. 2-4. Damage ratings for reinforced concrete elements
Source: Courtesy of CH2M HILL, Inc. and COWI, Inc., reproduced with permission.

Table 2-14

Table 2-14. Condition Assessment Ratings

Rating		Description
6	Good	No visible damage or only minor damage noted. Structural elements may show very minor deterioration, but no overstressing observed. No repairs are required.
5	Satisfactory	Limited minor to moderate defects or deterioration observed but no overstressing observed. No repairs are required.
4	Fair	All primary structural elements are sound but minor to moderate defects or deterioration observed. Localized areas of moderate to advanced deterioration may be present but do not significantly reduce the load-bearing capacity of the structure. Repairs are recommended, but the priority of the recommended repairs is low.
3	Poor	Advanced deterioration or overstressing observed on widespread portions of the structure but does not significantly reduce the load-bearing capacity of the structure. Repairs may need to be carried out with moderate urgency.
2	Serious	Advanced deterioration, overstressing, or breakage may have significantly affected the load-bearing capacity of primary structural components. Local failures are possible, and loading restrictions may be necessary. Repairs may need to be carried out on a high-priority basis with urgency.
1	Critical	Very advanced deterioration, overstressing, or breakage has resulted in localized failure(s) of primary structural components. More widespread failures are possible or likely to occur, and load restrictions should be implemented as necessary. Repairs may need to be carried out on a very high-priority basis with strong urgency.

Table 2-16

Table 2-16. Description of Recommended Action Options

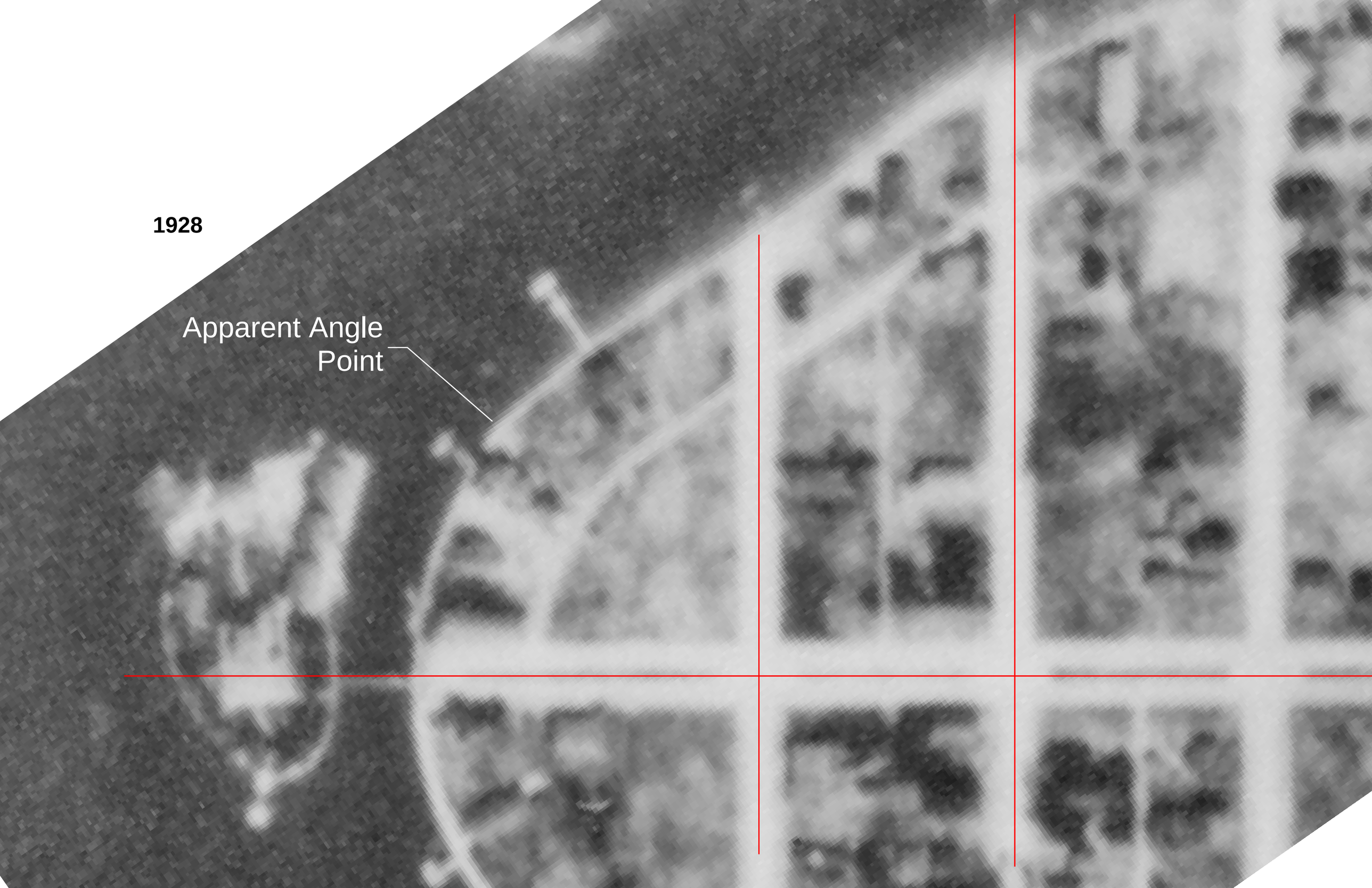
Recommended Action	Description
Emergency Action	Recommended whenever an unsafe condition is observed. If the situation is life threatening, significant property damage may occur, or significant environmental damage may occur, and appropriate owner representatives should be contacted immediately. Emergency actions may consist of barricading or closing all or portions of the structure, placing load restrictions, or unloading portions of the structure
Engineering Evaluation	Recommended whenever significant damage or defects are encountered that require a structural investigation or evaluation to quantify the structural capacity, determine if repairs are required, or determine what method of repair is appropriate. Although the scope of the routine inspections should include the structural assessment of the damage or defects on the capacity of typical structural components relative to their new condition, the engineering evaluation should consider the actual/anticipated loads that are or will be imposed on the structure
Structural Repair or Upgrade Design Inspection	Recommended whenever repairs are required, typically as a result of a routine inspection, but may also result from a special purpose inspection or post-event inspection
Special Purpose Inspection	Typically recommended to determine the cause or significance of nontypical deterioration, usually prior to designing repairs. Special testing, analysis, monitoring, or investigation using nonstandard equipment/techniques is typically required
Repair Plans Development	Recommended when the structural repair or upgrade design inspection has been completed and any special purpose inspections recommended have been completed. Indicates that the field data has been collected, and the structure is ready to have repair documents prepared
No Action	Recommended when no further action is necessary on the structure until the next scheduled routine inspection

APPENDIX D – Historical Photographs

1927

Apparent Angle
Point

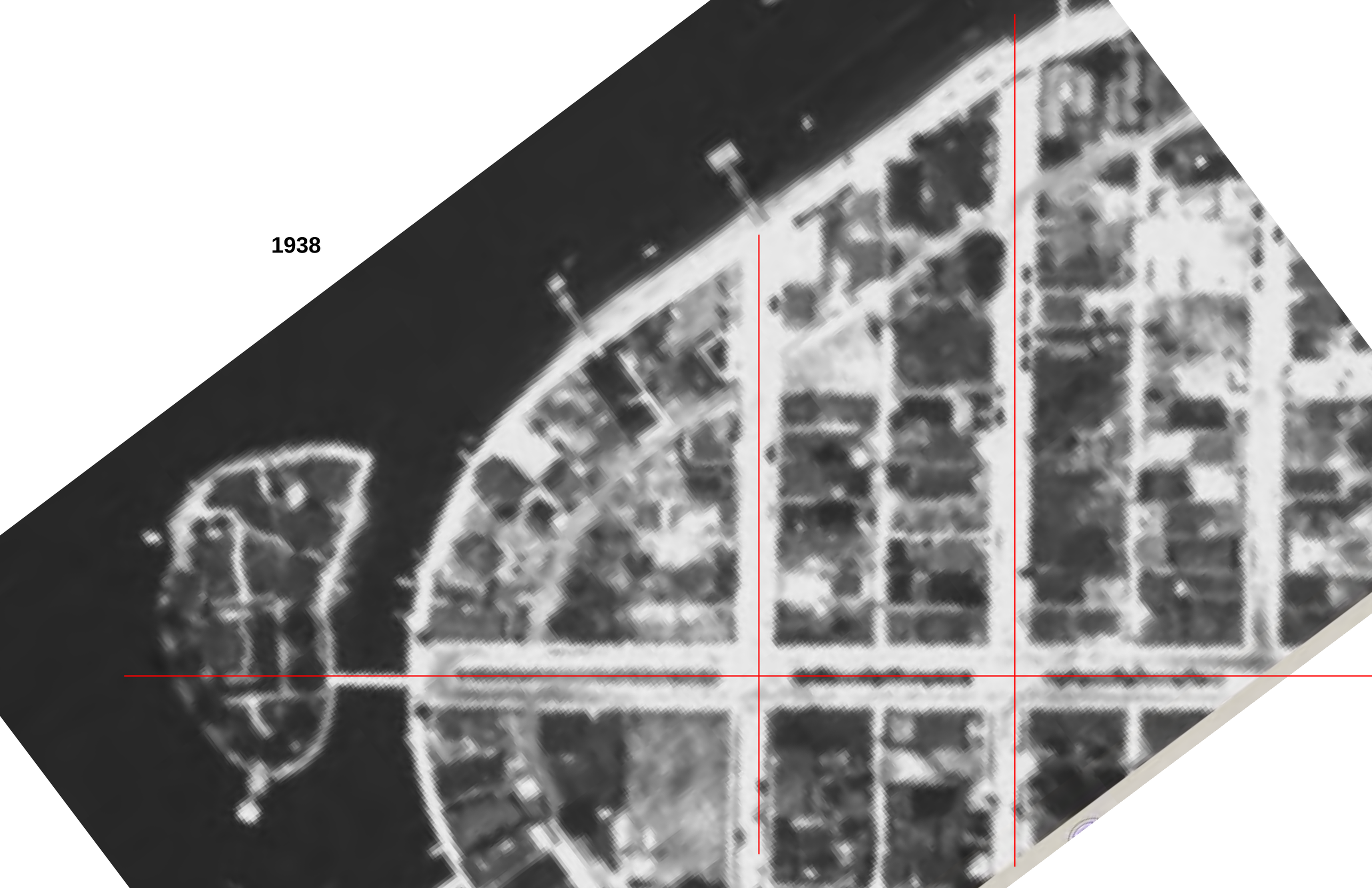
1928



1931

Apparent Angle Point

1938




1945


2016
North Bay Front
Emerald Ave


1921
EMERALD AVE
SEAWALL

Appendix 6

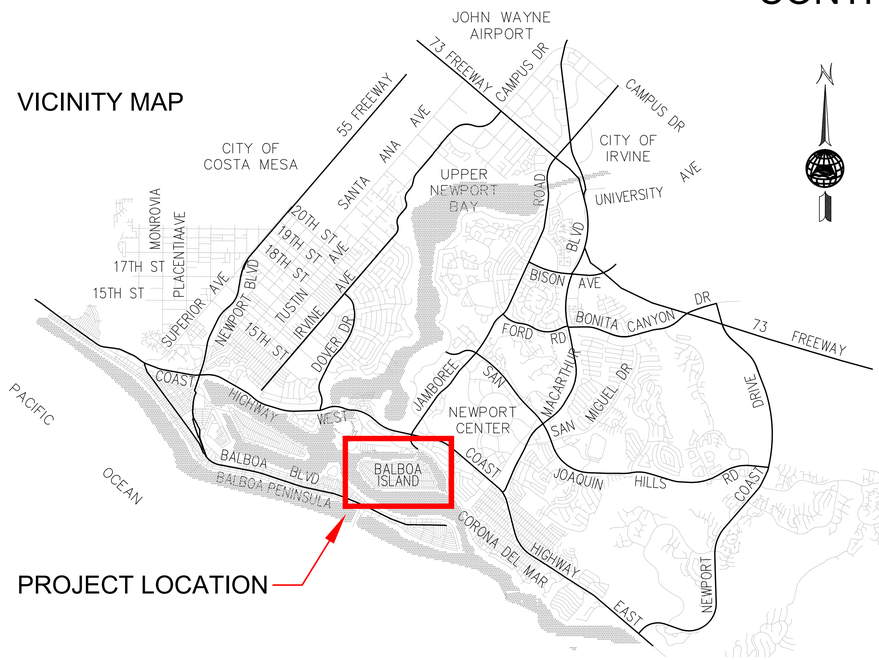
Current Project Inspection

CITY OF NEWPORT BEACH
PUBLIC WORKS DEPARTMENT

BALBOA ISLAND COPING REPAIR

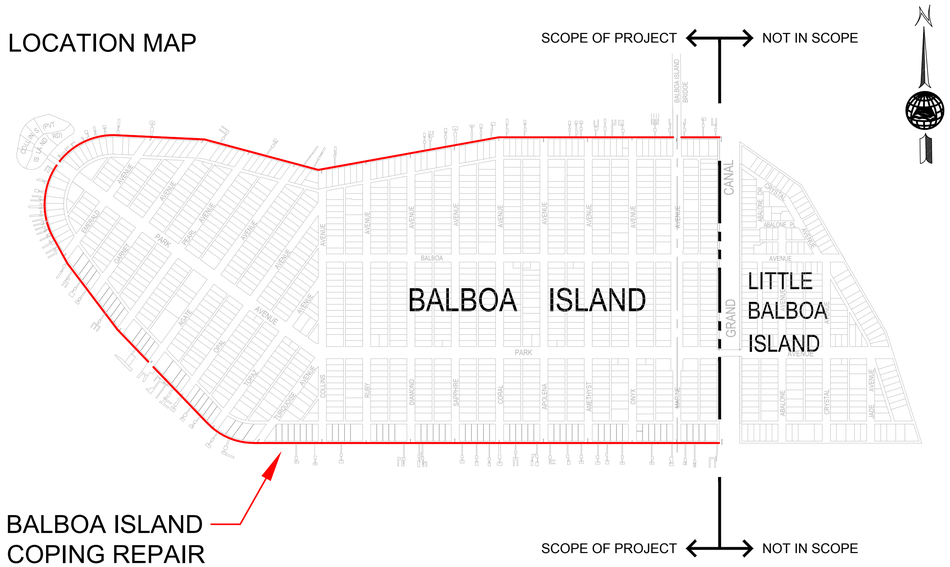
CONTRACT NO. C-7066-1

VICINITY MAP



PROJECT LOCATION

LOCATION MAP



BALBOA ISLAND COPING REPAIR PROJECT

DRAWING INDEX

SHEET	SHEET TITLE
1	TITLE SHEET, VICINITY MAP, LOACTION MAP, DRAWING INDEX
2	GENERAL NOTES
3	OVERALL PLAN
4	SECTION PLANS
5	SECTION PLANS
6	SECTION PLANS
7	SECTION PLANS
8	SECTION PLANS
9	SECTION PLANS
10	SECTION PLANS

SHEET	SHEET TITLE
13	DETAILS
14	DETAILS
15	DETAILS
16	DETAILS
17	DETAILS
18	DETAILS

SHEET	SHEET TITLE

80% REVIEW SUBMITTAL NOT FOR CONSTRUCTION

CALL TOLL FREE
1-800-227-2600
BEFORE YOU DIG

BASIS OF BEARINGS:

BENCHMARK:

EMERGENCY TELEPHONE NUMBERS

	DAY	NIGHT
SOUTHERN CALIFORNIA GAS COMPANY	(800) 624-8153	
SOUTHERN CALIFORNIA EDISON COMPANY	(800) 611-1911	
AT&T TELEPHONE COMPANY	(800) 332-1321	
CITY OF NEWPORT BEACH UTILITIES DIVISION	(949) 644-3011	(949) 644-3717
ORANGE COUNTY SANITATION DISTRICT	(714) 962-2411	
TIME WARNER CABLE	(714) 542-6222	
COX COMMUNICATIONS	-	
ENGINEER OF RECORD		

NO.	DATE	REVISION

REVIEWED:

WARREN A. STEWART, RCE C41358
COWI MARINE NORTH AMERICA

DESIGNED: WNST | DRAWN: MCLS
CHECKED: GAVP | DATE: 03/18/16

BALBOA ISLAND COPING REPAIR

TITLE SHEET, VICINITY MAP, LOCATION MAP, DRAWING INDEX

CITY OF NEWPORT BEACH
PUBLIC WORKS DEPARTMENT

H-5235-S

SHEET 1 OF XX

GENERAL NOTES

SECTION 1 : GENERAL

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND SITE CONDITIONS BEFORE STARTING WORK . THE ENGINEER SHALL BE NOTIFIED OF ANY DISCREPANCY.

2. THE CITY OF NEWPORT BEACH AND/OR THE ENGINEER SHALL BEAR NO RESPONSIBILITY FOR EXPENSES INCURRED AS A RESULT OF FAILURE ON THE PART OF THE CONTRACTOR TO VERIFY DIMENSIONS AND/OR VERIFIABLE SITE CONDITIONS PRIOR TO BEGINNING WORK.

3. NOTES AND DETAILS ON THE DRAWINGS SHALL TAKE PRECEDENCE OVER THESE GENERAL NOTES.

4. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE ALL EXISTING UTILITIES WHETHER SHOWN HERE ON OR NOT AND TO PROTECT THEM FROM DAMAGE. THE CONTRACTOR SHALL BEAR ALL EXPENSE OF REPAIR OR REPLACEMENT IN CONJUNCTION WITH THE EXECUTION OF THIS WORK.

5. DIMENSIONS TAKE PRECEDENCE OVER SCALE.

6. SUBSTITUTIONS: NO SUBSTITUTIONS SHALL BE MADE WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER.

7. DAMAGE TO EXISTING FACILITIES: THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DAMAGE TO EXISTING STRUCTURES, PAVEMENT, CONCRETE SIDEWALK, UNDERGROUND UTILITIES, LANDSCAPING, CONCRETE PILES, LANDINGS, BULKHEAD AND FACILITIES ON OR ADJACENT TO THE PROJECT AND SHALL REPAIR ANY DAMAGE AT NO COST AND TO THE SATISFACTION OF THE HOMEOWNER AND ENGINEER.

8. THE CONTRACTOR SHALL NOT USE THE SIDEWALK OR THE AREA BEHIND THE BULKHEAD FOR EQUIPMENT AND/OR MATERIAL STORAGE.

9. CLEAN-UP: ALL TRADES SHALL, AT ALL TIMES, KEEP THE PREMISES FREE FROM ACCUMULATION OF WASTE MATERIALS OR RUBBISH CAUSED BY THE WORK DURING CONSTRUCTION, AND AT THE COMPLETION OF THE WORK SHALL REMOVE ALL RUBBISH AND DEBRIS.

10. SCHEDULE: CONTRACTOR SHALL SUBMIT A DETAILED SCHEDULE OF WORK INDICATING THE SEQUENCE OF ALL CONSTRUCTION PHASES FOR APPROVAL BY THE ENGINEER.

11. DATUM: ALL ELEVATIONS SHOWN ARE BASED ON A DATUM OF MEAN LOWER LOW WATER -0.00.

SECTION 2 : REGULATORY REQUIREMENTS

1. THE CONTRACTOR SHALL, AT ALL TIMES, COMPLY WITH ALL OSHA AND STATE SAFETY ORDERS.

2. ALL WORK SHALL CONFORM TO THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, 2015 EDITION, INCLUDING SUPPLEMENTS (SSPWC).

SECTION 3 : CONCRETE

1. ALL CONCRETE WORK SHALL CONFORM TO THE REQUIREMENTS OF ACI 301, "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS" AND THE "2013 CALIFORNIA BUILDING CODE", CHAPTER19A, EXCEPT AS MODIFIED BY THE SUPPLEMENTAL REQUIREMENTS HEREIN AND IN THE PROJECT SPECIFICATIONS.

2. CAST IN PLACE CONCRETE SHALL BE HARD ROCK CONCRETE AND SHALL

   COMPLY WITH SSPWC SECTION 201-1.1.3

   A. CONCRETE TYPE 750-CSE-5000P

   B. MAX WATER-CEMENT RATIO = 0.40

   C. HIGH RANGE WATER REDUCER REQUIRED

   D. PUMP MIX ONLY IF PUMPING CONCRETE

3. ALL EXPOSED EDGES AND CORNERS SHALL BE ROUND WITH A 1-1/2" RADIUS, UNLESS OTHERWISE NOTED.

4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION WITH ALL TRADES TO ENSURE THAT ALL EMBEDDED BOLTS, ANCHORS, BLOCKOUTS, PLATES, ETC. ARE PROPERLY LOCATED AND INSTALLED BEFORE POURING CONCRETE.

5.. REINFORCING STEEL SHALL CONFORM TO THE FOLLOWING:

   TYPICAL REINFORCING.....ASTM A-615, GR. 60

   BARS TO BE WELDED.....ASTM A-706

6. ALL REINFORCING STEEL DETAILING, FABRICATION, ACCESSORIES AND PLACEMENT SHALL CONFORM TO ACI 315 "DETAILS AND DETAILING OF CONCRETE REINFORCEMENT". PROVIDE 3 INCHES MINIMUM COVER FOR REINFORCING BARS UNLESS OTHERWISE NOTED. WHERE NEW CONCRETE IS TO BE POURED AGAINST EXISTING, MIN CLEARANCE SHALL BE 2".

7. CONTINUOUS REINFORCING STEEL SHALL BE DETAILED IN AS LONG A LENGTH AS PRACTICAL AND SHALL HOOK AROUND CORNERS FROM BOTH DIRECTIONS TO FORM A SPLICE LENGTH.

8. ALL LAP SPLICES SHALL BE TENSION CLASS "B" LAP SPLICES WHERE NO CALL OUT IS MADE ON THE DRAWINGS.

9. WELDING ELECTRODES FOR WELDED SPLICES SHALL BE E70XX. ALL WELDING SHALL BE PERFORMED BY AWS CERTIFIED WELDERS. ALL WELDED JOINTS SHALL BE AWS PREQUALIFIED.

10. HOOKS SHOWN BUT NOT DIMENSIONED SHALL CONFORM TO THE REQUIREMENTS FOR A "STANDARD HOOK" PER ACI 315.

11. ALL INSERT HOLES, SHE-BOLTS, ETC. AND OTHER IMPERFECTIONS ON THE SURFACES OF THE CONCRETE SHALL BE FILLED WITH GROUT, BRUSHED AND SACKED TO A UNIFORM FINISH.

12. TOP HORIZONTAL SURFACES OF CONCRETE SHALL BE FINISHED WITH A FLOAT FINISH.

13. GROUTED REBAR DOWELS AND ANCHOR RODS

   A. EPOXY GROUTING SHALL BE USED IN ALL LOCATIONS WHERE REINFORCING STEEL BARS AND ANCHOR RODS ARE BEING EMBEDDED INTO EXISTING CONCRETE. DESIGN IS BASED UPON SIMPSON STRONG-TIE SET ADHESIVE ANCHORS AS DEFINED IN C-A-2016. OTHER MANUFACTURES MAY BE APPROVED PROVIDING SIMILAR PERFORMANCE CAN BE DEMONSTRATED. COMPLY WITH THE FOLLOWING UNLESS MANUFACTURER'S RECOMMENDATIONS ARE MORE STRINGENT. SUBMIT TESTING INFORMATION FOR SYSTEM SELECTED. MIN EMBEDMENT FOR BARS IS SHOWN ON THE DRAWINGS.

   B. PRIOR TO DRILLING HOLES, LOCATE AND FIELD MARK ALL EXISTING REINFORCING. USE JAMES-METER OR 1/4" PILOT HOLES TO LOCATE BARS. ADJUST LOCATION OF BAR OR BOLT TO MISS REINFORCING BUT GENERALLY MAINTAIN SPACING AND EDGE DISTANCES SHOWN ON THE DRAWING. NOTIFY ENGINEER IF NOT POSSIBLE PRIOR TO DRILLING HOLE AND FOLLOW INSTRUCTIONS.

   C. HOLES FOR ANCHOR RODS AND BARS SHALL BE OF A DIAMETER RECOMMENDED BY THE MANUFACTURER AND DRILLED WITH A CARBIDE-TIP IMPACT DRILL. IMMEDIATELY BEFORE APPLYING EPOXY GROUT, HOLES SHALL BE REAMED WITH A CIRCULAR WIRE BRUSH ATTACHED TO DRILL MOTOR AND THEN BLOWN OUT WITH OIL FREE COMPRESSED AIR.

   D. EPOXY GROUT FOR DOWNWARD HOLES MAY BE EITHER NON-SAG OR LIQUID TYPE, NORMAL SET. EPOXY GROUT FOR HORIZONTAL OR OVERHEAD HOLES SHALL BE NON-SAG TYPE, NORMAL SET. LIQUID EPOXY SHALL BE POURED SLOWLY INTO THE HOLE TO AVOID TRAPPED AIR. NON-SAG EPOXY SHALL BE INJECTED INTO THE HOLE USING AN EXTENSION NOZZLE TO REACH THE BOTTOM OF THE HOLE. HOLES SHALL BE FILLED APPROXIMATELY HALF FULL WITH EPOXY.

   E. THE BAR OR ROD SHALL BE INSERTED SLOWLY INTO THE HOLE AND THEN ROTATED. DO NOT MOVE THE BAR OR ROD UP AND DOWN WHEN INSTALLING. REMOVE ANY EPOXY GROUT AROUND THE HOLE BEFORE IT HAS SET.

   F. ALL WORK SHALL BE PERFORMED UNDER FULL TIME SPECIAL INSPECTION. DO NOT INSTALL BARS OR RODS UNLESS INSPECTOR IS PRESENT.

SECTION 4 : REPAIRS TO EXISTING CAPS

1. CONTRACTOR SHALL REPAIR CRACKS NOTED AS "1/8 CRACKS" AND SPALLED CONCRETE IN THE EXISTING CONCRETE CAP AT LOCATIONS NOTED ON THE DRAWINGS. SIKA PRODUCTS OR APPROVED EQUAL ARE LISTED. CONTRACTOR SHALL MEASURE CRACK WIDTH WIDTH AND REPAIR AS FOLLOWS:

   A. FOR EXISTING CRACKS 1/8" WIDE OR GREATER

   ROUT OUT ANY LOOSE MATERIAL, FLUSH WITH FRESH WATER AND INJECT WITH SIKADUR 52 EPOXY ADHESIVE. DURING THE CRACK REPAIR EFFORT, IF THE REINFORCING IS EXPOSED AND THE CROSS SECTIONAL AREA OF THE REINFORCING CAN BE DETERMINED TO BE 50% OR LESS OF THE ORIGINAL AREA, CHIP CONCRETE, AND SPLICE WITH NEW LENGTH OF REINFORCING. NEW REINFORCING SHALL BE WELDED TO THE EXISTING REINFORCING AND LAPPED A MINIMUM OF TWELVE (12") INCHES. PATCH CONCRETE WITH DRY PACK TO EXISTING CONTOUR. REFER TO SECTIONS TITLED "CONCRETE PATCHING" AND "REINFORCING" FOR ADDITIONAL INFORMATION.

   B. FOR EXISTING CRACKS LESS THAN 1/8"

   APPLY SIKAPRONTO-19 TF METHACRYLATE JOINT SEALER PER MFR INSTRUCTUCTIONS.

2. EXPANSION JOINTS

   REMOVE ANY LOOSE MATERIAL, PRIME JOINT WITH SIKAFLEX 429 PRIMER. AFTER PRIMER HAS DRIED, INSTALL A CLOSED CELL FOAM BACKER ROD INTO JOINT SUCH THAT THE DEPTH OF THE JOINT IS ½ INCH. ALLOW THE BACKER MATERIAL TO BE EXPOSED TO THE AIR FOR A MINIMUM OF 20 MINUTES THEN APPLY SIKAFLEX 1A SEALANT ACCORDING TO MANUFACTURER'S SPECIFICATIONS.

3. CONCRETE PATCHING (BULKHEAD COPING)

   WHERE THE CONCRETE HAS SPALLED WITH A LOSS OF ONE INCH OR MORE OF CONCRETE, OR AS INDICATED BY THE ENGINEER. THE CONTRACTOR SHALL PATCH THE AREA AS FOLLOWS:

   1. SAW CUT EDGES 1" DEEP, CHIP AND REMOVE ANY LOOSE MATERIAL. CHIP 1" BEYOND EXISTING REBAR.
   2. CLEAN THE AREA OF ALL DUST AND DEBRIS.
   3. DRY AREA TO BE PATCHED.
   4. IMMEDIATELY BEFORE PLACING CONCRETE, COAT THE AREA WITH SIKA ARMATEC 110 EPOCEM.
   5. FOR SPALLS THAT WILL NOT RECEIVE NEW CONCRETE THAT COVERS IT,PATCH CONCRETE WITH SIKATOP 122 PLUS TO EXISTING CONTOURS.

   NOTE: CONTRACTOR SHALL PLAN THE CONCRETE PATCHING EFFORT DURING LOW TIDE CONDITIONS TO PREVENT SALTWATER CONTAMINATION OF THE PREPARED SURFACES.

SECTION 5: METALS

1. STEEL SHALL BE DESIGNED, DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION AISC 360 "SPEDIFICATION FOR STRUCTURAL STEEL BUILDINGS", AND THE AMERICAN WELDING SOCIETY CODE AWS D1.1, "WELDING IN BUILDING CONSTRUCTION".

2. STAINLESS STEEL SHAPES SHALL BE ALLOY 316L, CONDITION A, COLD FINISHED CONFORMING TO STANDARD ASTM A 276.

3. SHEAR STUDS TO BE MADE OF STAINLESS STEEL, ALLOY 316L, CONFORMING TO STANDARD ASTM A 276 OR ASTM A 493, AS MANUFACTURED BY NELSON STUD WELDING OR APPROVED EQUAL. MIN YIELDING STRENGTH 50,000 PSI. MIN TENSILE STRENGTH 75,000 PSI.

4. ANCHOR RODS (ALL THREAD) SHALL CONFORM TO STANDARD ASTM F1554 GR.105; HEAVY HEX NUTS: ASTM A563 GR.DH; WASHERS: ASTM F436.

5. RODS, NUTS AND WASHERS SHALL BE GALVANIZED PER ASTM A-123 OR A-153 AS APPLICABLE.

6. WELDING ELECTRODES FOR CARBON STEEL SHALL BE E70XX. ELECTRODES FOR STAINLESS STEEL SHALL BE BEST SUITABLE FOR 316L STEEL. ALL WELDING SHALL BE PERFORMED BY AWS CERTIFIED WELDERS. ALL WELDED JOINTS SHALL BE AWS PREQUALIFIED. GROOVE AND BUTT WELDS ARE "COMPLETE PENETRATION", UNLESS OTHERWISE NOTED.

7. ALL STRUCTURAL STEEL ACCESSORIES OR INCIDENTAL ITEMS NOT SPECIFICALLY SHOWN OR HEREIN SPECIFIED, BUT NECESSARY TO FULLY CARRY OUT THE OBVIOUS INTENT OF THE PLANS SHALL BE INCLUDED UNDER THIS SECTION WITHOUT ADDITIONAL COST.

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ENGINEER OF RECORD		

NO.	DATE	REVISION

REVIEWED:

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COWI MARINE NORTH AMERICA

DESIGNED: WNST DRAWN: MCLS

CHECKED: GAVP DATE: 03/18/16

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GENERAL NOTES

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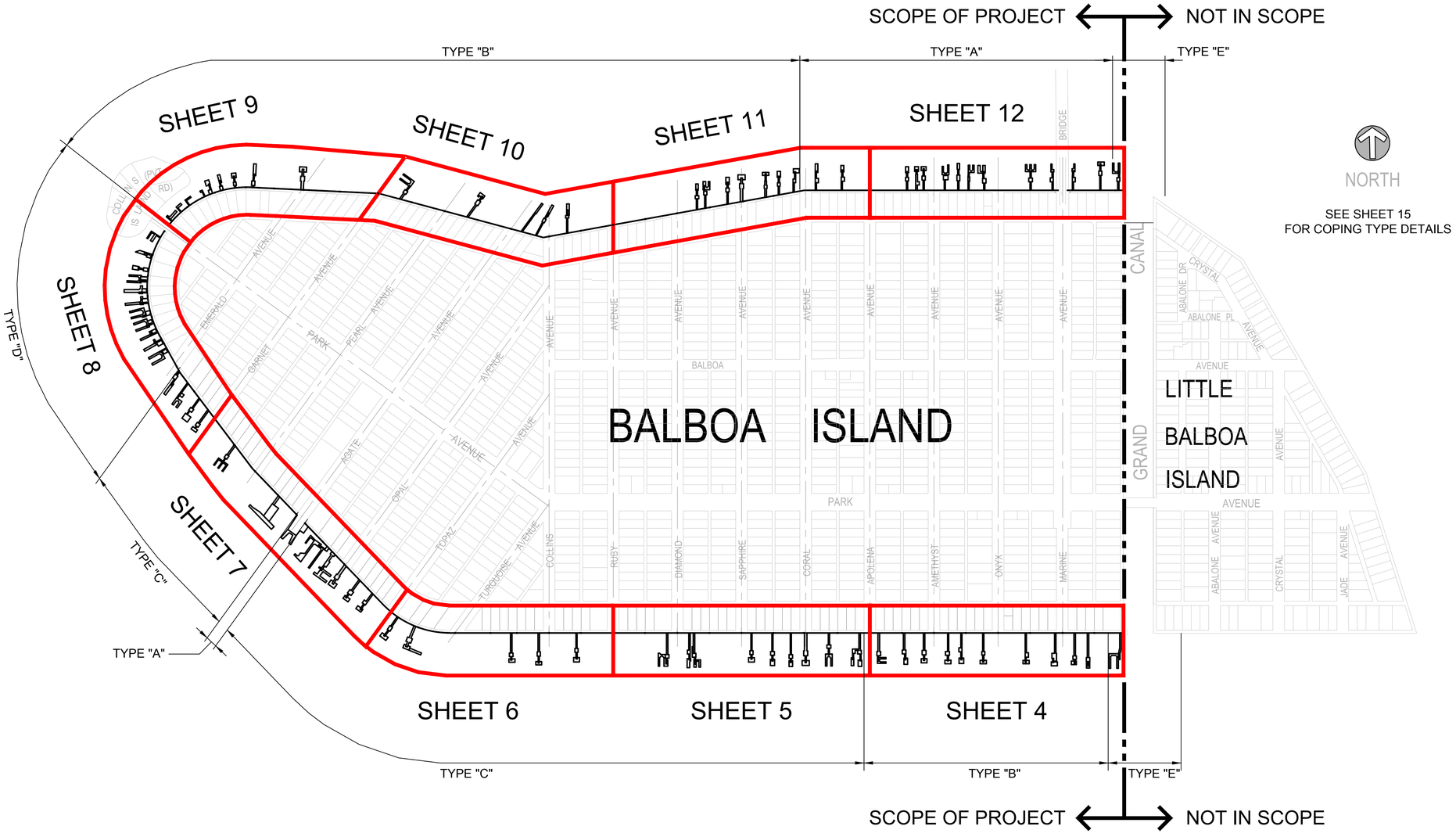

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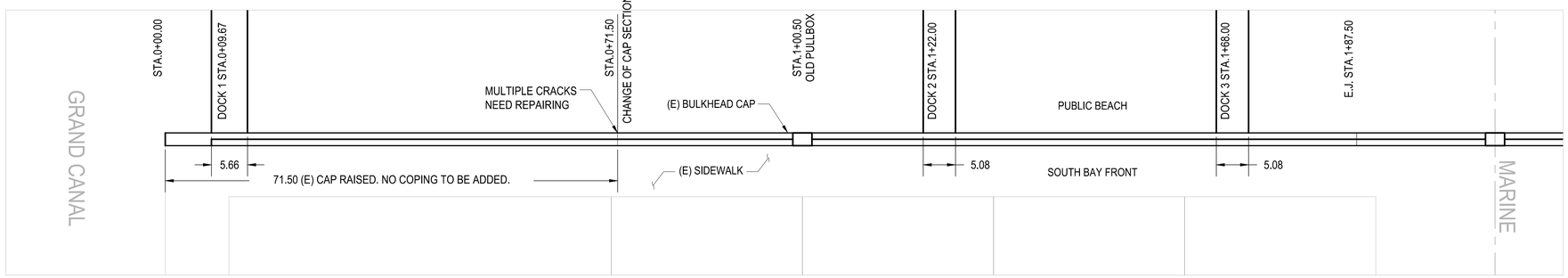
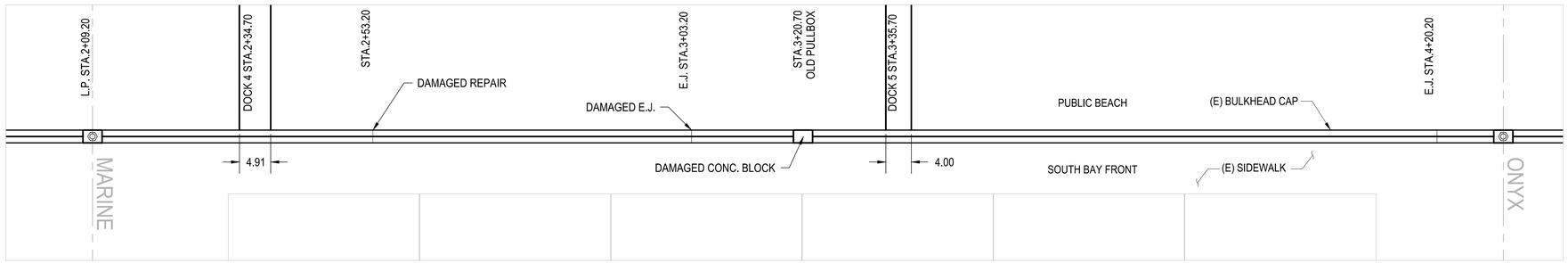
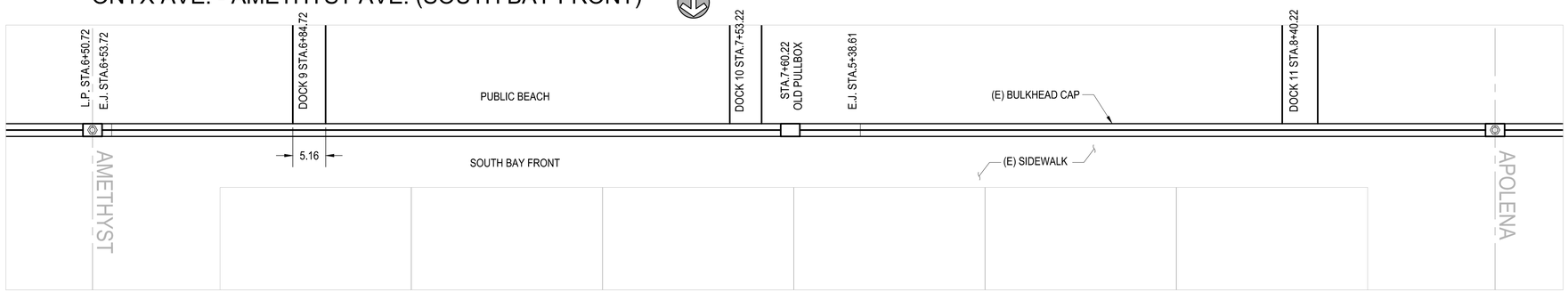


GRAND CANAL - MARINE AVE. (SOUTH BAY FRONT)



MARINE AVE. - ONYX AVE. (SOUTH BAY FRONT)

ONYX AVE. - AMETHYST AVE. (SOUTH BAY FRONT)



AMETHYST AVE. - APOLENA AVE. (SOUTH BAY FRONT)

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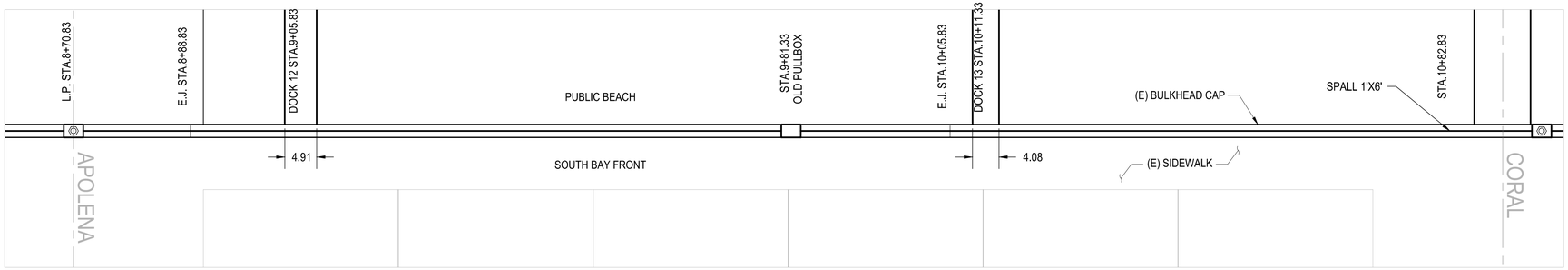
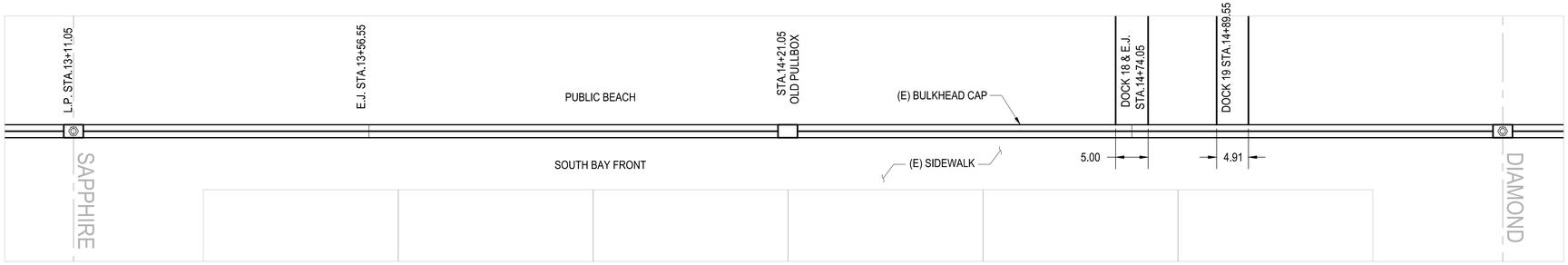
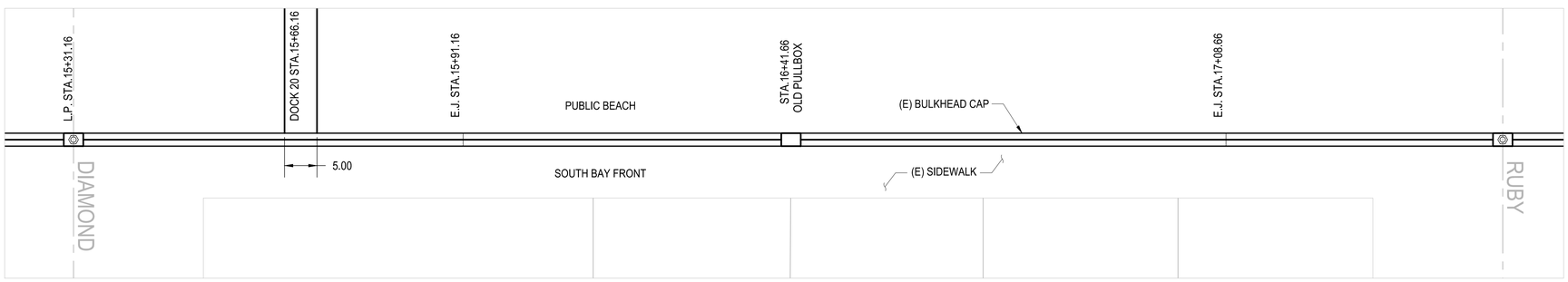


APOLENA AVE. - CORAL AVE. (SOUTH BAY FRONT)

CORAL AVE. - SAPPHIRE AVE. (SOUTH BAY FRONT)



SAPPHIRE AVE. - DIAMOND AVE. (SOUTH BAY FRONT)



DIAMOND AVE. - RUBY AVE. (SOUTH BAY FRONT)

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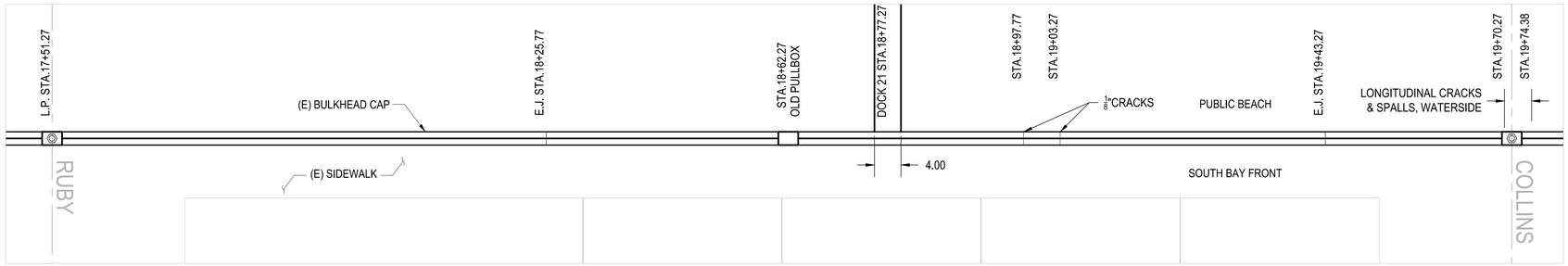
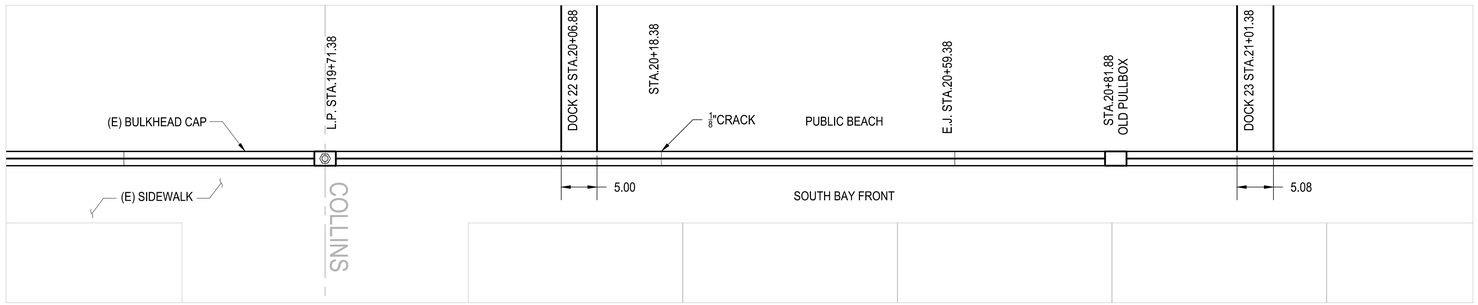
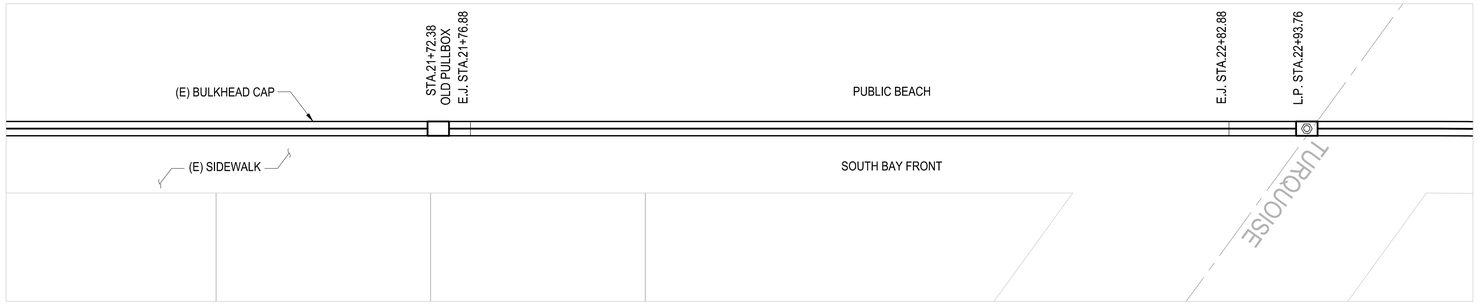


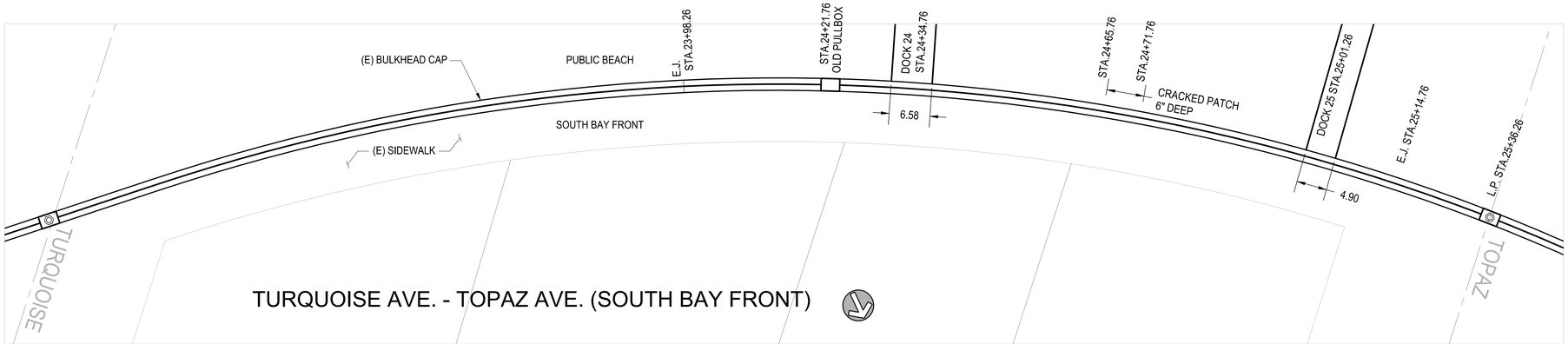
RUBY AVE. - COLLINS AVE. (SOUTH BAY FRONT)



COLLINS AVE. - DOCK 23 (SOUTH BAY FRONT)



DOCK 23 - TURQUOISE AVE. (SOUTH BAY FRONT)



TURQUOISE AVE. - TOPAZ AVE. (SOUTH BAY FRONT)

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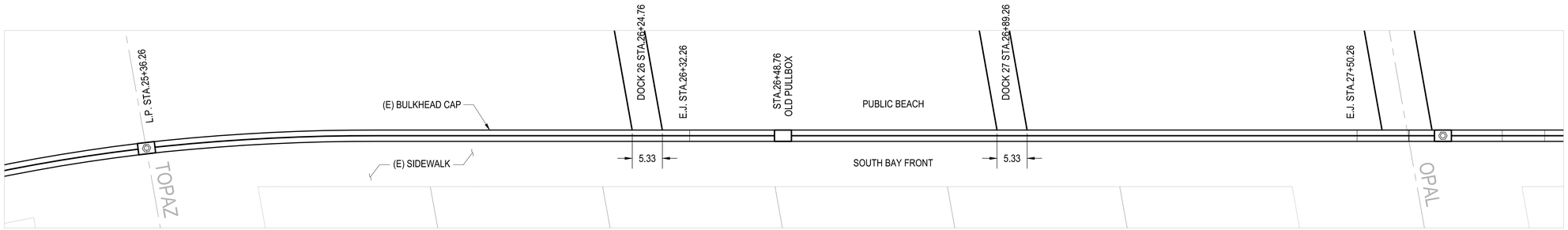
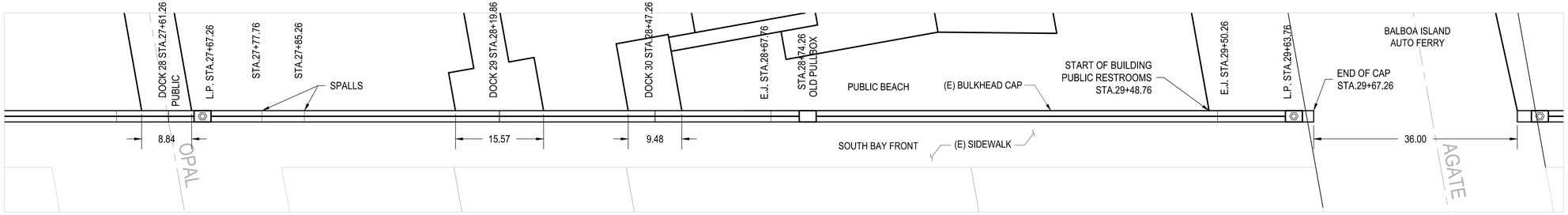
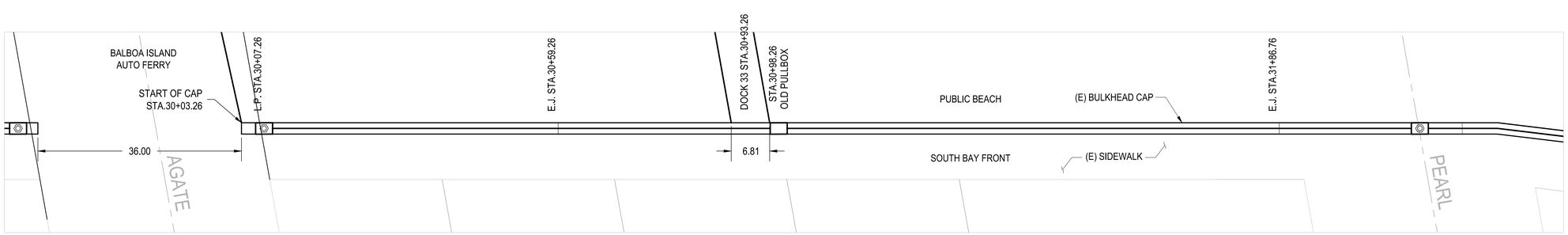


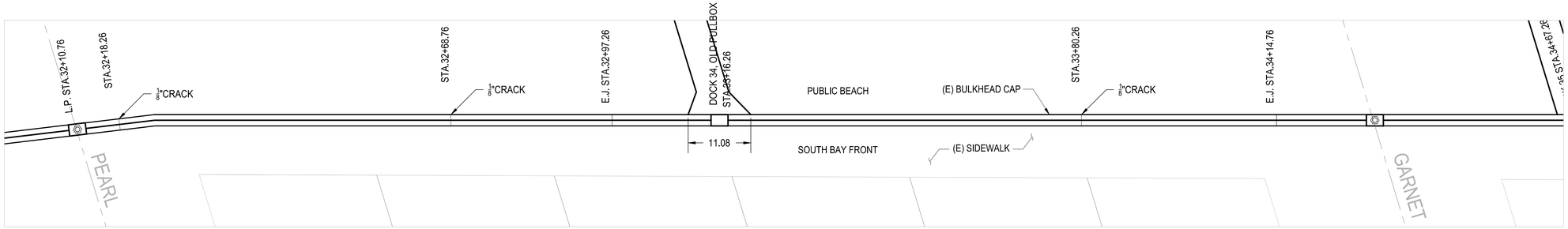
TOPAZ AVE. - OPAL AVE. (SOUTH BAY FRONT)



OPAL AVE. - AGATE AVE. (SOUTH BAY FRONT)



AGATE AVE. - PEARL AVE. (SOUTH BAY FRONT)



PEARL AVE. - GARNET AVE. (SOUTH BAY FRONT)

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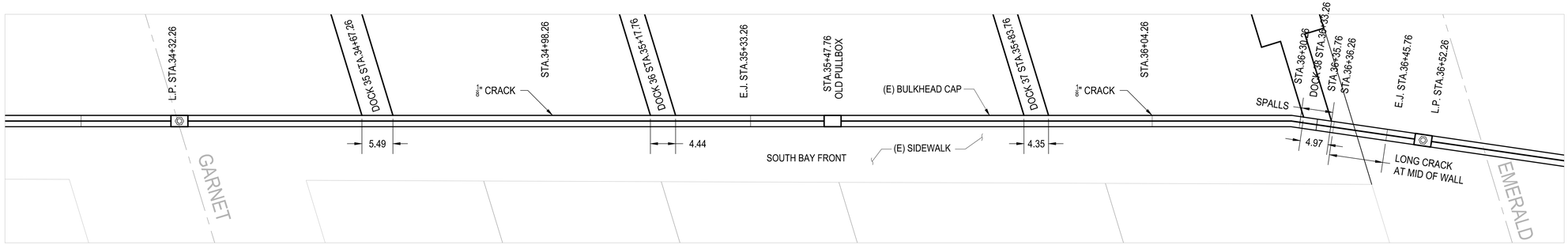
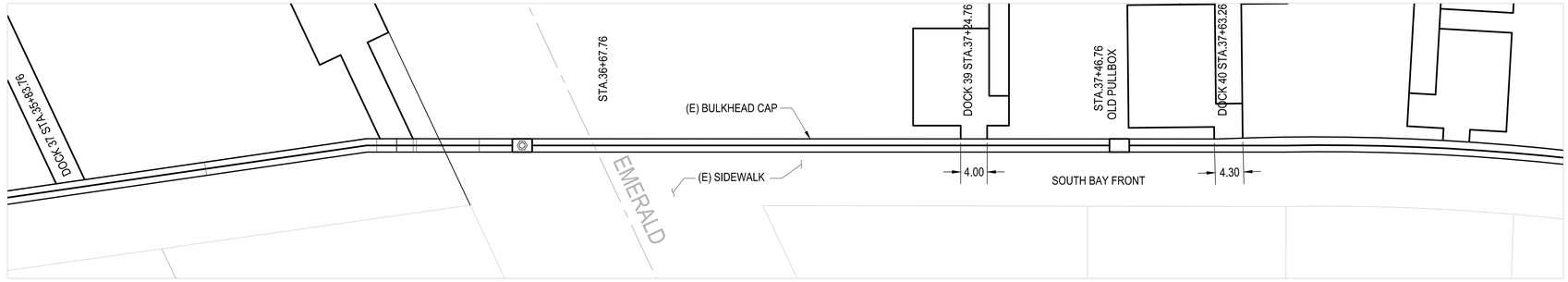
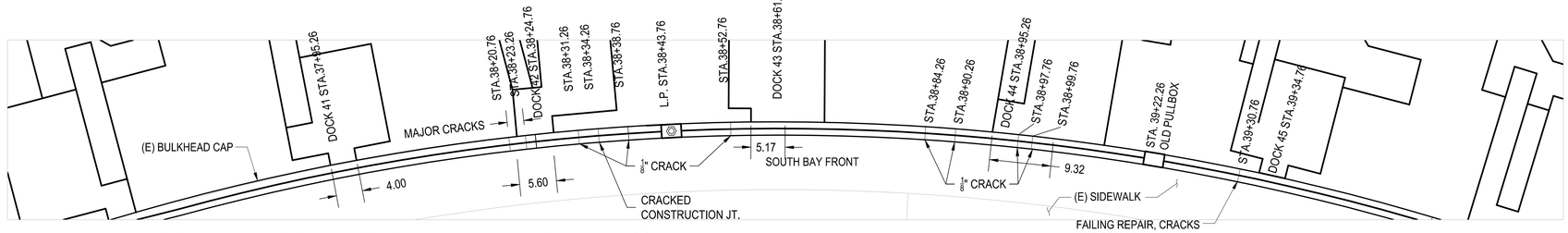


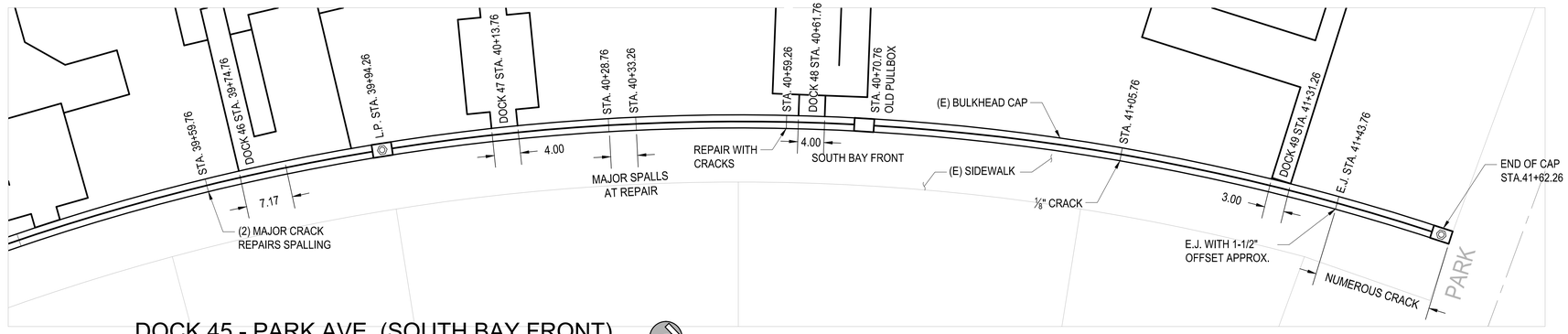
GARNET AVE. - EMERALD AVE. (SOUTH BAY FRONT)



EMERALD AVE. - DOCK 41 (SOUTH BAY FRONT)



DOCK 41 - DOCK 45 (SOUTH BAY FRONT)



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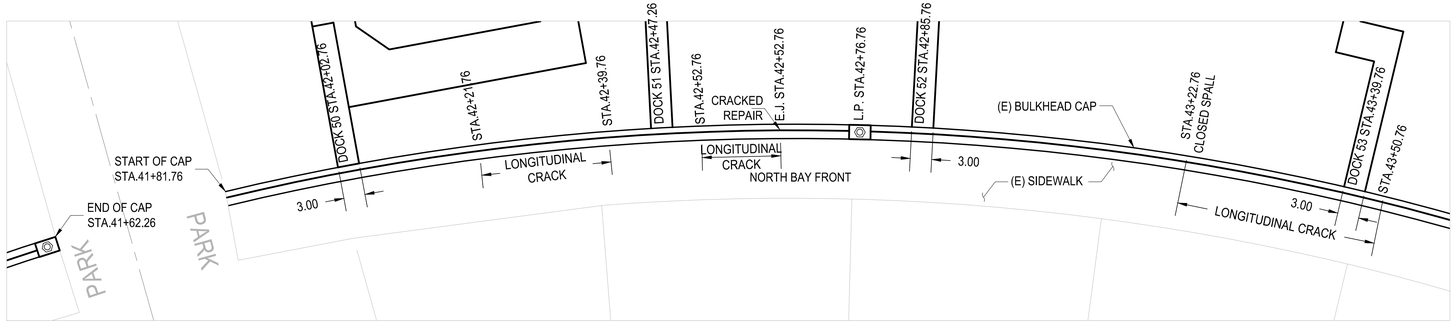
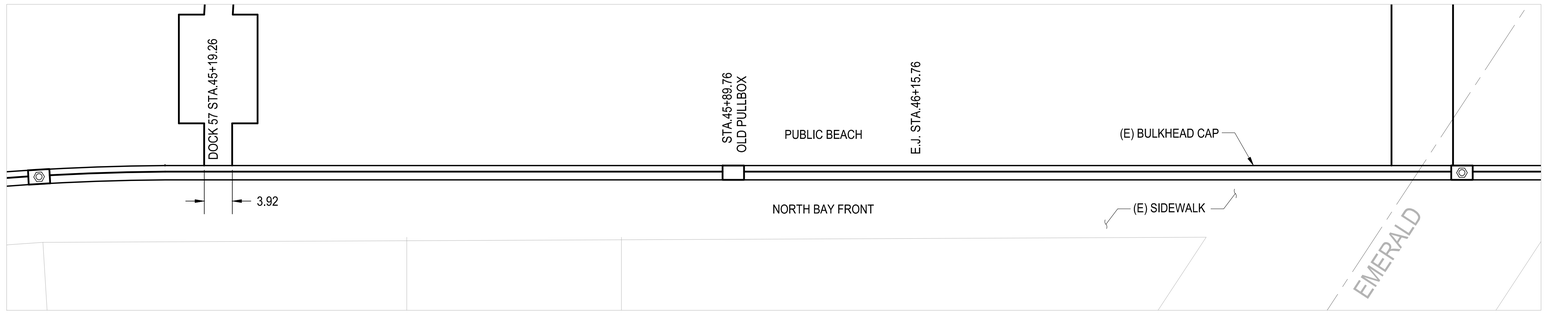


PARK AVE. - DOCK 53 (NORTH BAY FRONT)

DOCK 53 - DOCK 57 (NORTH BAY FRONT)



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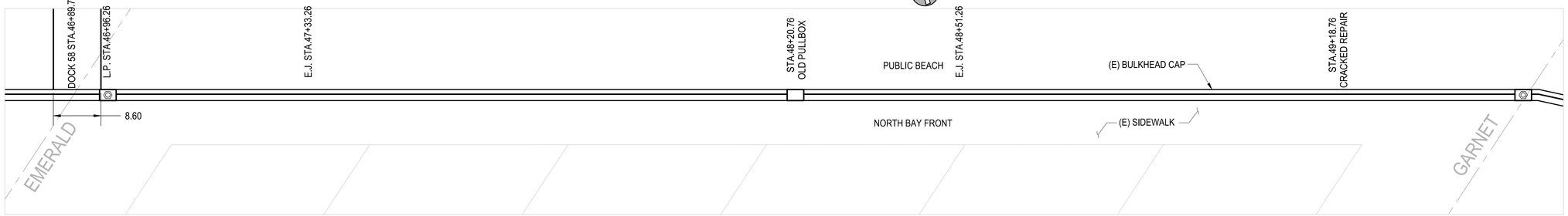

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COWI MARINE NORTH AMERICA

DESIGNED: WNST DRAWN: MCLS
CHECKED: GAVP DATE: 03/18/16

BALBOA ISLAND COPING REPAIR

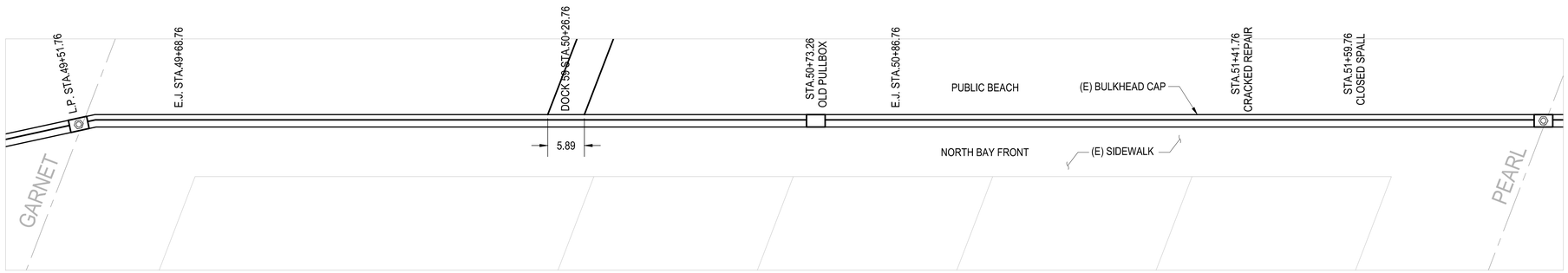
SECTION PLANS

SCALE 1:10

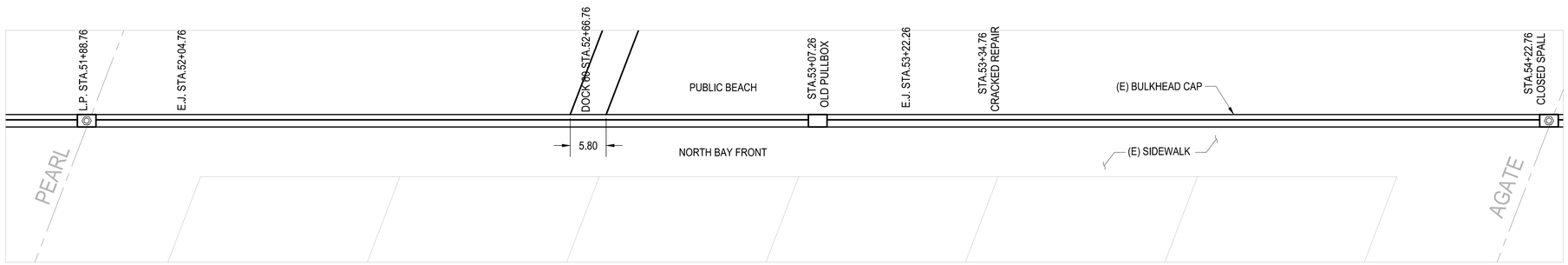
CITY OF NEWPORT BEACH
PUBLIC WORKS DEPARTMENT

H-5235-S

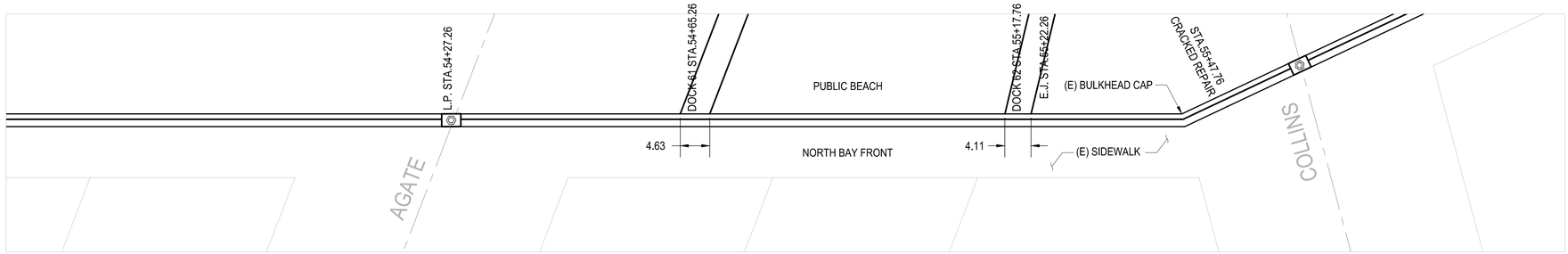
SHEET 9 OF XX



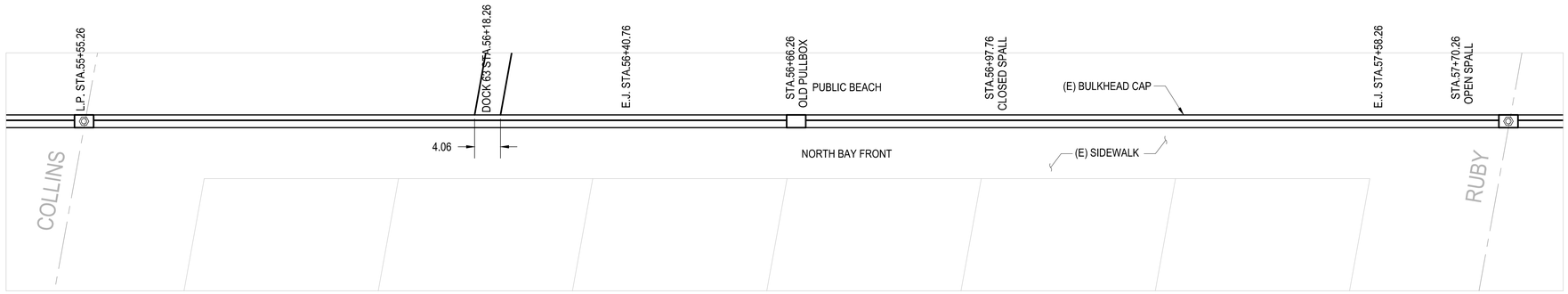
GARNET AVE. - PEARL AVE. (NORTH BAY FRONT)



PEARL AVE. - AGATE AVE. (NORTH BAY FRONT)



AGATE AVE. - COLLINS AVE. (NORTH BAY FRONT)



COLLINS AVE. - RUBY AVE. (NORTH BAY FRONT)

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BASIS OF BEARINGS:

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SOUTHERN CALIFORNIA EDISON COMPANY	(800) 611-1911	
AT&T TELEPHONE COMPANY	(800) 332-1321	
CITY OF NEWPORT BEACH UTILITIES DIVISION	(949) 644-3011	(949) 644-3717
ORANGE COUNTY SANITATION DISTRICT	(714) 962-2411	
TIME WARNER CABLE	(714) 542-6222	
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ENGINEER OF RECORD		

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CITY OF NEWPORT BEACH
PUBLIC WORKS DEPARTMENT

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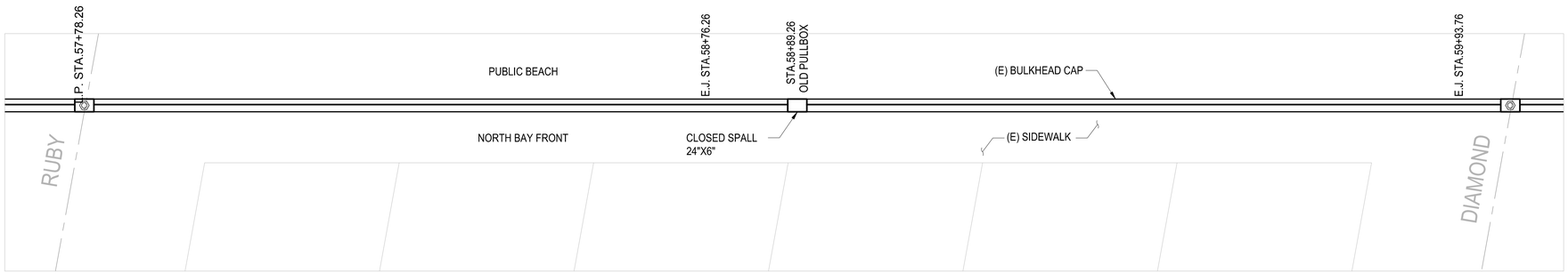
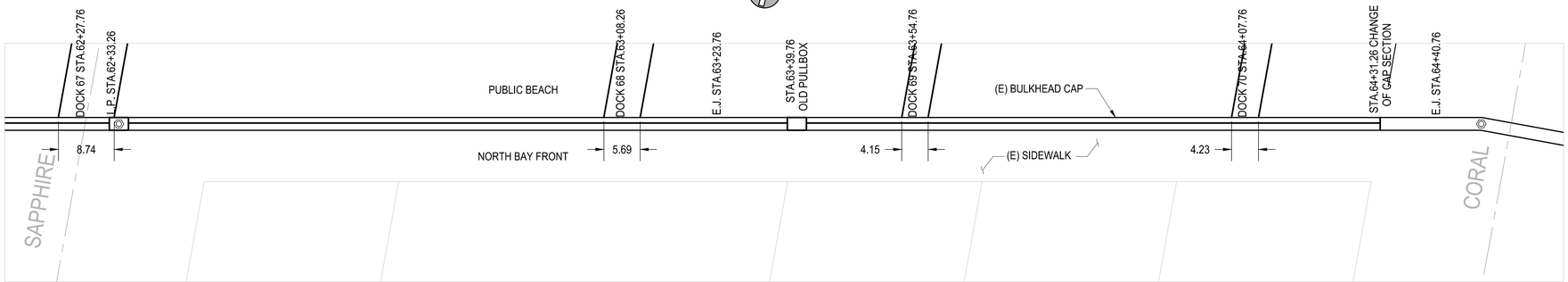


RUBY AVE. - DIAMOND AVE. (NORTH BAY FRONT)

DIAMOND AVE. - SAPPHIRE AVE. (NORTH BAY FRONT)



SAPPHIRE AVE. - CORAL AVE. (NORTH BAY FRONT)

CORAL AVE. - APOLENA AVE. (NORTH BAY FRONT)

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CITY OF NEWPORT BEACH
PUBLIC WORKS DEPARTMENT

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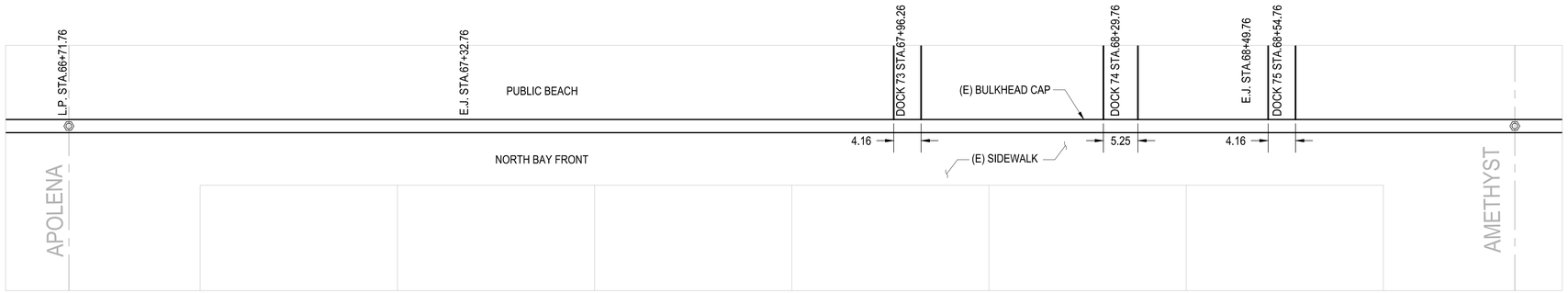
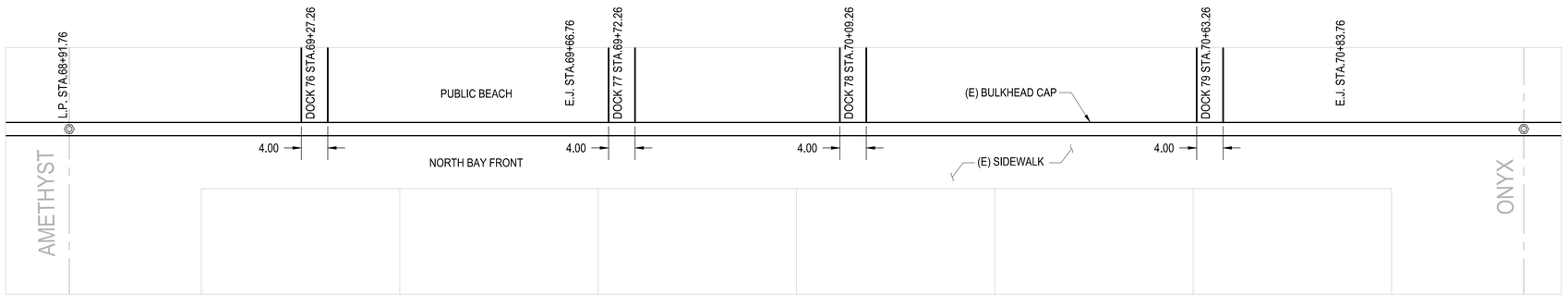
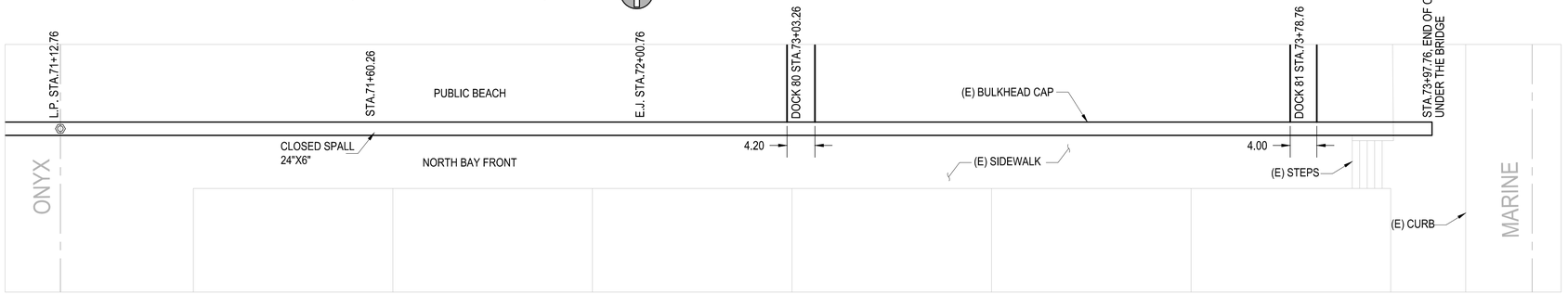
SHEET 11 OF XX



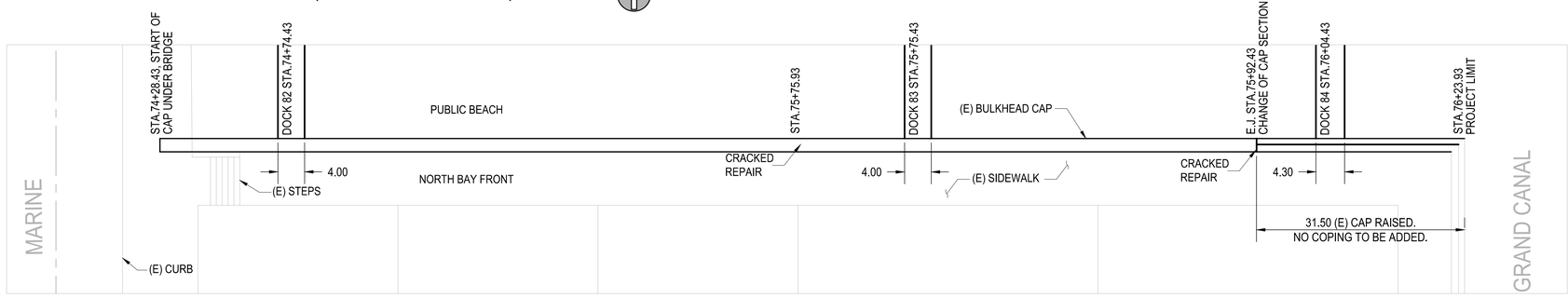
APOLENA AVE. - AMETHYST AVE. (NORTH BAY FRONT)



AMETHYST AVE. - ONYX AVE. (NORTH BAY FRONT)



ONYX AVE. - MARINE AVE. (NORTH BAY FRONT)



MARINE AVE. - GRAND CANAL (NORTH BAY FRONT)

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BALBOA ISLAND COPING REPAIR

SECTION PLANS

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CITY OF NEWPORT BEACH
PUBLIC WORKS DEPARTMENT

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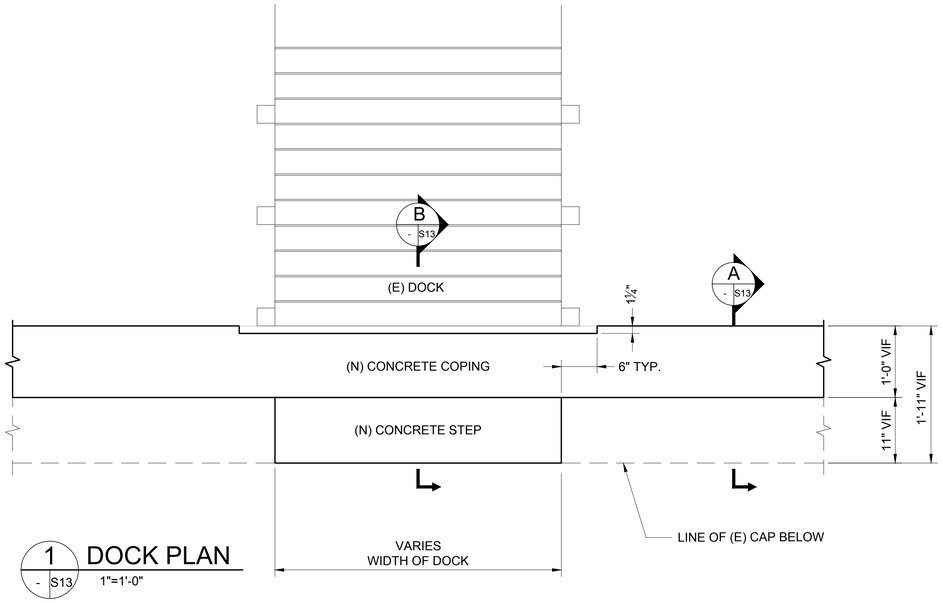
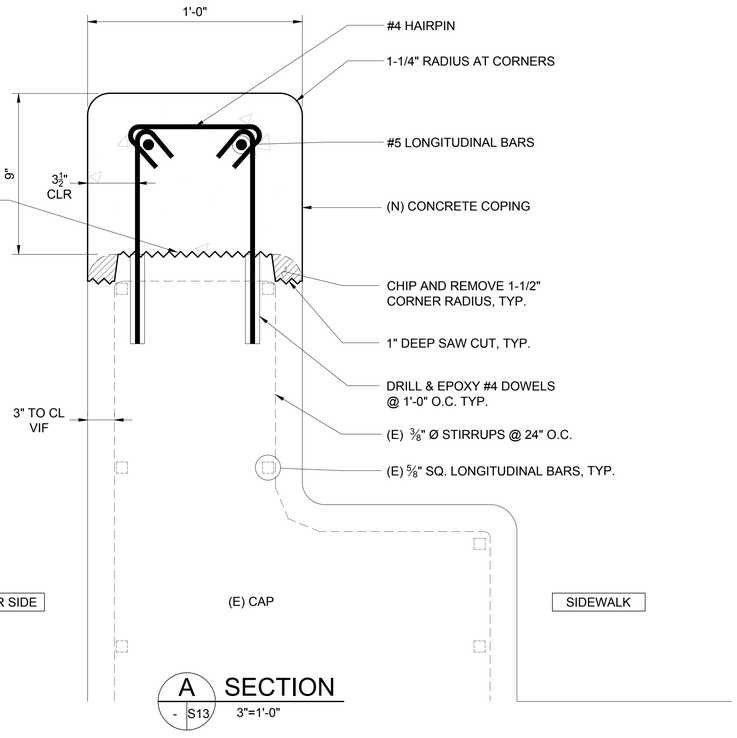
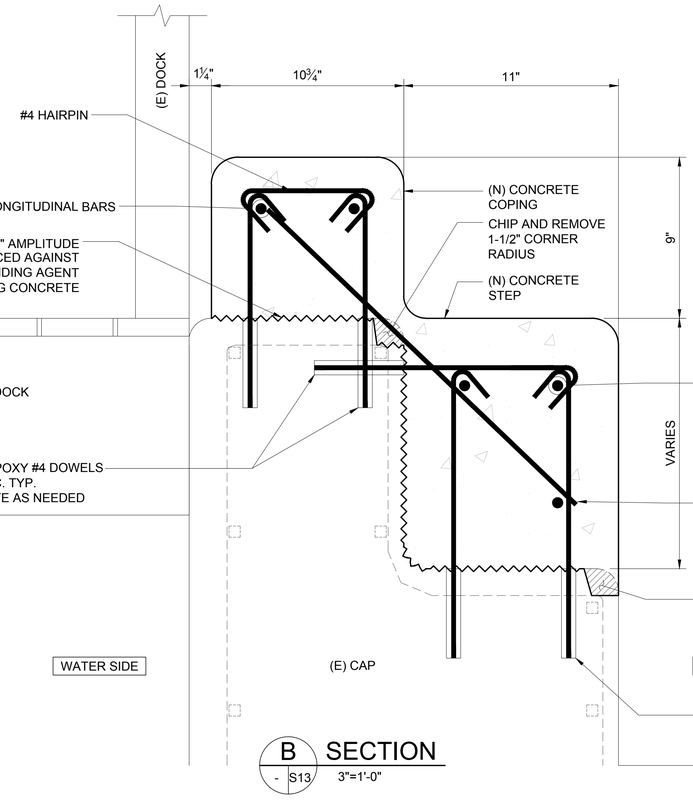
SHEET 12 OF XX



1 DOCK PLAN
- S13 1"=1'-0"



A SECTION
- S13 3"=1'-0"



B SECTION
- S13 3"=1'-0"

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BALBOA ISLAND COPING REPAIR

TYPICAL SECTION
DOCK SECTION

SCALE AS SHOWN

CITY OF NEWPORT BEACH
PUBLIC WORKS DEPARTMENT

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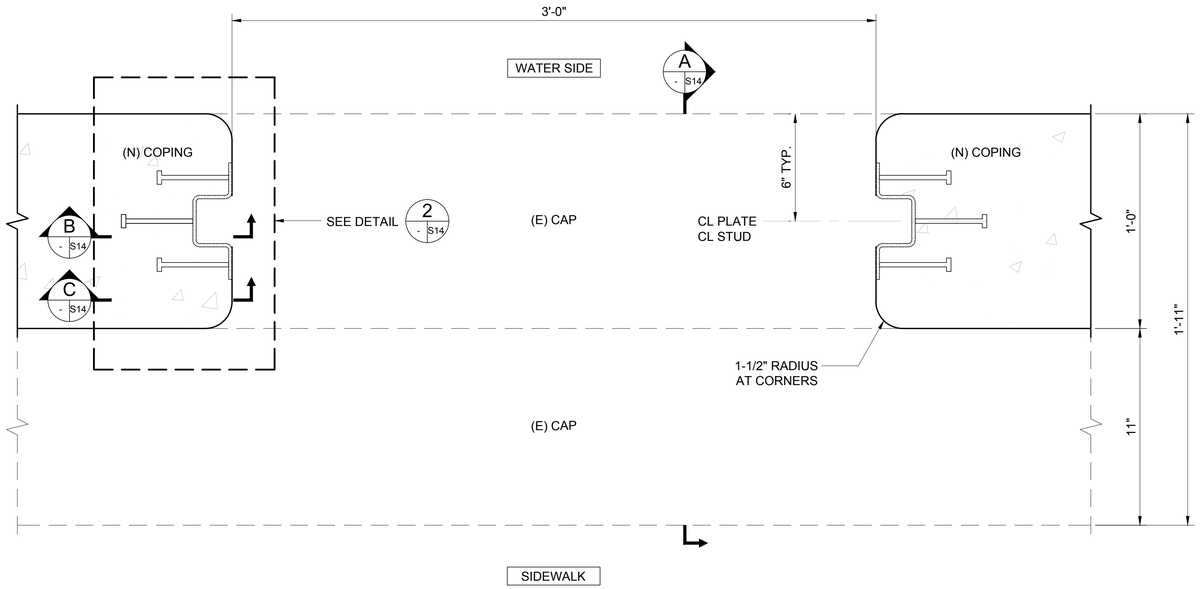
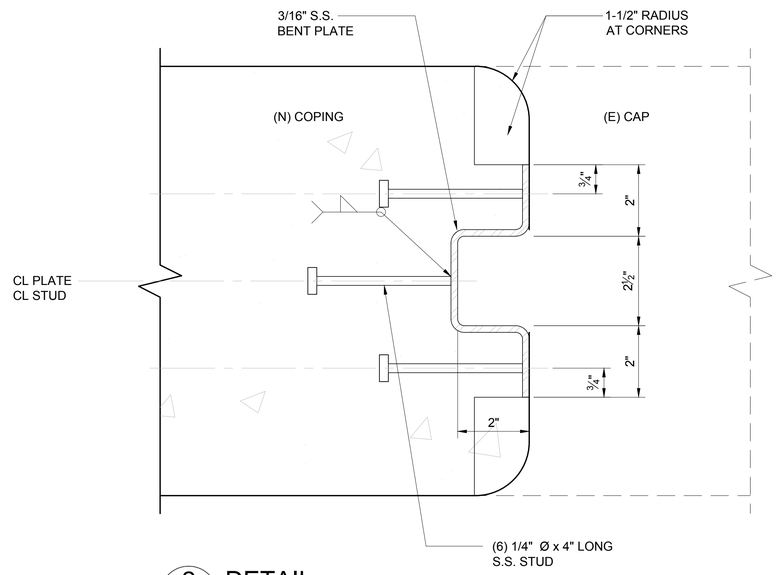
SHEET 13 OF XX



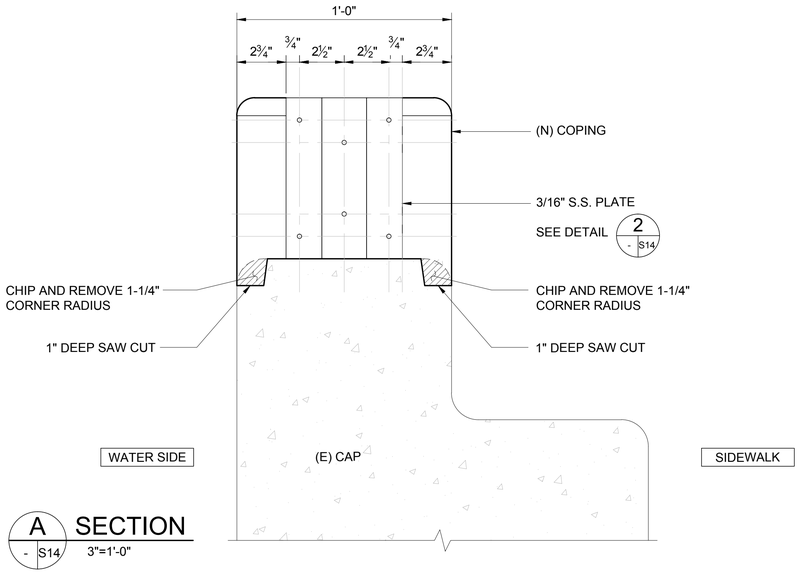
1 - S14 PLAN VIEW - PUBLIC ACCESS GAP DETAIL

3"=1'-0"



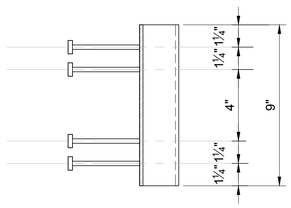
2 - S14 DETAIL

6"=1'-0"



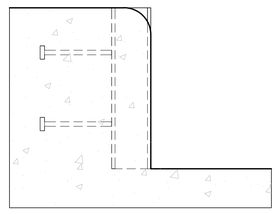
A - S14 SECTION

3"=1'-0"



B - S14 SECTION

3"=1'-0"



C - S14 SECTION

3"=1'-0"

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PUBLIC ACCESS GAP DETAILS

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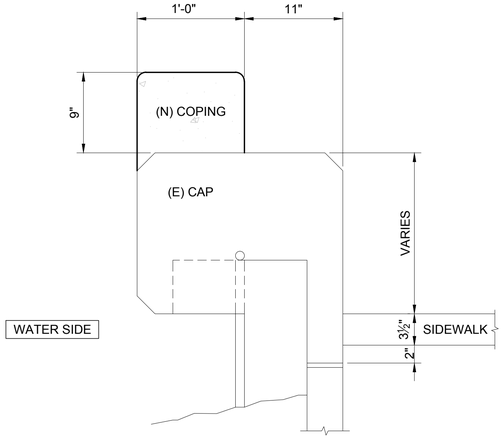
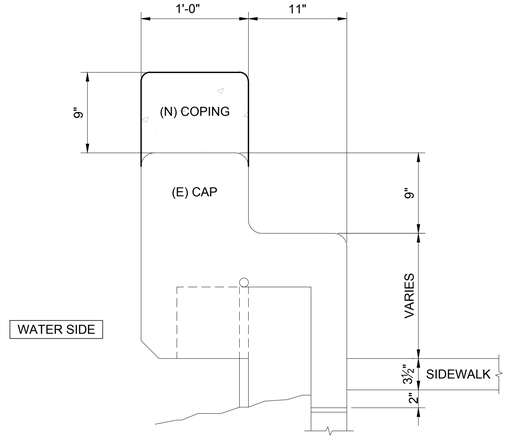
SHEET 14 OF XX



1 - S15 TYPE A COPING
1/1/2"=1'-0"



2 - S15 TYPE B COPING
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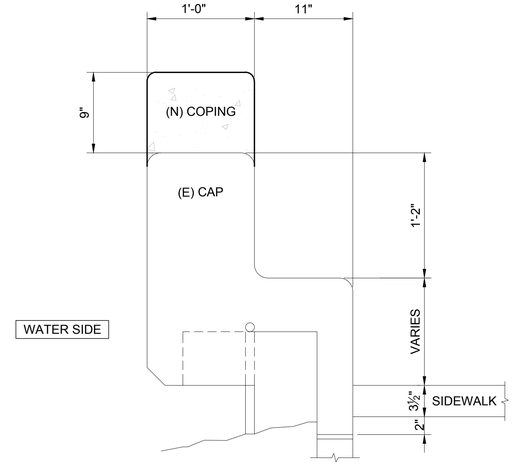
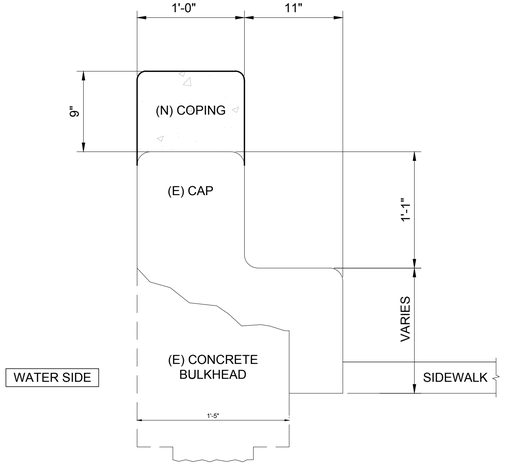


3 - S15 TYPE C COPING
1-1/2"=1'-0"



4 - S15 TYPE D COPING
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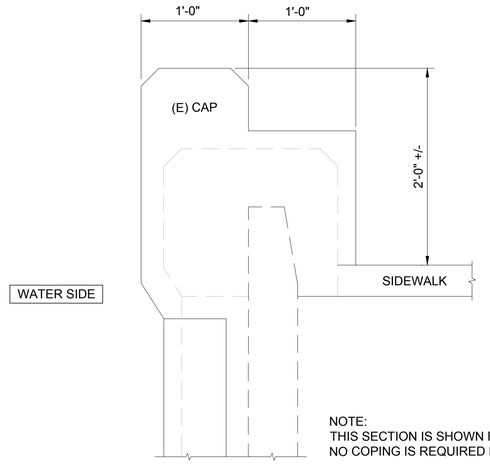

NOTE:
THIS SECTION IS SHOWN FOR REFERENCE ONLY.
NO COPING IS REQUIRED HERE.

5 - S15 TYPE E - NO COPING REQUIRED
1-1/2"=1'-0"

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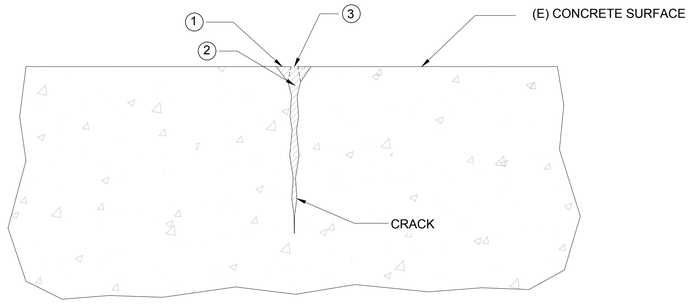
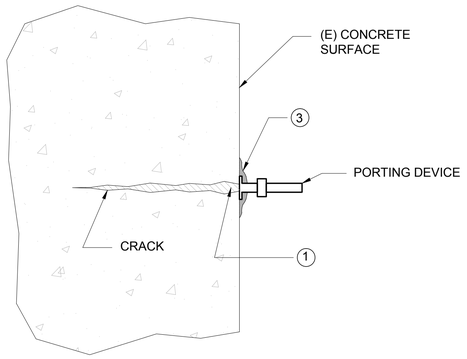
SHEET 15 OF XX

1. ROUT TOP OF CRACK TO FORM VEE-GROVE. THOROUGHLY CLEAN WITH COMPRESSED AIR AND WIRE-WHEEL TOOL.
2. FOR CRACKS ⅛" WIDE AND GREATER, FILL CRACK WITH OVEN DRIED SILCA SAND
3. APPLY METHACRYLATE SEALER FOLLOWING MANUFACTURER'S RECOMMENDATIONS AND ALLOW TO PENETRATE CRACK.
4. CAST OVEN DRY SILCA SAND ON TOP OF THE CRACK TO ABSORB EXCESS. SCRAPE OFF AFTER INITIAL SET.



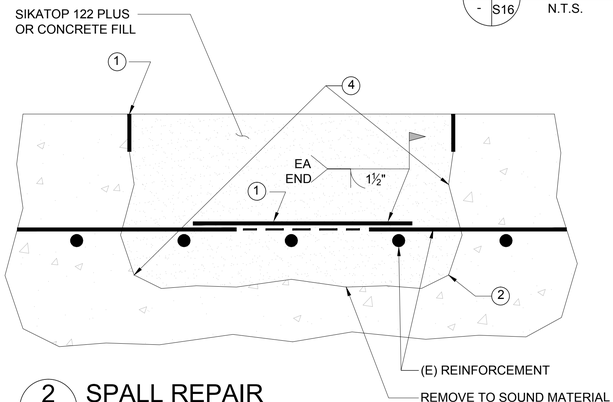
TOP SURFACE CRACKS ONLY



VERTICAL SURFACE CRACKS

1. THOROUGHLY CLEAN WITH COMPRESSED AIR AND WIRE-WHEEL TOOL. REMOVE ALL LOOSE DEBRIS.
2. FOR CRACKS ¼" WIDE AND GREATER, FILL CRACK WITH OVEN DRIED SILCA SAND
3. SEAL SURFACE OF CRACK AND INSTALL INJECTION PORTS AT 8" O.C. USING CRACK SEALING (CAPPING OR PASTE-OVER) EPOXY PER MANUFACTURER'S INSTRUCTIONS.
4. START INJECTION AT THE LOWEST PORT UNTIL EPOXY SHOWS AT AN UPPER PORT, CLOSE LOWER PORT AND CONTINUE FROM UPPER PORT. REPEAT UNTIL ALL PORTS HAVE BEEN INJECTED.
5. WHEN INJECTED EPOXY HAS CURED, REMOVE PORTS AND SEALING EPOXY. GRIND SURFACE SMOOTH.
6. FOR SURFACES THAT WILL BE REMAIN VISIBLE AFTER PROJECT IS COMPLETE, FINISH TO MATCH SURROUNDING SURFACE.

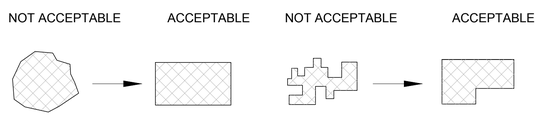
1 CRACK REPAIR
- S16 N.T.S.

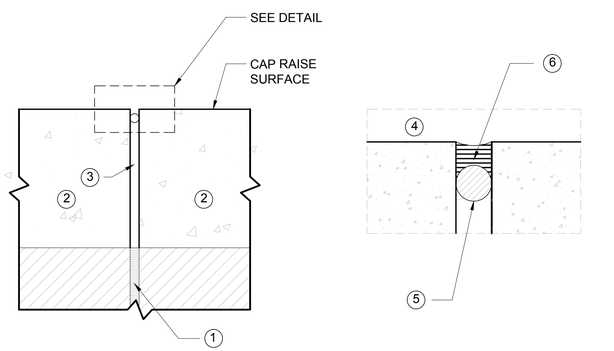


2 SPALL REPAIR
- S16 N.T.S.

SPALL REPAIR NOTES:

1. SAW CUT EDGES 1" DEEP.
2. CHIP AND REMOVE ALL LOOSE MATERIAL. CHIP 1" BEYOND EXISTING REBAR. PRESERVE ALL REBAR. USE SMALLEST CHIPPING HAMMER FOR THE WORK. DAMAGED REBAR WILL BE REPLACED AT NO ADDITIONAL COST TO THE CITY.
3. INSPECT REINFORCING REPLACE ANY REINFORCING SHOWING 20% LOSS OF SECTION OR GREATER BY CUTTING OUT DETERIORATED SECTION AND WELDING IN NEW SECTION. USE A706 REBAR OF SAME AREA OR LARGER. IF NEEDED, PRE-HEAT EXISTING STUBS.
3. CLEAN THE AREA OF ALL DUST AND DEBRIS AND DRY AREA TO BE PATCHED.
4. IMMEDIATELY BEFORE PLACING CONCRETE, COAT THE AREA WITH APPROVED BONDING AND ANTI-CORROSION AGENT.
5. FOR SPALLS THAT WILL NOT RECEIVE NEW CONCRETE THAT COVERS IT, PATCH CONCRETE WITH APPROVED CONCRETE PATCHING MATERIAL. MATCH THE EXISTING CONTOURS.
6. PATCH CONFIGURATIONS SHOULD BE KEPT AS SHOWN BELOW





3 EXPANSION JOINTS
- S16 N.T.S.

EXPANSION JOINT NOTES:

1. WHERE INDICATED ON DRAWINGS, COMPLETELY REMOVE EXISTING JOINT MATERIALS BEFORE CONSTRUCTING CAP RAISE AND MAKE ANY CONCRETE REPAIRS NEEDED AT CORNERS AND EDGES TO PROVIDE BASE FOR JOINT SEALANT. OTHERWISE START W/ NOTE #2.
2. CONSTRUCT NEW CAP RAISE WITH GAP FOR EXPANSION JOINTS ON TOP OF EXISTING. MATCH WIDTHS.
3. AFTER CAP RAISE HAS CURED, REMOVE ANY FORM MATERIALS IN GAP AND COMPLETELY CLEAN.
4. APPLY BONDING AGENT RECOMMENDED BY SEALANT MFR. FOLLOW MFR'S INSTRUCTIONS.
5. INSTALL BACKING ROD AS RECOMMENDED BY MFR. ROD SHOULD BE ½" BELOW SURFACE OF JOINT. FOLLOW RECOMMENDATION FOR MAKING 90° CORNERS.
6. FILL JOINTS (NEW & EXISTING IF INDICATED) WITH SEALANT AND ALLOW TO CURE. SEALANT SHALL COVER ENTIRE JOINT WITH NOT VOIDS. SCHEDULE JOINT SEALING SO THAT THEY WILL NOT BE IMPACTED BY HIGH TIDES UNTIL FULLY CURED.

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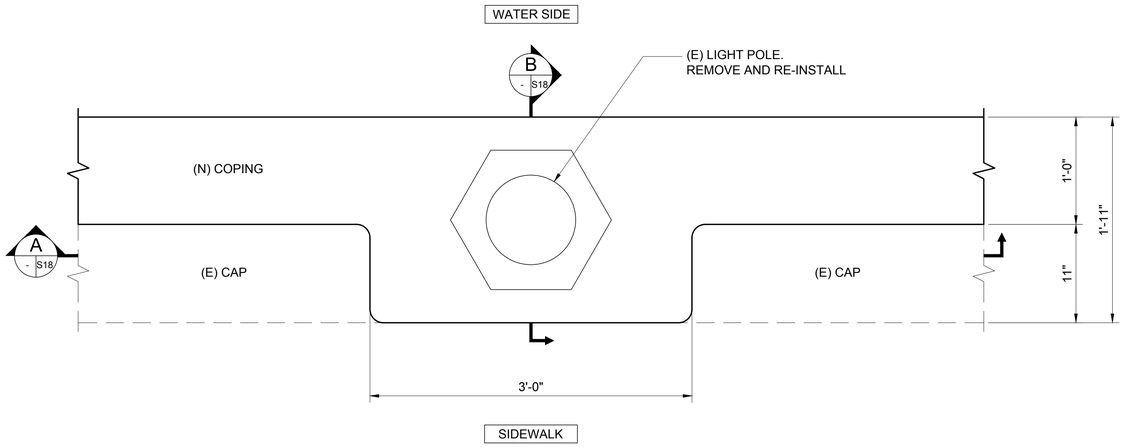
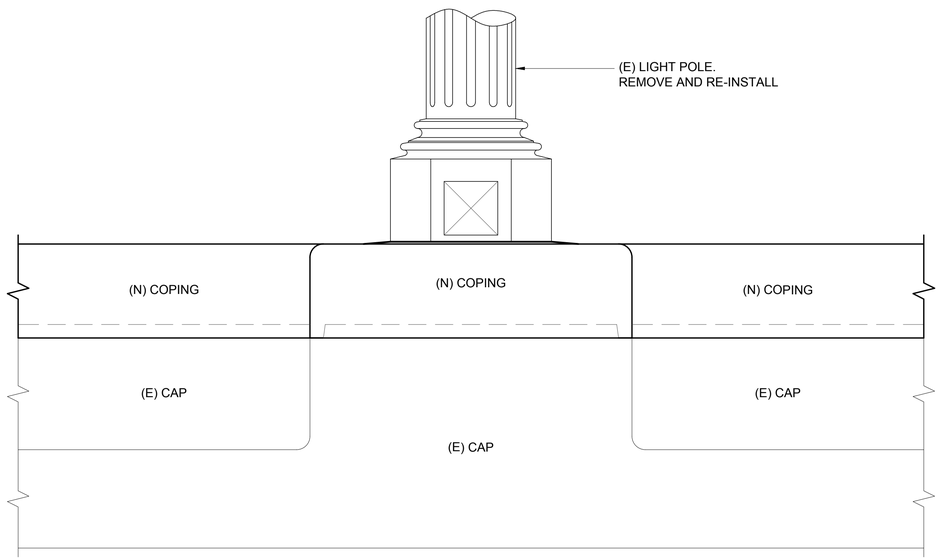
SHEET 16 OF XX



1 - S17 PLANVIEW - (N) COPING AT LIGHT POLE

1-1/2"=1'-0"



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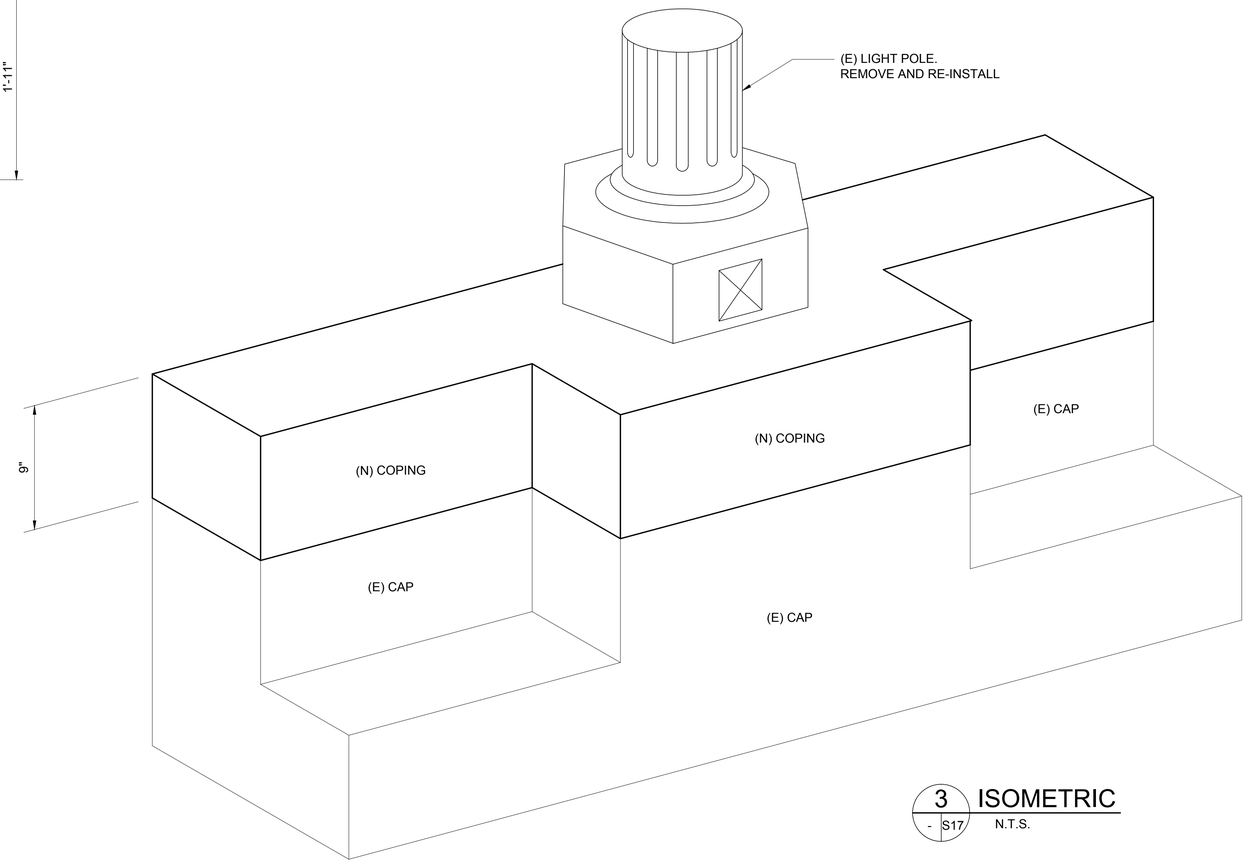

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CITY OF NEWPORT BEACH UTILITIES DIVISION	(949) 644-3011	(949) 644-3717
ORANGE COUNTY SANITATION DISTRICT	(714) 962-2411	
TIME WARNER CABLE	(714) 542-6222	
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ENGINEER OF RECORD		

NO.	DATE	REVISION

REVIEWED:

WARREN A. STEWART, RCE 041358
COWI MARINE NORTH AMERICA

DESIGNED: WNST | DRAWN: MCLS
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BALBOA ISLAND COPING REPAIR

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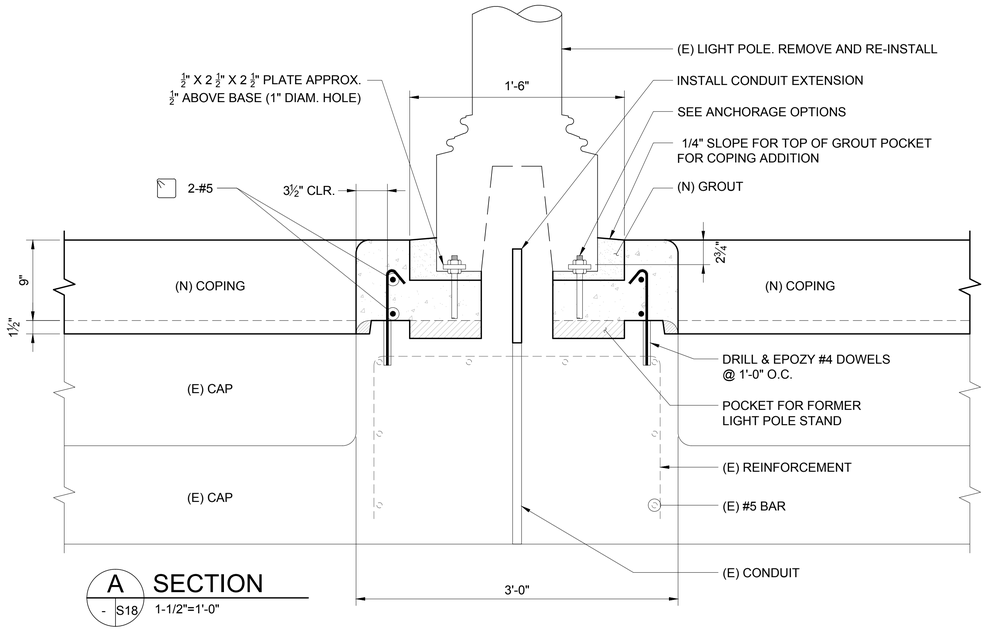
SHEET 17 OF XX



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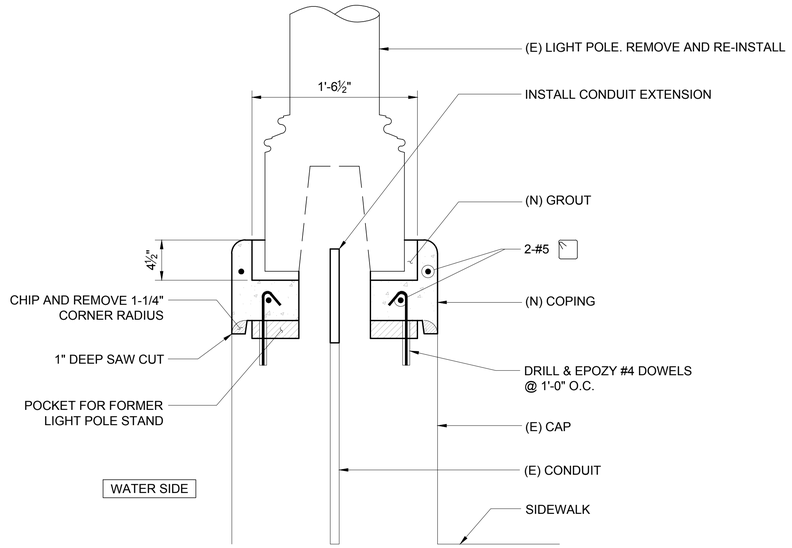

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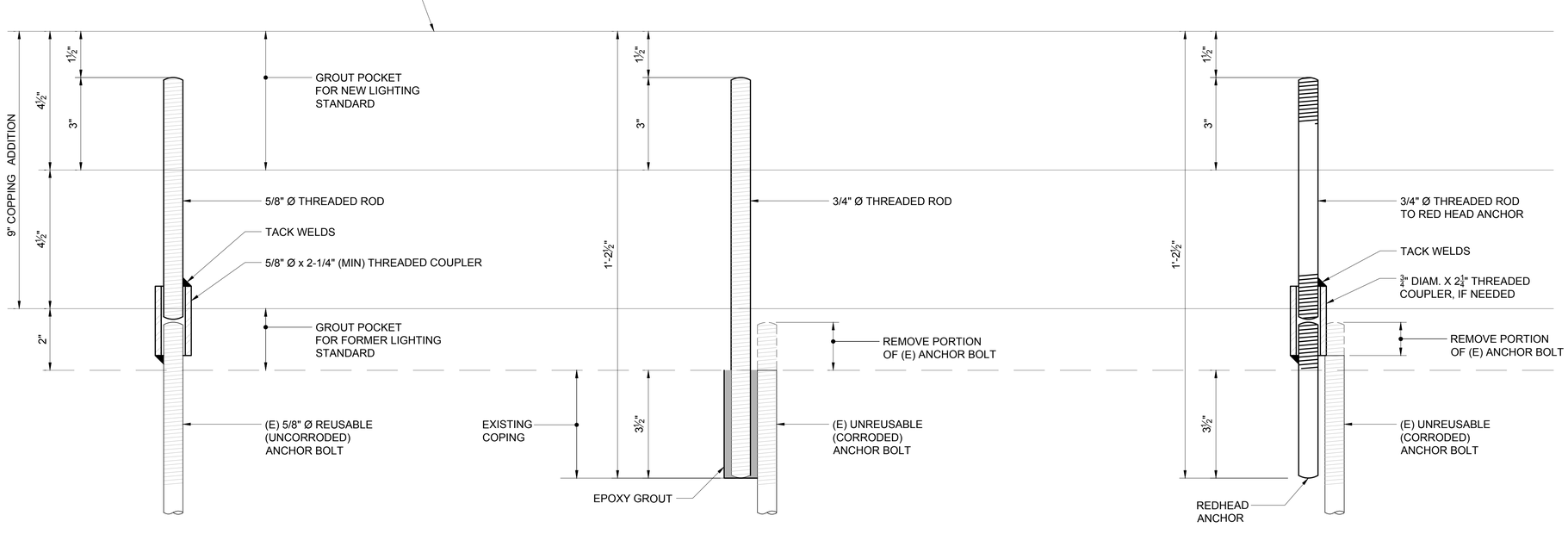

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2 ANCHORAGE DETAIL B
- S18
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3 ANCHORAGE DETAIL C
- S18
6"=1'-0"

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ATTACHMENT 5

Consistency Analysis - Newport Beach Local Coastal Program Implementation Plan Appendix A (*Sea Level Rise*)

Everest International Consultants prepared the "Assessment of Seawall Structural Integrity and Potential for Seawall Over Topping for Balboa Island and Little Balboa Island" (Everest study) for the City of Newport Beach in 2011 (Attachment 5A). The study analyzes potential flooding of the Balboa Islands for a range of seawall elevations and sea level rise scenarios based on the best available science at the time of study, prior to certification of the City of Newport LCP. The study covers a range of possible scenarios to help the City evaluate various options to minimize potential flood risk at the Balboa Islands due to future sea level rise. Since the completion of the Everest study, the City held many public meetings to present the findings and recommendations of the study, as well as to seek input from local residents and stakeholders on the approach for addressing flooding issues at the Balboa Islands.

After conducting extensive public outreach, the City selected a phased approach for addressing the flooding issue at the Balboa Islands. The first phase entails the proposed addition of a nine-inch cap to the existing seawall, which will provide adequate short-term flood protection for the Balboa Islands. In the meantime, the City will develop a longer-term solution of replacing the existing seawalls, which are generally over 70 years old and need to be replaced within the next 15 to 25 years. This phased approach follows the guidance provided in the Everest study which recommends, "in the interim [prior to the replacement of the seawall], augment the existing seawalls by 6 to 8 inches either by adding a cap extension, or by being prepared to deploy sandbags…" (see Page 6.1 of Everest report).

Even though the Everest study did not specifically analyze a seawall condition with the addition of a nine-inch seawall cap, the potential benefit of the nine-inch addition in preventing flooding at the Balboa Islands can be evaluated based on the scenarios that were analyzed in the study. The Everest study conducted flood modeling for seventeen scenarios, covering a range of seawall elevations and sea level rise projections for Year 2025, 2050 and 2100. The seawall elevation and sea level rise conditions for the seventeen model scenarios were summarized in Table 3.3 of the Everest report. As shown in that table, the model simulations cover three seawall elevations - existing condition, an addition of six inches (0.5 ft) to the existing seawall, and increasing the seawall elevation to a uniform elevation at +10 ft, mean lower low water (MLLW). Since the existing seawall elevations at Balboa Islands range from 7.9 to 9.5 ft, MLLW (Figure 2.2 of the Everest report), raising the seawall elevation to a uniform elevation of +10 ft, MLLW would represent addition of a cap height ranging from 0.5 ft to 2.1 ft. The proposed nine-inch cap would bring the bulkhead heights at Balboa Islands to a minimum 8.7 MLLW.

The following analysis provides an assessment of applicability and consistency with the City of Newport Beach Local Coastal Program Implementation Program Appendix A (LCP Appendix A).

<u>Sea Level Rise Science</u>

LCP Appendix A notes that sea level rise projections for the project horizon are based on the National Research Council's (NRC) 2012 report. The Everest study was conducted prior to the publication of the CCC's Sea Level Policy Guidance (CCC Guidance), which also recommends the use of NRC 2012 projections. However, the selection of the sea level rise projections for the Everest study was based on review of available agency guidelines and best science at the time of study. The Everest study has considered guidelines published by the following agencies:

- U.S. Army Corps of Engineers (USACE) Guidance,
- State of California: Executive Order S-13-08,

- California State Coastal Conservancy,
- California Natural Resources Agency, and
- California Ocean Protection Council.

After reviewing and comparing the guidelines from the above five agencies, the Everest study chose to apply the NRC III methodology recommended by the USACE Guidance to estimate the projected mean sea level rise for Year 2025, 2050 and 2100. These projected sea level rise values are compared with the CCC Guidance in the table below.

Year	Projected Sea Level Rise (inches)	
	Everest Study	CCC Guidance (NRC 2012)
2025	4.8	N/A
2030	N/A	2 – 12
2050	16.6	5 – 24
2100	55	17 -66

N/A – not applicable

As shown in the above table, the sea level rise projections used in the Everest study are well within the range recommended in the CCC Guidance. Hence, even though the Everest study did not specifically utilize the NRC 2012 projections, the flood model simulation results presented in the Everest report are applicable for the sea level rise projections recommended by the CCC Guidance.

Geologic Stability and Erosion

The project will not have any impact to coastal processes such as erosion and changes in shoreline in the vicinity of the site, because most proposed construction activities will occur on the boardwalk side of North/South Bay Front. The project entails making repairs to the surface of the existing seawall and adding a nine-inch cap to the top of the seawall. There are no ground-disturbance or grading activities that would occur as a result of the project. Construction activities that occur on the beach-side of the seawall would be limited to the surface of the existing seawall, avoid high tide events when feasible, and no permanent structures or alterations to the beach would occur. The proposed construction activities would not extend the footprint of the seawall seaward of the existing boundary, consistent with the California Coastal Act, Section 30212(b)(b). Therefore, implementation of the project does not require the preparation of a Geologic Stability report or an Erosion Control Plan.

Wave Uprush, Flooding, and Inundation

The City's Local Coastal Program Land Use Plan (LUP) policy 2.8.3-1 requires the completion of a wave uprush and impact report for new development. The proposed repairs and maintenance of the existing seawall do not constitute new development as defined in the California Coastal Act, Section 30212(b)(4). Nevertheless, the Everest study accounted for wave attacks and the corresponding wave runups on flood impact in its consideration of the effect of both local wind waves and ocean swells in the flood model simulations. The Everest study did not explicitly model the flood extent at the Balboa Islands with the proposed addition of a nine-inch cap to the existing seawalls. However, the model scenarios considered in the Everest study cover a range of seawall elevations and potential seal level rises for Year 2025, 2050 and 2100. Potential flood protection and flood extent at the Balboa Islands with the addition of a nine-inch cap can be estimated based on the results of the Everest study.

Two of the seventeen model simulations in the Everest study considered raising the existing seawalls at the Balboa Islands by six inches (Model Scenario 11 and 12 shown in Table 3.3 of the Everest report). Sea level for Year 2010 was simulated for Model Scenario 11, while projected sea level for Year 2025 was

used for Model Scenario 12. The effects of wind waves and corresponding wave overtopping to flooding at the Balboa Islands were included for these two scenarios. As shown in Figure 3.16 of the Everest report, the addition of six inches to the existing seawalls would prevent flooding of almost the entire Balboa Islands through 2025, with potential flood impact to only one building near the bridge to Collins Island. Hence, the proposed addition of a nine-inch cap to the existing seawalls should prevent flooding of the Balboa Islands through and beyond 2025 by two to five years depending on the actual rate of sea level rise.

The Everest study shows that raising the seawalls to a uniform height of +10 ft, MLLW would prevent the Balboa Island from flooding though 2050 (Figure 3.20 of the Everest report). The proposed nine-inch cap will bring the seawalls at Balboa Islands to 8.7 to 10.4 ft, MLLW. Hence, for the areas with higher existing seawalls (which are primarily located in Little Balboa Island), the proposed cap would be effective for preventing flooding up through almost Year 2050. Therefore, implementation of the project does not require the preparation of additional flooding or inundation analysis. Any future projects within the City of Newport Beach involving more substantial seawall re-construction on Balboa Island would be accompanied by an updated Wave Uprush and Wave Impact Study.

Other Impacts

The project site is along the North/South Bay Front boardwalk which is fully developed and paved, and the beach-side. The boardwalk itself and beach-side do not contain any landscaping; therefore, implementation of the project does not require the preparation of a Landscape Planting Plan.

There are no ground-disturbance activities that would result from the project, as all construction activities would be limited to the surface and top of the existing seawall and would be completed from areas that are already developed (e.g. the boardwalk) or disturbed (e.g. beach or existing revetment). Therefore, implementation of the project does not require the preparation of an Archaeological/Paleontological Research Plan.

Furthermore, there are no built structures or dwellings of historic significance in the project site. Therefore, implementation of the project does not require the preparation of an Initial Historic Evaluation or Lower Cost Visitor Accommodations Impact and feasibility Analysis. As such, the project would not affect conversion or demolition of affordable housing.

According to Map 4-1 of the City's LUP, there are no environmental study areas within or in the immediate vicinity of the project site. According to Map 4-2 of the City's LUP, eelgrass meadows are present in the waters surrounding Balboa Island. No construction activities would occur in harbor waters. Beach-side construction activities would avoid high tide events when feasible. Therefore, the eelgrass meadows would not be impacted as a result of the project.

Map 4-3 of the City's LUP recognizes Balboa Island Park, located along Agate Avenue, as a coastal view resource. Though seawall repairs and capping would occur along the segment located at South Bay Front and Agate Avenue, there are no staging areas identified at the terminus of Agate Avenue due to the Balboa Island Ferry dock. As a result, the project would not impact access to Balboa Island Park or the Balboa Island Ferry dock.

Wilma's Patio (formally Pepper's Restaurant) is recognized as a historical resource on Balboa Island, according to Map 4-4 of the City's LUP. The construction site along South Bay Front at Marine Avenue is one block south of the restaurant, and no construction-related activities would impact the restaurant. Therefore, implementation of the project does not require the preparation of an Initial Resource Survey or Visual Impact Analysis.

ATTACHMENT 5A

Assessment of Seawall Structural Integrity and Potential for Seawall over-Topping for Balboa Island and Little Balboa Island

Prepared by Everest International Consultants, Inc., April 2011

ASSESSMENT OF SEAWALL STRUCTURAL INTEGRITY AND POTENTIAL FOR SEAWALL OVER-TOPPING

for Balboa Island and Little Balboa Island

MAIN REPORT

Prepared for
City of Newport Beach

Prepared by
Everest International Consultants, Inc.

In association with
Flow Simulation, LLC
URS Corporation

April 2011

EVEREST

ASSESSMENT OF SEAWALL STRUCTURAL INTEGRITY AND POTENTIAL FOR SEAWALL OVER-TOPPING FOR BALBOA ISLAND AND LITTLE BALBOA ISLAND

MAIN REPORT

Submitted to

City of Newport Beach
Public Works Department
3300 Newport Boulevard
Newport Beach, California 92663

Contact: Robert Stein, Assistant City Engineer

Submitted by

Everest International Consultants, Inc.
444 West Ocean Boulevard, Suite 1104
Long Beach, California 90802

Contact: Ying-Keung Poon, Project Manager

In association with

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5 Twain Street
Irvine, California 92617

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URS Corporation
5772 Bolsa Avenue, Suite 100
Huntington Beach, California 92649

April 2011

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ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
BFE	Base Flood Elevation
BIIA	Balboa Island Improvement Association
CEQA	California Environmental Quality Act
CO-CAT	Coastal and Ocean Working Group of the California Climate Action Team
EIR	Environmental Impact Report
EO	Executive Order
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
ft	foot/feet
in	inch(es)
IPCC	Intergovernmental Panel on Climate Change
LiDAR	Light Detection and Ranging
MLLW	mean lower low water
MSL	mean sea level
NA	not applicable
NAS	National Academy of Sciences
NAVD88	North American Vertical Datum 1988
NGDC	National Geophysical Data Center
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRC	National Research Council
NTDE	National Tidal Datum Epoch
OPC	Ocean Protection Council
OPR	Office of Planning and Research
SCCOOS	Southern California Coastal Ocean Observing System
SFHA	Special Flood Hazard Area
SSO	sanitary sewer overflow
USACE	U.S. Army Corps of Engineers
UV	ultraviolet

1 INTRODUCTION

The City of Newport Beach (City) has been dealing with localized flooding for years, even before global warming and the associated sea level rise issue became widely understood. Due to lower-than-optimum seawall and land mass heights around the Newport Harbor (Harbor) and Newport Bay (Bay) and the preponderance of privately owned seawalls, gangways, docks and other infrastructures that are outside the City's direct control, flooding of city streets and walkways has occurred on Balboa Peninsula, Balboa Island and other areas in the City when high water levels occur. The challenge of flood control is compounded by City storm drain lines that empty by gravity into the Bay and therefore do not provide flood relief when the Bay water level is high. Furthermore, City and privately owned storm drains can provide a conduit for water to enter the boundary of the various land masses when drain valves or plugs malfunction or are not properly used. To a lesser extent, distress in the form of concrete cracks and construction joints allows water to breach the protection of these walls and contributes to localized flooding.

The Balboa Island and the Little Balboa Island are two adjacent islands in the Newport Bay separated by a channel – the Grand Canal. These two islands are also collectively known as the Balboa Island. Balboa Island was formed by building up a Bay sand bar and tidal marsh in the early 20th Century. Since its inception the island has been plagued by flooding, which forced initial investors and residents to construct a mix of concrete and timber seawalls along the waterfront. In exchange for property taxes from Balboa Island property owners, the City took the first steps of constructing a proper seawall by designing and building a concrete seawall along much of the Grand Canal in 1929. A seawall for the remainder of the island was designed in 1935 and constructed in 1938 as part of the National Recovery Act.

Under normal present-day conditions, wave overtopping and flooding occur in Balboa Island during high tide and high wave events, causing damage to residences, businesses, vehicles, public infrastructure and the environment. Home damage includes, but is not limited to, loss of personal property and effects, cosmetic and structural damage, and mold growth. Businesses are prone to the same damage as homes as well as loss of inventory and business interruptions. Interiors of vehicles and possibly their mechanical parts may be damaged. Additionally, fuel tanks, home natural gas connections, and vehicles may leak petrochemical products into the environment. Sewers and storm drains are the most susceptible public utilities. When streets become flooded, water infiltrates the sewer system, which then causes sewage to spill out in an event called a "sanitary sewer overflow" (SSO). People and the environment are thereby exposed to raw sewage. An example of an SSO is shown in Figure 1.1. During high water events, the City closes the storm drain outlets to the Bay to prevent sea water from flowing backwards through the storm water outlets and inundating Balboa Island. Figure 1.2 shows a picture of City personnel pumping

out water that was collected at the storm drain outlet junction structure located at a bay-front street in a high water and high wave event in December 22, 2010.

Figure 1.1 Example of a Sanitary Sewer Overflow

Figure 1.2 City Personnel Pumping Flood Water Back into the Bay

Additional photos from this event depicting wave overtopping and flooding of the Balboa Island seawall and the resulting damage are shown in Figures 1.3 to 1.7. As shown in Figure 1.3 and 1.4, water overtopped the seawall at Turquoise and South Bay Front flooding the boardwalk. Flood waters spilled into adjacent streets as seen in Figure 1.5 and some businesses were inundated as shown in Figure 1.6. After the tide ebbed and the flood waters drained, the boardwalk was covered with sand and debris as shown in Figure 1.7, clogging the boardwalk drainage system.

In an effort to prevent potential damages to property and residences around the Harbor due to flood waters associated with storms and sea level rise, the City has retained Everest International Consultants, Inc. to conduct an assessment of the potential flood impacts to Balboa Island and Little Balboa Island. This assessment includes:

1) Predicting flood water overtopping and resulting inundation due to sea level rise and storm events over the next 100 years,
2) Assessing the condition of the seawalls and remaining useful life of the seawalls,
3) Assessing options to extend or replace the seawalls,
4) Providing recommendation for flood hazard mitigation measures, and
5) Developing cost and phasing for seawall retrofit.

Balboa Island represents approximately 11% of the entire seawall waterfront in the City. Built over 70 years ago, the Islands' seawall is the oldest within the City inventory. Around the harbor, it is loosely estimated that over 80% of the seawalls in the City are privately owned, with the remaining 20% being publically-owned by the City, County, or the State. Since the Balboa Island and Little Balboa Island have public boardwalks around the entire waterfront, and all the seawalls around the islands are publically-owned and reasonably accessible, these seawalls provide an excellent pilot study opportunity for the City to assess flood risk and seawall condition in the Harbor.

This report highlights the major findings of the seawall and residence elevation surveys (Chapter 2); flood and wave overtopping modeling results for existing and future sea level rise scenarios (Chapter 3), seawall condition assessment (Chapter 4); and flood hazard mitigation alternatives and recommendations for seawall improvement phasing (Chapter 5). Recommendations for coping with sea level rise for Balboa Island are provided in Chapter 6.

Figure 1.3 Waves Splashing over the Balboa Island Seawall at Turquoise and South Bay Front

Figure 1.4 Bay Waters Overtopping the Seawall

Figure 1.5 Street Flooding

Figure 1.6 Flooded Businesses

Figure 1.7 Accumulated Sand and Debris, Post-Storm

Details of the Study are provided in three technical appendices. Appendix A – *Balboa Island and Little Balboa Island Elevation Survey* provides a detailed summary of the methodology and control points used for the survey, as well as maps and spreadsheets of the survey results. The results of Appendix A are used to define the seawall and residences elevations for the flood inundation and wave overtopping modeling summarized in Appendix B – *Balboa Island and Little Balboa Island Flood Inundation Modeling*. Lastly, Appendix C – *Condition Assessment Study and Report: Balboa Island Seawalls* provides detailed findings of the seawall assessment and recommendations for seawall modifications and other alternatives to address the potential flood risk due to sea level rise identified in Appendix B.

2 SEAWALL AND RESIDENCE ELEVATION SURVEYS

2.1 Overview

Topographic surveys were conducted on Balboa Island and Little Balboa Island on April 26 and 27, May 3 and 18, and June 6, 2010. The surveys provide top of seawall, boardwalk, and mudline elevations around the boardwalk; as well as first floor elevations of some houses around the boardwalk and three streets that transect the islands – Pearl, Coral and Crystal Avenues. In addition, topographic surveys were also conducted for the Balboa Island Ferry Boat Landing and its surroundings, as well as the three bridges on the Island. The bridges are:

1) Marine Avenue Bridge, which links the Balboa Island to the mainland,
2) The Park Avenue Bridge, which spans the Grand Canal and connects Balboa Island and Little Balboa Island; and
3) The Collins Island Bridge, which extends Park Avenue on Balboa Island over a small channel onto Collins Island.

The main objective for the topographic survey is to provide accurate top of seawall elevations, as well as identify low points at the Ferry Boat Landing and the three bridges to be used for simulating flood inundation during high tides. The mudline elevations along the outside of the seawall were also measured and are used for estimating wave overtopping of the seawalls during high tide. A summary of the flood inundation modeling is provided in Chapter 3 with the details documented in Appendix B. In addition, the survey data are useful for the development of inundation solutions for the two islands described in Chapter 5 and in more details in Appendix C.

The survey was conducted by a team of two California licensed civil engineers. Three existing Orange County benchmarks were used for determining elevations. Elevations were read through a KJ-24 Automatic Level along either closed or open oriented traverses starting at one of the benchmarks and ending at either the same (closed traverse) or different benchmark (open traverse). This method allowed for error distribution between the survey points along the traverse. The rod has 1/100 foot increments. Vertical accuracy of elevations read through the automatic level is ± 0.01 feet.

A brief summary of the seawall and residential house survey data are presented in the following sections. Details of these data, as well as survey results for the ferry boat landing and bridges are provided in Appendix A.

2.2 Datum

All elevation measurements are recorded in feet and the vertical datum used in the survey is the North American Vertical Datum of 1988 (NAVD88). NAVD88 is used as the primary datum for this report because it is a fixed datum that does not change over time or vary from city to city. However, since most maritime elevations in southern California are referenced to the mean lower low water (MLLW) datum, it is also used in this report. When elevation is reported, it is reported in NAVD88 with the equivalent MLLW shown in parentheses.

The National Oceanic and Atmospheric Administration (NOAA) is responsible for developing the various vertical (elevation) datums that are used by the public. The MLLW developed by NOAA's National Ocean Service (NOS) is a tidal datum, which is based on the National Tidal Datum Epoch (NTDE, i.e. a recent 19-year period over which tide data is collected and computed to determine average values used for tidal datums). A 19-year period is used because this relates to the length of a lunar cycle, and the moon is the primary gravitational influence on tide height. Tides on the west coast of the United States have a mixed semi-diurnal pattern with two uneven high tides and two uneven low tides per day. MLLW is the average of the lower of the two daily low tides over a tidal epoch. As sea levels change, so do the elevations of the high and low tides relative to a geodetic datum such as NAVD88. Therefore, MLLW is a "relative" datum, and it can change with each NTDE. For example, the current NTDE (1983 to 2001) has a MLLW datum that is 0.2 feet higher than the previous NTDE (1960 to 1978) for the Harbor. In addition, since MLLW is a tidal datum, it is only fixed locally (e.g., MLLW in the Harbor is different than MLLW in San Francisco Bay).

For the Harbor, 0.0 feet NAVD88 is equal to 0.18 feet MLLW under the most recent NTDE (1983 – 2001). Figure 2.1 shows graphically how the NAVD88 is related to the two most recent MLLW datums. In the figure, the high and low Balboa seawall elevations determined from the survey discussed in this Chapter, as well as the Balboa Island's Base Flood Elevation (BFE) are shown. Details of the BFE are provided in Section 2.4.

2.3 Seawall and Boardwalk Measurements

The survey data for the seawall and boardwalk are summarized in Figure 2.2. In the figure, locations of the Orange County benchmarks used for vertical control and the three transects (Pearl Avenue, Coral Avenue, and Crystal Avenue) through the two islands are marked. In addition, the figure also shows the horizontal stationing and top of seawall elevations around the boardwalk. These elevations are shown in both feet relative to NAVD88 and MLLW (NTDE 1983-2001), hereafter simply as MLLW.

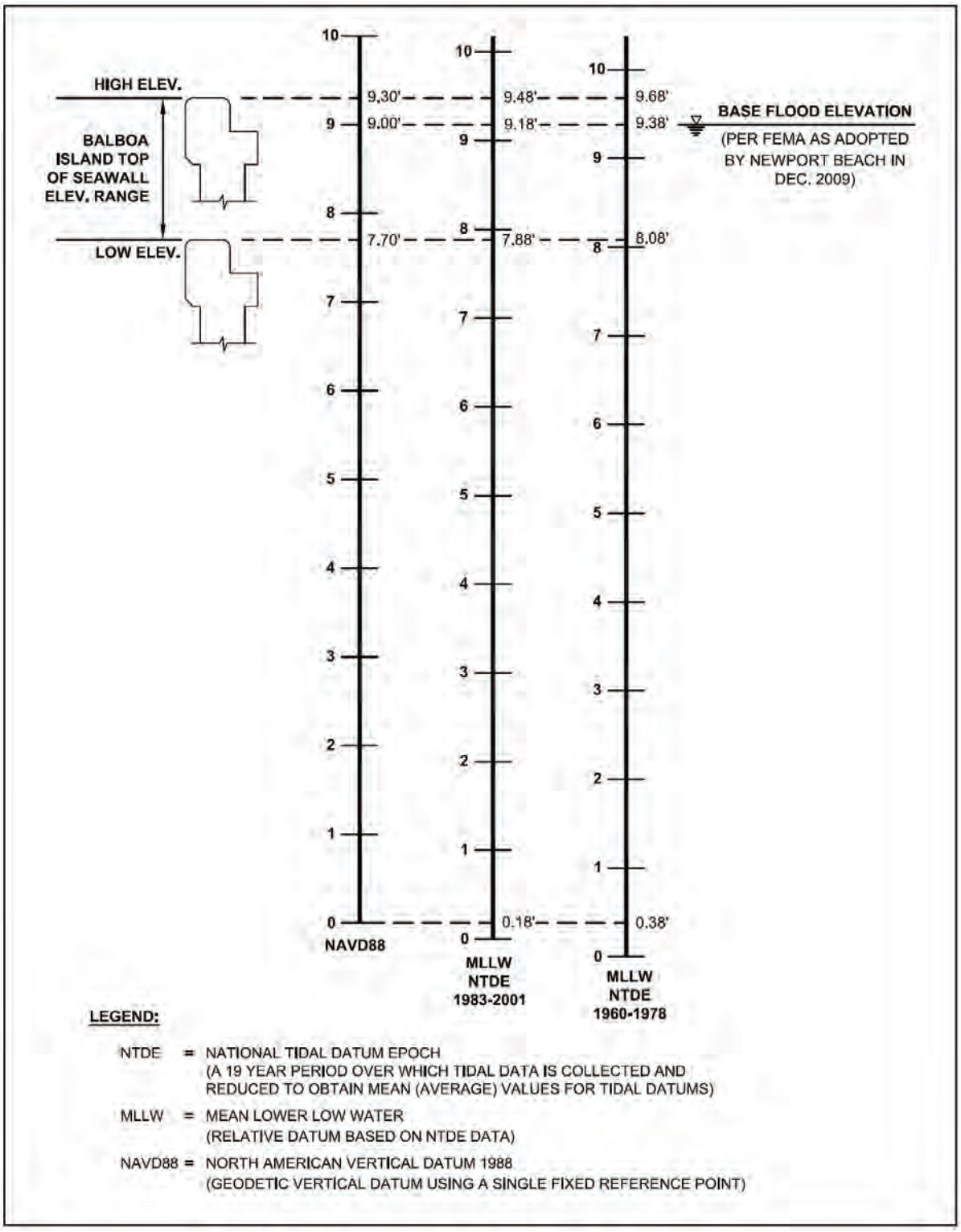

Figure 2.1 Comparison of Different Tidal Datums

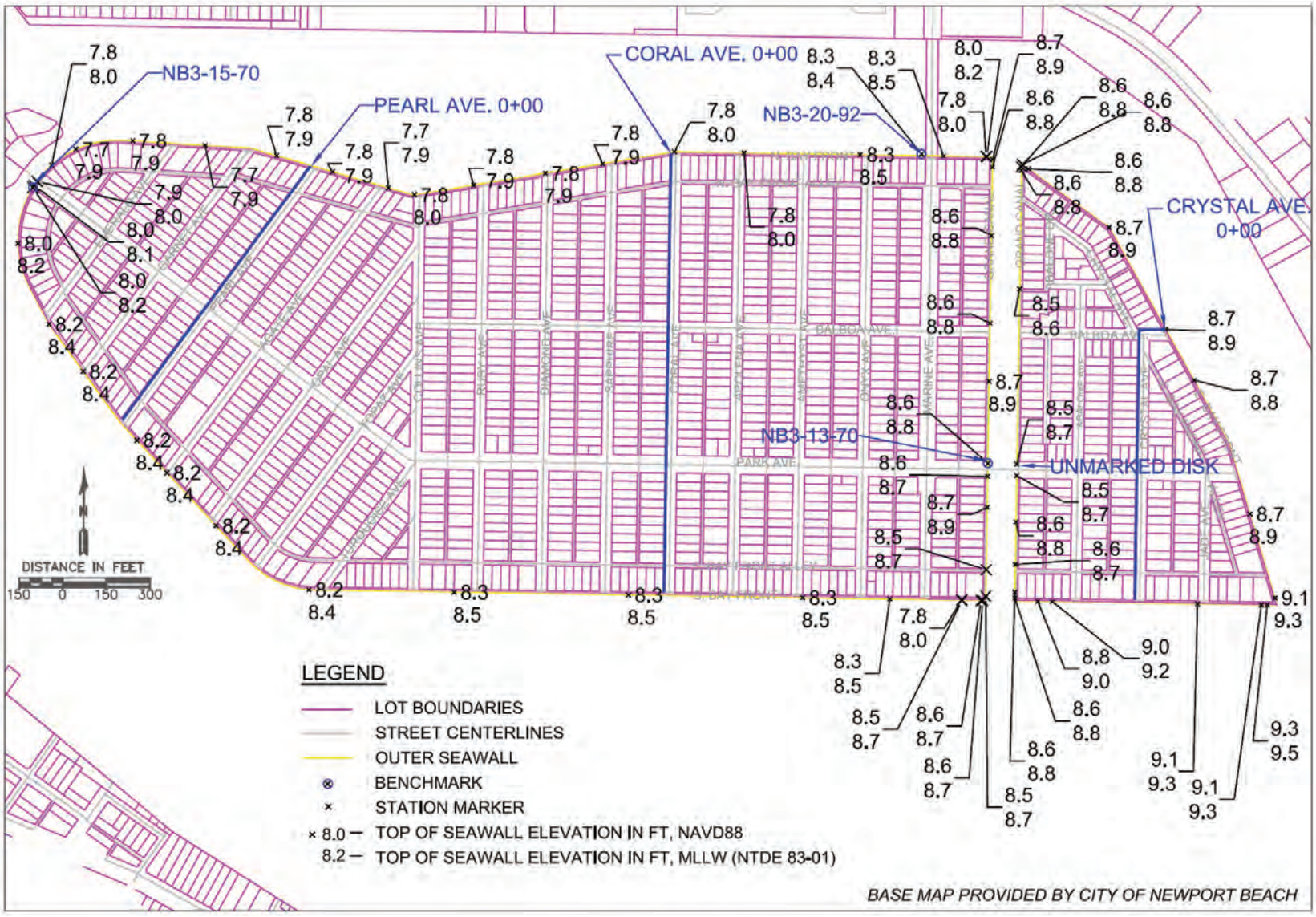

Figure 2.2 Top of Seawall Survey Results

The top of seawall elevations were found to vary between 7.6 and 8.7 feet NAVD88 (7.8 and 8.9 feet MLLW) on Balboa Island and between 8.5 and 9.3 feet NAVD88 (8.7 and 9.5 feet MLLW) on Little Balboa Island. Mudline elevations vary between approximately 1 foot below the top of seawall elevation in locations where the beach sand has been replenished and/or managed, to approximately 7 feet below the seawall elevation, where beach sands have eroded over time.

The boardwalk elevation along the Balboa Island seawall ranges between 5.0 and 7.3 feet NAVD88 (5.2 and 7.5 ft MLLW) with an average elevation of approximately 6.2 feet NAVD88 (6.4 feet MLLW). The low of 5.0 feet NAVD88 (5.2 feet MLLW) is an aberration in the data since most elevation data points fell between 5.5 and 6.7 feet NAVD88 (5.7 and 6.9 feet MLLW). The boardwalk around Little Balboa Island is between 6.2 and 6.8 feet NAVD88 (6.4 and 7.0 feet MLLW) with an average elevation of approximately 6.5 feet NAVD88 (6.7 feet MLLW). The sidewalk elevations, taken along three streets traversing the interior of the Island, averaged between 6 and 7 feet NAVD88 (6.2 and 7.2 feet MLLW) with extremes of 5.7 feet NAVD88 (5.9 feet MLLW) and 7.2 feet NAVD88 (7.4 feet MLLW).

2.4 House First Floor Elevations

In order to assess flooding of houses, residential first floor elevations were measured for ninety one houses along Pearl, Coral, and Crystal Avenues. The first-floor elevations correspond to the threshold upon which flood water would penetrate the living space of the building and potentially cause significant water damage. For the 91 surveyed parcels, the first floor elevations range from 6.2 feet NAVD88 (6.4 feet MLLW) to 11.6 feet NAVD88 (11.8 feet MLLW), with a median of 8.2 feet NAVD88 (8.4 feet MLLW), i.e. half of the first floor elevations are below 8.2 feet NAVD88 (8.4 feet MLLW). Details about the survey and the use of the surveyed data for flood modeling are provided in Appendix B.

The Federal Emergency Management Agency (FEMA) develops Flood Insurance Rate Maps (FIRMs) to determine the Base Flood Elevation (BFE) in an area and set flood insurance rates accordingly. Balboa Island is in a Special Flood Hazard Area (SFHA) called Zone A, which means the general land elevation is below the BFE. Per FEMA, the lowest floor elevation of structures in an SFHA must be above the BFE. The lowest floor is defined by FEMA as the lowest floor of an enclosed space including the basement area. This requirement is usually applied only to habitable space, so flood-resistant or unfinished areas used for parking, storage, or building access are typically exempted. For Balboa Island, the BFE is 9.0 feet NAVD88 (9.18 MLLW). On December 3, 2009, the City of Newport Beach adopted this BFE as the minimum top of slab elevation for habitable space for new construction on Balboa Island. For the 91 houses that were surveyed, approximately 85% of the houses have first floor elevation below the BFE.

3 FLOOD INUNDATION MODELING

3.1 Overview

A hydraulic model was developed and applied to Newport Bay to simulate tidal flow in the bay and inundation of Balboa and Little Balboa Islands resulting from extreme water levels and wave overtopping of the seawalls. The model was used to map present-day and future flood zones on the two islands based on actual and projected tide data[1] accounting for sea level rise and proposed improvements. Overtopping may occur from a combination of high Bay water levels and waves that either splash or flow over seawalls. Moreover, flood water is predicted to spread across the land in accordance with local topography.

A total of 17 different scenarios were simulated to map present-day and future flood zones and account for both sea level rise and potential infrastructure improvements. A brief summary of the flood inundation modeling methodology, the data used for model setup, model scenarios and model results are provided in the following sections. Details of the flood inundation modeling can be found in Appendix B.

3.2 Flood Modeling Methodology

Hydraulic modeling of Bay tide dynamics, overtopping of seawalls, and flood inundation was completed using the BreZo computer model developed by Dr. Brett Sanders at the University of California, Irvine. BreZo is a state-of-the-art, multi-dimensional flood inundation model based on the full shallow-water equations. BreZo is applied to the model domain, which encompasses all of Newport Bay and surrounding terrain and extends offshore as shown in Figure 3.1. An offshore boundary condition is specified to simulate the rise and fall of the ocean tide, which acts as the forcing for the hydraulic response of the Bay. A variable-resolution computational mesh was developed for this study. The mesh was locally refined on Balboa and Little Balboa islands for flood mapping precision. An intermediate resolution was used within the embayment, and a coarser resolution was used offshore. The locally refined mesh used for Balboa Island and Little Balboa Island is shown in Figure 3.1.

Several datasets were relied upon to implement BreZo including topographic and bathymetric data, seawall elevation data, ocean tide height data (including mean sea level trends), and wave-driven overtopping rates. These are briefly described in the following sections.

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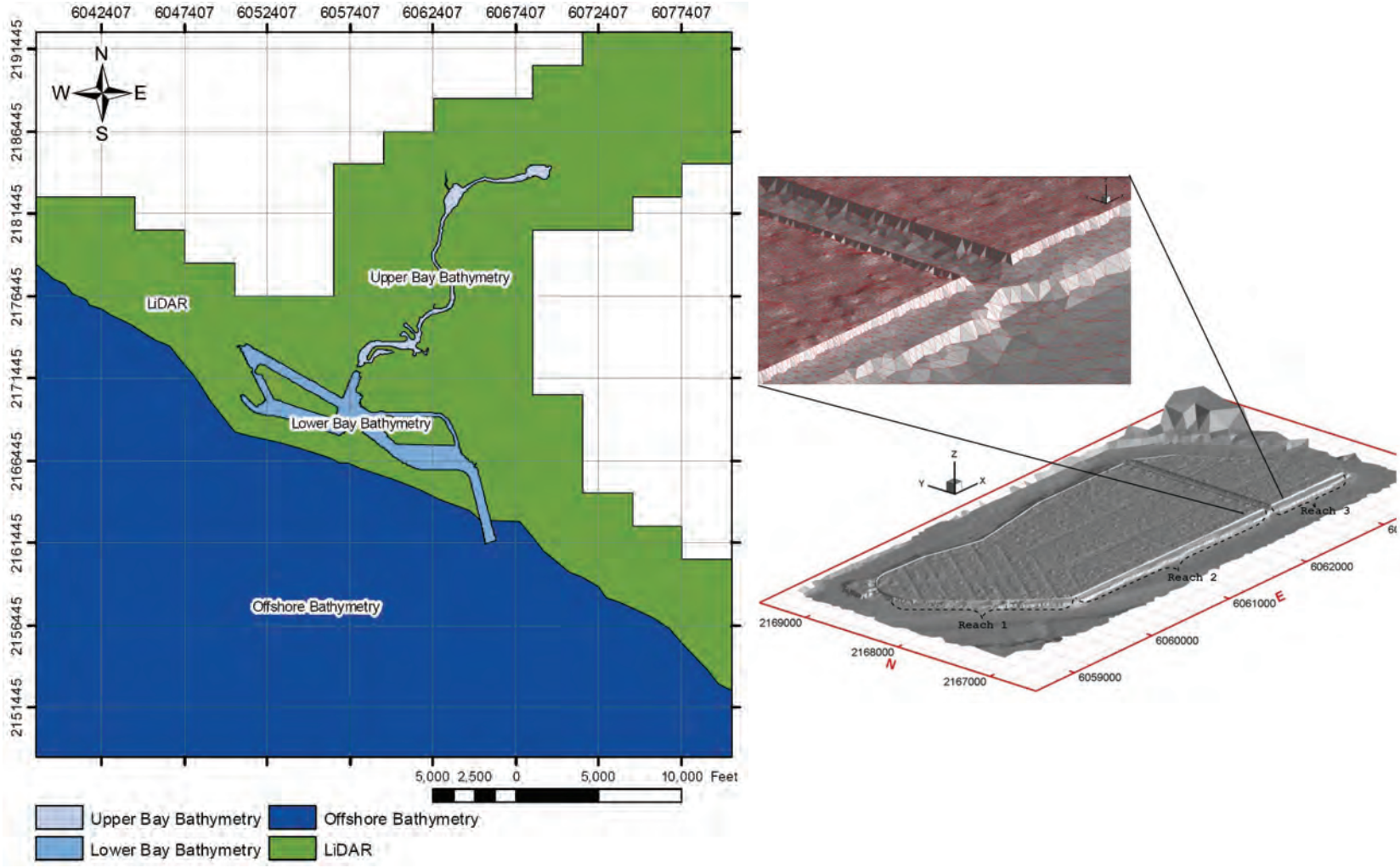
[1] Tide data used in this study is based on the NOAA gage for Los Angeles, the measured tide includes the astronomical tide and other factors affecting water level such as storm surge.



(a) Domain of hydraulic model encompasses all shaded areas, and the ocean tide boundary condition is applied on the southern boundary.

(b) Computational mesh of Balboa and Little Balboa Island region. Reach 1, 2 and 3 are subject to wave-driven overtopping.

Figure 3.1 Flood Modeling of the Newport Harbor Area

3.2.1 Topographic and Bathymetric Data

Several sources of data were obtained and organized to provide a seamless terrain map that synthesizes available topographic (above sea level) and bathymetric (below sea level) ground elevation data in the vicinity of Newport Harbor. The data sources include the following:

1) Light Detection and Ranging (LiDAR) topography data collected by Merrick for the City of Newport Beach.
2) Upper Bay bathymetry resulting from a multi-beam survey by an unknown contractor for the U.S. Army Corps of Engineers, Los Angeles District.
3) Lower Bay bathymetry data resulting from a multi-beam survey by an unknown contractor for the U.S. Army Corps of Engineers, Los Angeles District.
4) Offshore bathymetry data from the National Geophysical Data Center (NGDC) 3 Arc-Second Coastal Relief Model accessed from the Southern California Coastal Ocean Observing System (SCCOOS) website.

3.2.2 Seawall Elevation Data

Balboa and Little Balboa Islands are encircled by concrete seawalls that provide protection from flooding during periods of high tides and waves. Because elevations of the seawall represent a threshold for overtopping, it is critically important that they are surveyed with 0.1 ft accuracy or less. As described in Chapter 2, the seawall elevations used for setting up the BreZo Model were surveyed for this study with a vertical accuracy of approximately 0.01 ft. Additional detail is provided in Appendix A.

3.2.3 Wave-driven Overtopping Rates

Waves are an important driver of embayment flooding when the water level approaches the crest of the seawall. Wave action provides the necessary energy for water to rise up above the water level and spill over the barrier. Wave overtopping rates were calculated using the ACES program developed by the U.S. Army Corps of Engineers (Veri-Tech, Inc., 2009). The parameters controlling the onset of wave overtopping and the overtopping rate include structure type, structural slope, beach slope, water depth (hence the need for mudline elevations), and wave characteristics (height and period). Based on these parameters for Balboa and Little Balboa Islands, wave overtoppings were calculated for three different reaches (see Figure 3.1). Reach 1 and 2 correspond to the southwest and south sides of Balboa Island, respectively, and Reach 3 corresponds to the south side of Little Balboa Island. Waves along the northern and eastern shore of the island were considered to be small, and hence, not included in the inundation modeling.

Two major wave sources were considered for this study:

1. Wind waves - these are locally generated waves within the harbor caused by local winds, normally having short wave periods of typically less than 8 seconds, and are often referred to as “sea”, and

2. Ocean swell – these are waves generated from far away storm activities that have travelled a long distance to reach southern California coastline, typically with wave periods of 10 to 20 seconds. These waves travel into the Harbor through the harbor mouth.

Details of the wave analyses for wave overtopping simulations are provided in Appendix B.

3.3 Extreme High Tides and Sea Level Rise Projections

Extreme high tide scenarios are needed to support hydraulic modeling of coastal flooding and plan for sea level rise. Flooding occurs as tide heights rise above protective sea walls, and lasts from minutes to hours depending on the duration of overtopping and the required time to drain the flood water. For this study, two extreme high tide scenarios with 1%[2] and 10% probability of occurrence for both present and future sea level rise conditions are used. The two tide scenarios, in combination with different wave and seawall conditions, form the 17 flood modeling scenarios. These flood modeling scenarios and the results are discussed in Section 3.4.

The development of the extreme high tides for present and with future sea level rise consists of the following three steps:

1. Analyses of historical through present tide data to develop change in high tides relative to mean sea level,

2. Projection of future mean sea level rise, and

3. Projection of future extreme high tides by combining the trend of high tides (historical to present) (Step 1) and the projection of future sea level rise (Step 2).

A brief summary of these three steps are provide here, details are provided in Appendix B.

[2] A 1% probability of occurrence means that there is a 1 in 100 chance that an event equal or larger will occur during the year.

Step 1: Analyses of Historical Extreme High Tide Data

Over 80 years of hourly tide measurements at Los Angeles (NOAA Station ID: 9410660) were analyzed for this study. Newport Bay data were not used because only a short time-history of measurements was available. Using the hourly record, the mean and maximum value of the tide height from each year was computed, and a linear model was least-squares fit to each of the time series. These tide heights and trends are shown in Figure 3.2. These trend lines show that the annual maximum high tide is rising slightly faster than mean sea level. Figure 3.2 also shows that the maximum tide heights exhibit considerable inter-annual variability on the order of 1 foot. For this study, this variability is treated by considering the extreme tide height to be a random variable and probability analysis was performed to obtain the 1% and 10% extreme high tide trends shown in Figure 3.2. Details on the probability analysis are provided in Appendix B.

Based on the analyses of the historical data, mean sea level for 2010 is 2.65 feet NAVD88 (2.83 feet MLLW), and the 10% and 1% probability of occurrence extreme tide heights for 2010 are 7.41 and 7.71 feet NAVD88 (7.59 and 7.89 feet MLLW), respectively.

Step 2: Projection of Mean Sea Level

The U.S. Army Corps of Engineers (USACE) and many California State agencies have issued guidelines to provide guidance for incorporating sea level rise for Federal or State projects. The following is a brief summary of these recently issued guidelines.

U. S. Army Corps of Engineers (USACE) Guidance: The USACE issued an Engineer Circular titled, “Water Resource Policies and Authorities Incorporating Sea-level Change Considerations in Civil Works Programs” on July 1, 2009. The circular provides USACE guidance for incorporating the potential direct and indirect physical effects of projected future sea level change in the engineering, planning, design, and management of USACE projects. The guidance states that potential sea level change must be considered in every USACE coastal activity as far inland as the extent of estimated tidal influence. USACE recommends a multiple scenario approach to address uncertainty and help develop better risk-informed alternatives. Planning studies and engineering designs should consider alternatives that are developed and assessed for the entire range of possible future rates of sea level change. The alternatives should be evaluated using “low”, “intermediate”, and “high” rates of future sea level change for both “with” and “without” project conditions. The historic rate of sea level change should be used as the “low” rate. The “intermediate” rate of local mean sea level change should be estimated using the modified Curve I from the National Research Council (NRC) 1987 report titled “Responding to Changes in Sea Level: Engineering Implications”. The “high” rate of local sea level change should be estimated using the modified Curve III from the 1987 NRC report.

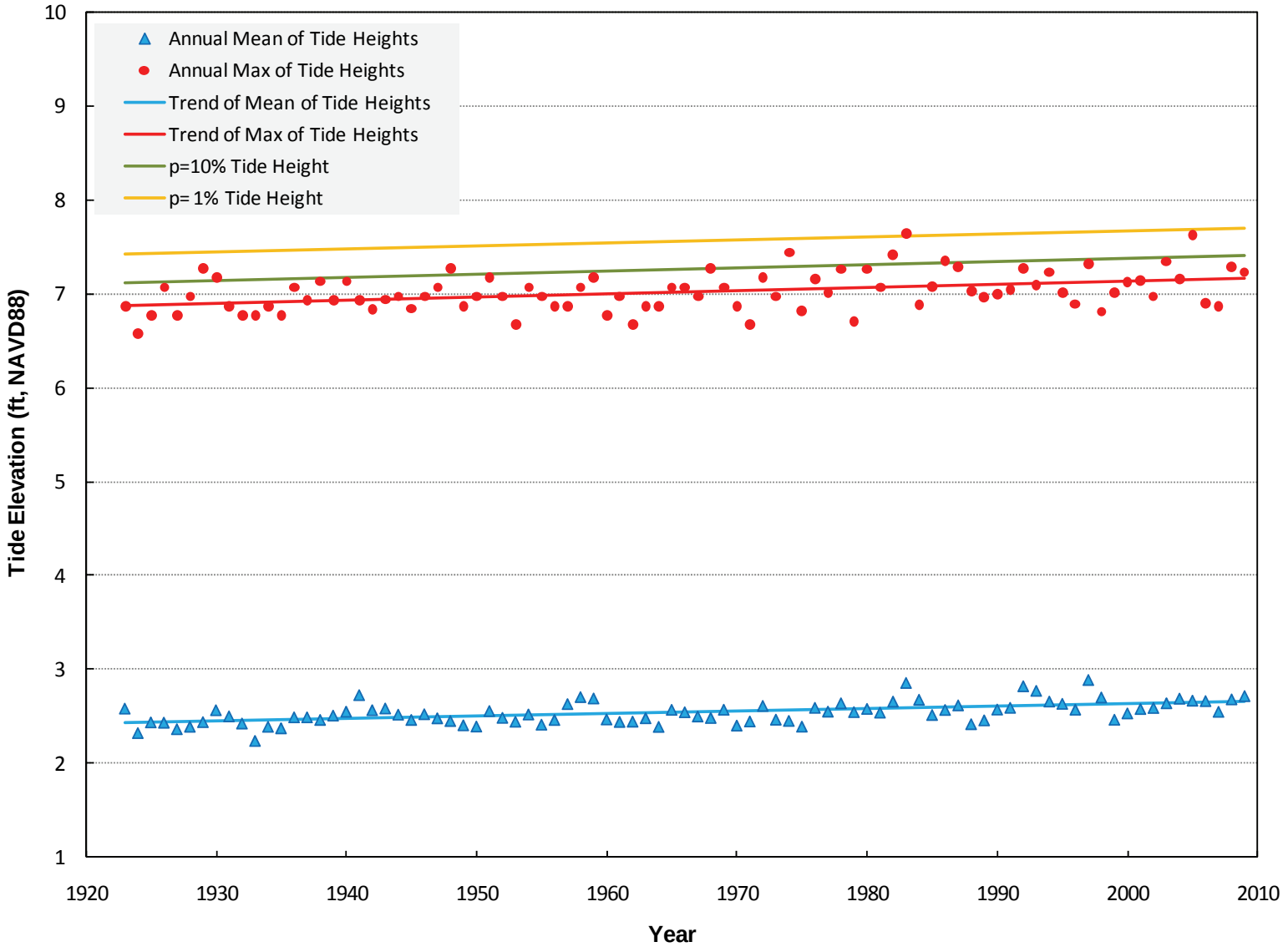


Figure 3.2 Mean and Annual Maximum Tide Elevations, and Trends of Mean, Maximum, 10% and 1% Annual Exceedance-Probability Tide Heights, Los Angeles, 1923 – 2009

State of California: Executive Order S-13-08: On November 14, 2008, Governor Arnold Schwarzenegger issued Executive Order (EO) S-13-08 (Office of the Governor, 2008) to enhance the State's management of potential climate effects from sea level rise, increased temperatures, shifting precipitation and extreme weather events. There are directives for four key actions in the EO including:

- initiate California's first statewide climate change adaptation strategy that will assess the state's expected climate change impacts, identify where California is most vulnerable and recommend climate adaptation policies by early 2009;
- request the National Academy of Sciences (NAS) establish an expert panel to report on sea level rise impacts in California to inform state planning and development efforts;
- issue interim guidance to state agencies for how to plan for sea level rise in designated coastal and floodplain areas for new projects; and
- initiate a report on critical existing and planned infrastructure projects vulnerable to sea level rise.

The Sea Level Rise Assessment Report is required to be completed by the NAS by December 1, 2010. The EO directs that, prior to release of the final Sea Level Rise Assessment Report from the NAS, all State agencies that are planning construction projects in areas vulnerable to future sea level rise shall, for the purposes of planning, consider a range of sea level rise scenarios for the years 2050 and 2100 in order to assess project vulnerability and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise. The EO also directs the Governor's Office of Planning and Research (OPR) to provide State land-use planning guidance related to sea level rise and other climate change impacts by May 30, 2009. That guidance has not been released by OPR as of this writing.

California State Coastal Conservancy: The California State Coastal Conservancy Board adopted the *Climate Change Policy* on June 4, 2009. The *Climate Change Policy* describes the concerns about the effects of global warming on coastal, marine, and near-coast resources within the Conservancy's jurisdiction. The *Policy* recommends prior to the completion of the NAS report on sea level rise, consistent with Executive Order S-13-08, the Conservancy will consider the following sea level rise scenarios in assessing project vulnerability and, to the extent feasible, reducing expected risks and increasing resiliency to sea level rise:

- 16 inches by 2050 (1.3 ft)

- 55 inches by 2100 (4.6 ft) [3]

California Natural Resources Agency: The California Natural Resources Agency had issued draft guidance on sea level rise in response to Executive Order S-13-08 in a document entitled *2009 California Climate Adaptation Strategy* (released August 3, 2009). The report provides a summary of the latest science on how climate change could impact the State and provides recommendations on how to manage against those threats in seven sector areas. The sectors include: Public Health; Biodiversity and Habitat; Ocean and Coastal Resources; Water Management; Agriculture; Forestry; and Transportation and Energy Infrastructure. The most pertinent recommendation is to comply with the CEQA Guidelines, which will be done in the Environmental Impact Report (EIR) for this project.

California Ocean Protection Council: On November 9, 2010, the *Resolution of the California Ocean Protection Council on Sea-Level Rise, Draft* was released for public comment. The guidance document was created by the Sea-Level Rise Task Force of the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT), including staff from fifteen different agencies which reached agreement on the recommendations in the guidance document:

The guidance advises to use sea level rise values from Vermeer and Rahmstorf (2009) as a starting place and select sea level rise values based on agency and context-specific considerations of risk tolerance and adaptive capacity. These values are summarized below in Table 3.1.

Table 3.1 Sea Level Rise Projections Using 2000 as the Baseline

YEAR	RANGE OF SEA LEVEL RISE (IN)
2030	5 – 8
2050	10 – 17
2070	17 – 32
2100	31 – 69

[3] Based on the reference material quoted in the Coastal Conservancy Climate Change Policy, these sea level rise values use Year 2000 as the base year.

For this study, future mean sea levels are estimated by applying the NRC III methodology recommended by the Corps (USACE 2009) since it is likely that the City may seek support from USACE for funding to implement major flood protection projects. Figure 3.3 shows how sea level rise predicted by the USACE / NRC III methodology compares with sea level rise projections by Vermeer and Rahmstorf (2009) (recommended by OPC) that correspond to low (B1), medium (A2) and high (A1FI) future carbon emission scenarios developed by the Intergovernmental Panel on Climate Change (IPCC). Vermeer and Rahmstorf (2009) considered output from 19 climate models and a range of carbon cycling scenarios to characterize the uncertainty in their projections, and this is reflected by the vertical spread of each projection. Figure 3.3 shows that the USACE / NRC III sea level rise projection closely tracks the upper limit of the medium emission scenario (A2) and the mean of the high emission scenario (A1FI). Figure 3.3 also shows that current estimates of sea level rise are considerably greater than those of a few years ago when the IPCC Assessment Report 4 (AR4) was published. In Figure 3.3, the Coastal Conservancy recommended sea level rise for 2050 and 2100 are also shown. It can be seen that the Coastal Conservancy recommended values are similar to the values based on USACE/NRC III methodology.

Step 3: Projections of Future Extreme Tides

Figure 3.4 and Table 3.2 show projections of future tide heights assuming that the future extreme tides will follow the USACE/NRC III sea level rise trend. As shown in Figure 3.4, projections point to a rapid increase of sea level over the coming decades, compared to the historical rate of rise. The projections also show that the difference between the 10% and 1% extreme tide events is very important in the near future, but less important in the long term compared to sea level rise.

Table 3.2 Sea Level and Annual Maximum Tide Height Projections Through 2100

YEAR	MEAN SEA LEVEL (FT, NAVD88)	10% TIDE HEIGHT (FT, NAVD88)	1% TIDE HEIGHT (FT, NAVD88)	PROJECTED SEA LEVEL RISE (FT)*
2010	2.65	7.41	7.71	-
2025	3.05	7.81	8.11	0.40
2050	4.03	8.79	9.09	1.38
2100	7.25	12.01	12.31	4.60

* equals change in mean sea level from 2010.

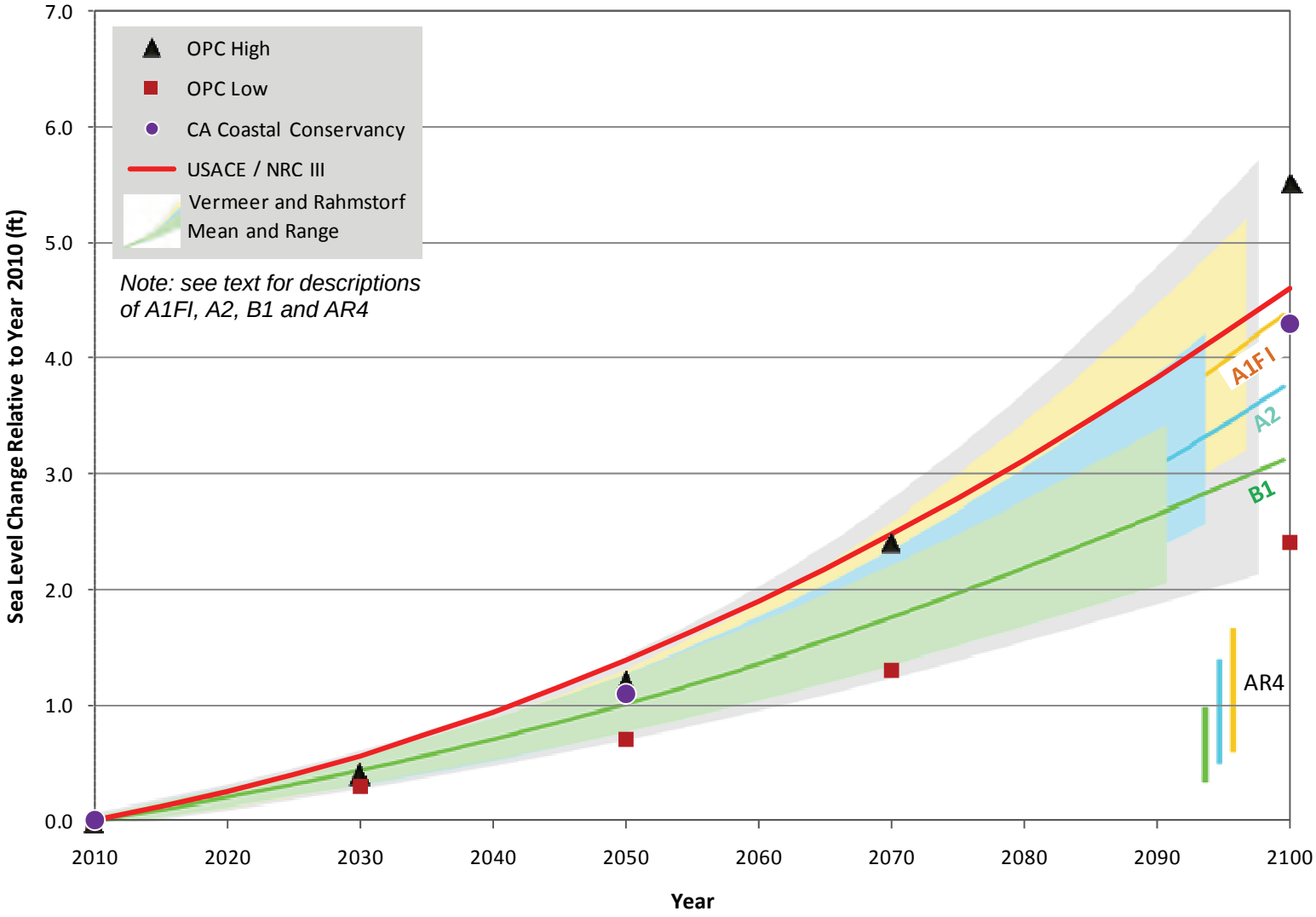


Figure 3.3 Comparison of USACE/NRC III Projections of Sea Level Rise with Vermeer and Rahmstorf (2009), (Adopted from Vermeer and Rahmstorf 2009) and OPC and California State Coastal Conservancy Recommendations

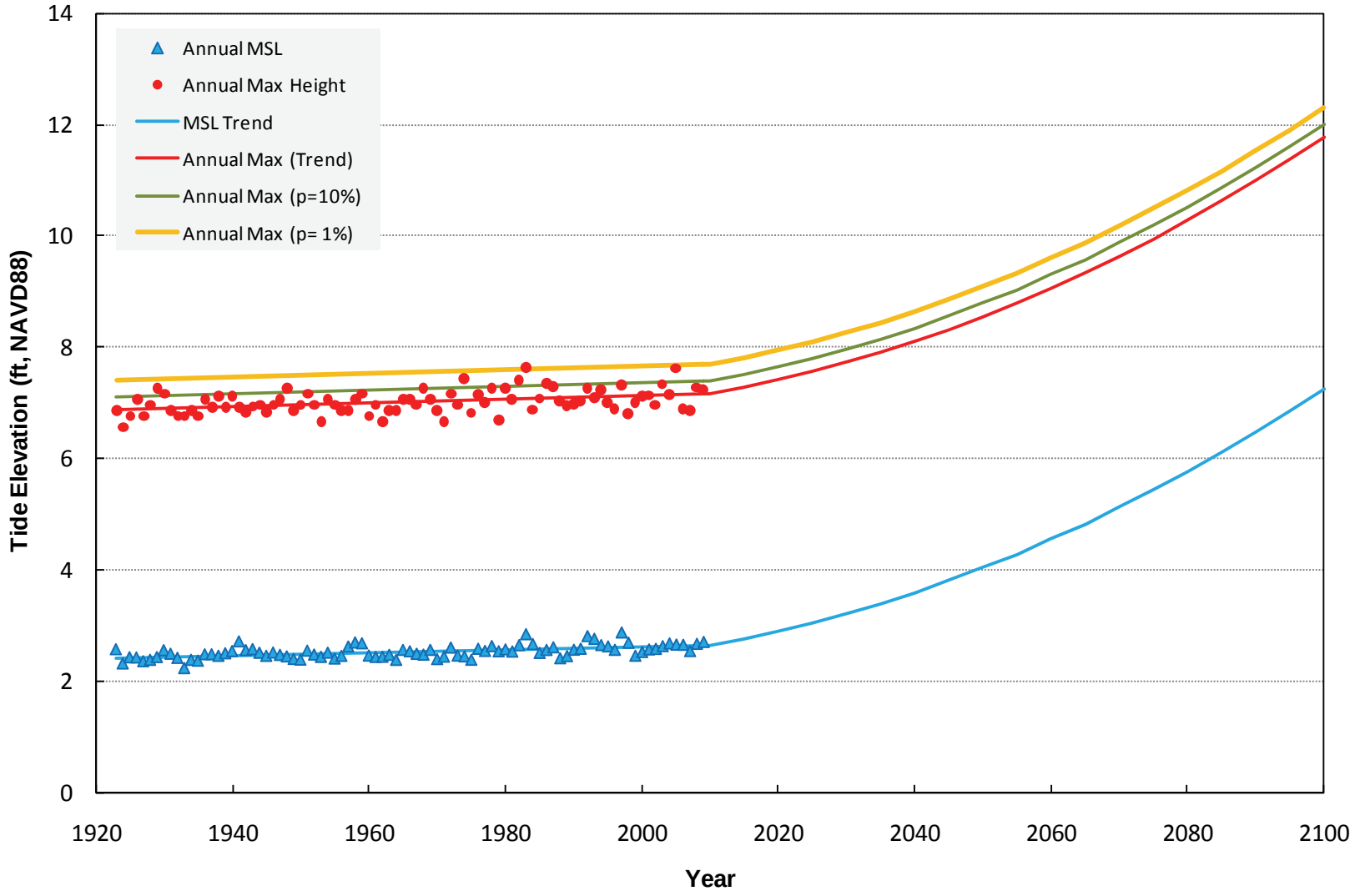


Figure 3.4 Projections of Mean Sea Level and Extreme Tide Heights Through 2100

3.4 Flood Inundation Model Scenarios

The BreZo Model was used to simulate existing and future (with sea level rise) flood inundations of Balboa Island and Little Balboa Island. A total of seventeen scenarios representing different seawall conditions, sea level rise and the corresponding high tides and wave conditions, were simulated. Each scenario is characterized by: (a) the year and corresponding rise of mean sea level, (b) the tide height that is superimposed upon mean sea level to represent the total ocean height, (c) a wave condition that may contribute to seawall overtopping, and (d) flood defense infrastructure which may be improved to mitigate future flooding. These model scenarios are summarized in Table 3.3.

Three different seawall conditions were modeled: 1) existing, 2) a sandbagging scenario that would add 6 inches to the existing seawall height and shore up low points, and 3) a proposed new seawall with top of seawall at +9.8 ft NAVD88 (+10 ft MLLW). The sandbagging scenario was proposed based on the potential sea level rise conditions and model results discussed in the next section such that it would be effective in minimizing flooding at the two islands for possibly the next 20 to 25 years. Details about the proposed new seawall are provided in Chapter 5.

In addition to the present mean sea level and high tide conditions, sea level rise and the corresponding high tide conditions for Year 2025, 2050 and 2100 were simulated. For flood inundation, it is the water level during high tides (on top of the rise in sea level in the future) together with wave overtopping that governs the severity of flooding. Hence, the 17 flood model scenarios include a combination of tide height and wave (wind wave or ocean swell) conditions. Two different tide heights with annual exceedance probabilities of 10% and 1% were simulated. These 10% and 1% exceedance tide heights for present (2010) and Year 2025, 2050 and 2100 are shown in Table 3.2.

Table 3.3 Flood Inundation Modeling Scenarios

SCENARIO	SEAWALL CONDITION	YEAR	SEA LEVEL RISE FROM 2010	TIDE HEIGHT (ANNUAL EXCEEDANCE PROBABILITY)	WAVE SCENARIO
1	Existing Conditions	2010	NA	10%	No Waves
2	Existing Conditions	2010	NA	10%	Wind Waves
3	Existing Conditions	2010	NA	10%	Ocean Swell
4	Existing Conditions	2010	NA	1%	Wind Waves
5	Existing Conditions	2025	0.40 ft	10%	Wind Waves
6	Existing Conditions	2025	0.40 ft	10%	Ocean Swell
7	Existing Conditions	2025	0.40 ft	1%	Wind Waves
8	Existing Conditions	2050	1.38 ft	10%	No Waves
9	Existing Conditions	2050	1.38 ft	1%	No Waves
10	Existing Conditions	2100	4.60 ft	10%	No Waves
11	Sandbagging (+0.5 ft)	2010	NA	1%	Wind Waves
12	Sandbagging (+0.5 ft)	2025	0.40 ft	1%	Wind Waves
13	10 ft (MLLW) seawall	2010	NA	1%	Wind Waves
14	10 ft (MLLW) seawall	2025	0.40 ft	1%	Wind Waves
15	10 ft (MLLW) seawall	2050	1.38 ft	1%	Wind Waves
16	10 ft (MLLW) seawall	2050	1.38 ft	10%	Wind Waves
17	10 ft (MLLW) seawall	2100	4.60 ft	1%	Wind Waves

3.5 Flood Inundation Model Results

The flood model results were used to estimate the number of parcels and the number of buildings on Balboa Island and Little Balboa Island that may be subject to flooding under each of the 17 model scenarios. A summary of model results are shown in Table 3.4. A total of 1,410 parcels were identified on the two islands, and the building impact assessment assumes one building per parcel with the first floor height characterized by the statistical distribution described in Section 2.3. Potential damage is assumed when the local flood water height predicted by the model exceeds the first floor height. In the table, the average flood depth within the predicted flood zone is also shown.

Table 3.4 Average Flood Depth, Parcel and Building Impacts Associated with Each Model Scenario

Scenario	Year	Tide Height (Annual Exceedance Probability)	Wave Scenario	Average * Flood Depth (ft)	Impacted** Parcels (number)	Parcels Impacted (%)	Impacted*** Buildings (number)	Impacted Buildings (%)	Flood Extent Figure Number
Existing Condition Scenarios									
1	2010	10%	No Waves	0.26	61	4.0	3 ± 2	0.2	Figure 3.5
2	2010	10%	Wind Waves	0.26	61	4.3	3 ± 2	0.2	Figure 3.6
3	2010	10%	Ocean Swell	0.29	514	36.5	24 ± 5	1.7	Figure 3.7
4	2010	1%	Wind Waves	0.36	324	23.0	22 ± 4	1.5	Figure 3.8
5	2025	10%	Wind Waves	0.48	681	48.3	66 ± 7	4.7	Figure 3.9
6	2025	10%	Ocean Swell	0.79	1,176	83.4	235 ± 13	16.6	Figure 3.10
7	2025	1%	Wind Waves	1.16	1,179	83.6	420 ± 14	29.8	Figure 3.11
8	2050	10%	No Waves	1.84	1,410	100.0	894 ± 17	63.4	Figure 3.12
9	2050	1%	No Waves	2.15	1,410	100.0	1047 ± 15	74.3	Figure 3.13
10	2100	10%	No Waves	5.02	1,410	100.0	1410 ± 1	100.0	Figure 3.14
Sandbagging Scenarios									
11	2010	1%	Wind Waves	0.03	0	0.0	0	0.0	Figure 3.15
12	2025	1%	Wind Waves	0.12	12	0.9	0-1	<0.1	Figure 3.16
10-foot Seawall Scenarios									
13	2010	1%	Wind Waves	0	0	0.0	0	0.0	Figure 3.17
14	2025	1%	Wind Waves	0	0	0.0	0	0.0	Figure 3.18
15	2050	1%	Wind Waves	0	0	0.0	0	0.0	Figure 3.19
16	2050	10%	Wind Waves	0	0	0.0	0	0.0	Figure 3.20
17	2100	1%	Wind Waves	5.30	1,410	100.0	1410 ± 1	100.0	Figure 3.21

* *Average flood depth within the predicted flood zone.*

** *An Impacted Parcel implies some fraction of the parcel is flooded.*

*** *An Impacted Building implies that the predicted flood depth exceeds a statistical estimate for the foundation height. Again note that actual first floor heights for individual houses were not used in the model.*

In addition to estimating the number of impacted parcels and buildings, the flood model results were also used to generate graphics to illustrate the flood extent and flood depth associated with each modeling scenario. These graphics are shown in Figures 3.5 through 3.21 for model Scenarios 1 through 17, respectively. Even though the model results were used only to quantify the number of parcels and buildings that may be impacted under each model scenario, the graphics showing flood extent and flood depth can be used to qualitatively describe where other damages (e.g. cars parked on a flooded street likely to be damaged) may occur.

A brief description of the flood model simulation findings are provided in the following section based on the results shown in Table 3.2, and the graphics showing the flood extent.

3.5.1 Existing Condition Scenarios

Scenarios 1 through 10 reveal the flood risk of existing conditions in response to tide height, sea level rise, and wave height effects. Scenarios 1 to 4 (see Figures 3.5 to 3.8) show that the present day (2010) flood risk mainly involves flooded streets. Scenarios 3 and 4 also show a small fraction (1%) of the buildings in Balboa Island being impacted. Scenario 3 shows that ocean swell has the potential to overtop the southern boundary of Balboa Island when combined with a 10% exceedance-probability tide. Flood water that overtops the southern seawall generally spreads north, but Park Avenue also acts to spread flood water east and west. The lowest elevations are on the west side of the island, so street flooding tends to progress in this direction.

Scenario 4 shows that flooding may commence on the southwest and northwest edges of Balboa Island from a 1% exceedance probability tide and wind waves. The number of impacted parcels is smaller compared to Scenario 3, but the estimated impact to buildings is roughly equal. This is attributed to lower elevations on the west end of the island. This scenario causes water to pond more and spread less compared to Scenario 3.

Ocean swell (Scenario 3, see Figure 3.7) is predicted to have a stronger effect on flooding than wind waves (Scenario 4, see Figure 8), mainly because swell-induced overtopping is initiated at lower tide heights than wind-wave overtopping. Additionally, flood modeling indicates that Little Balboa Island is presently well protected from tide and wave-driven flooding. This is attributed to a higher seawall compared to Balboa Island.

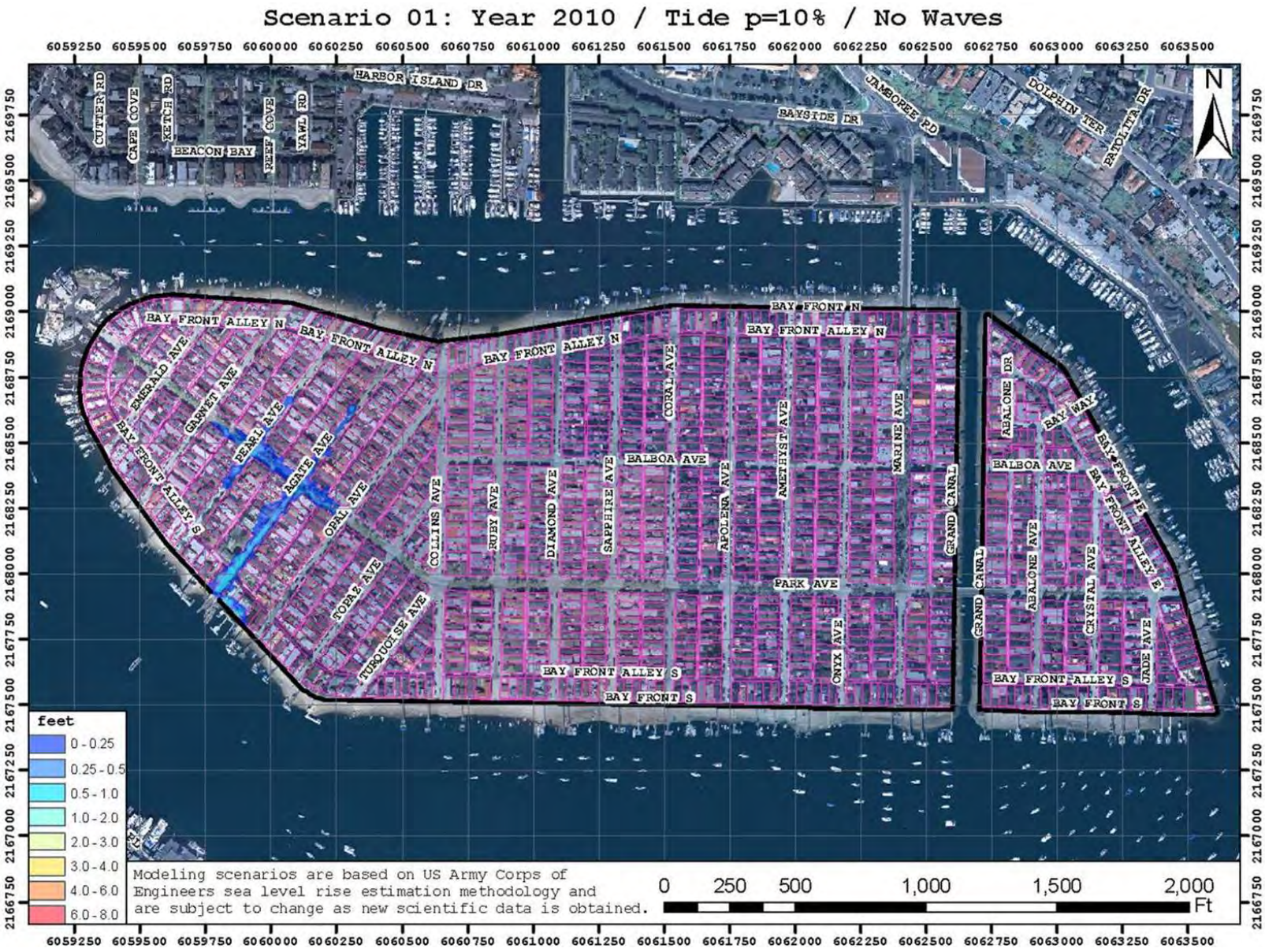


Figure 3.5 Model Prediction of Flood Extent and Flood Depth for Scenario 1

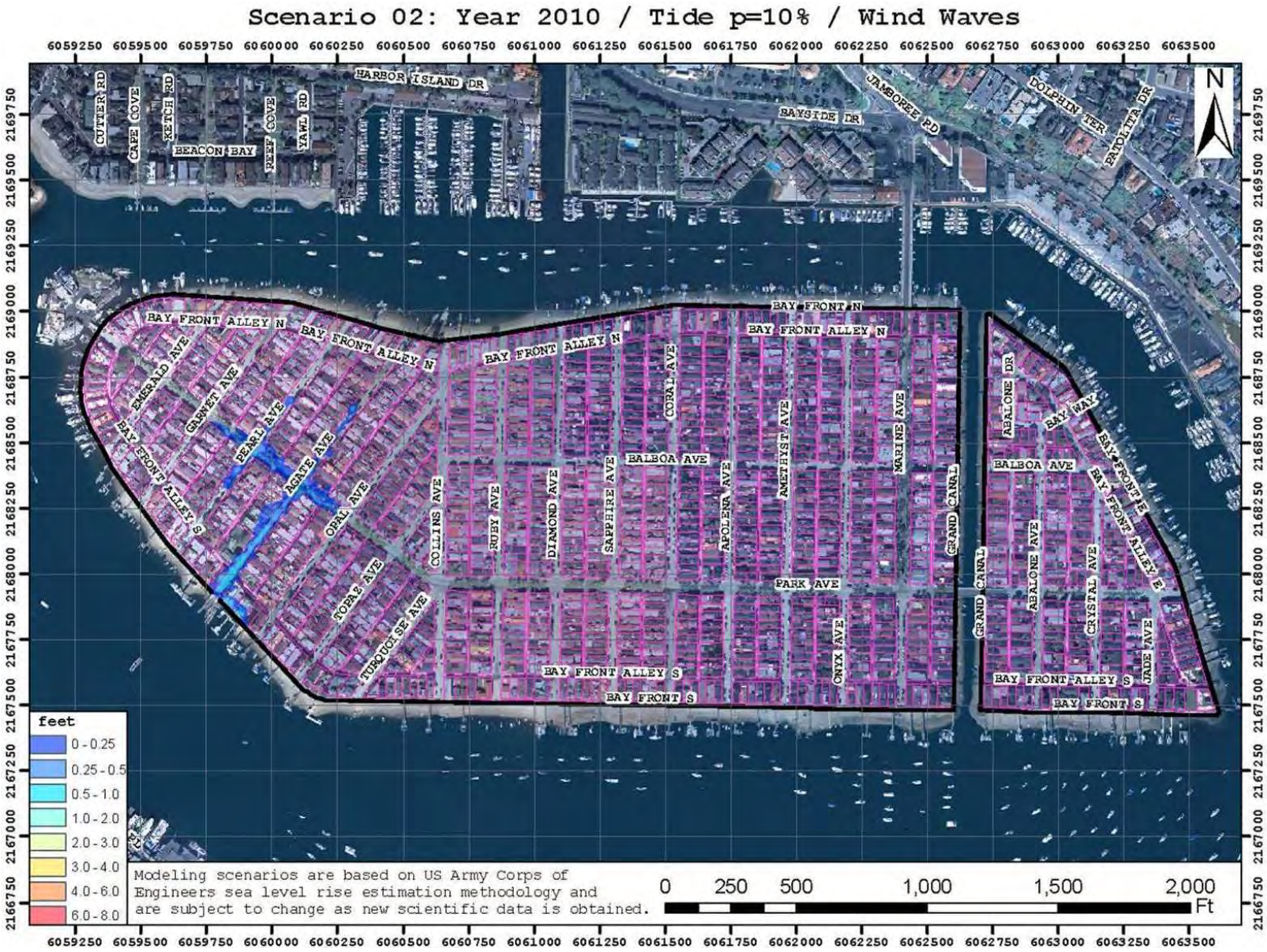


Figure 3.6 Model Prediction of Flood Extent and Flood Depth for Scenario 2

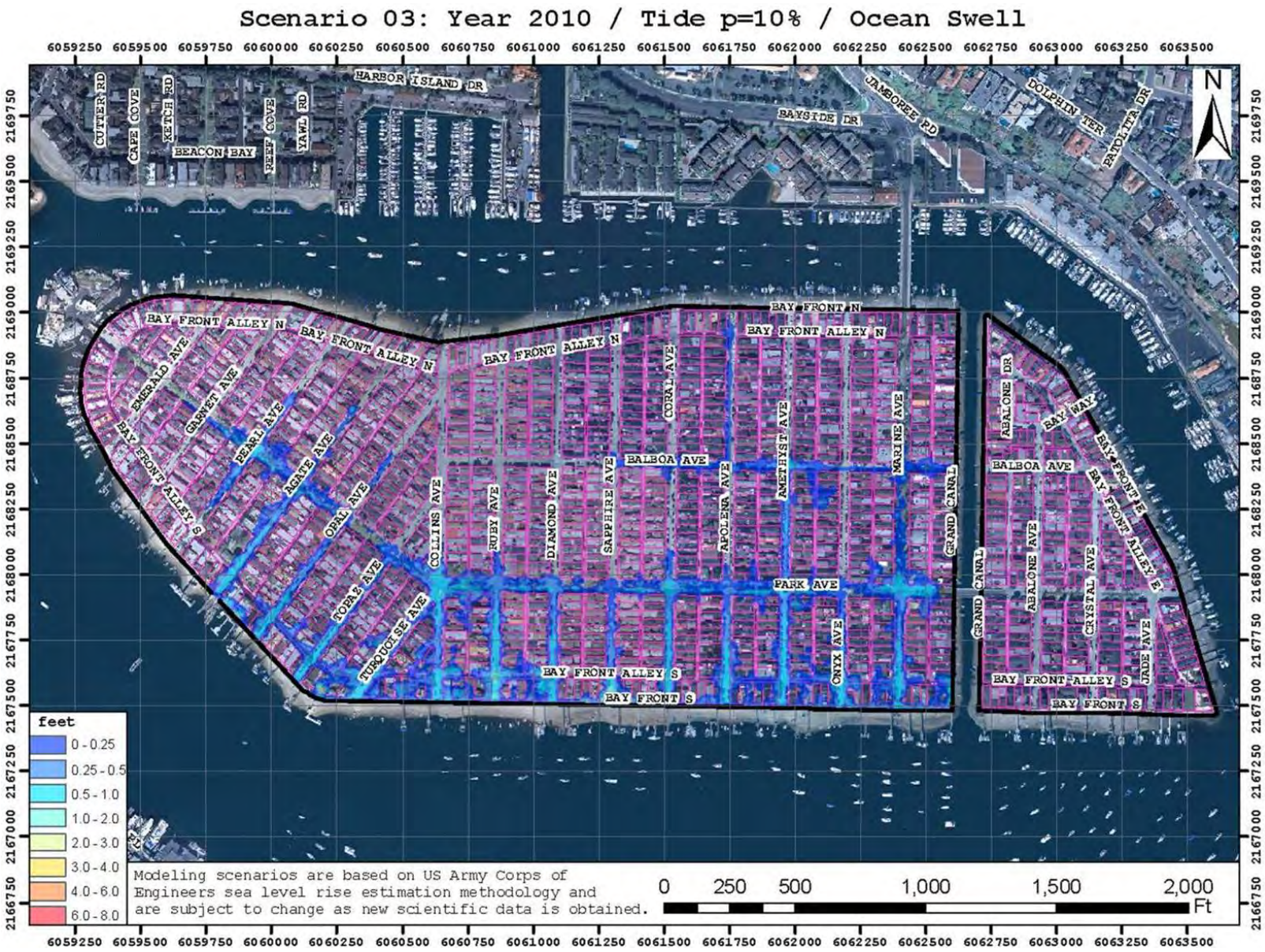


Figure 3.7 Model Prediction of Flood Extent and Flood Depth for Scenario 3

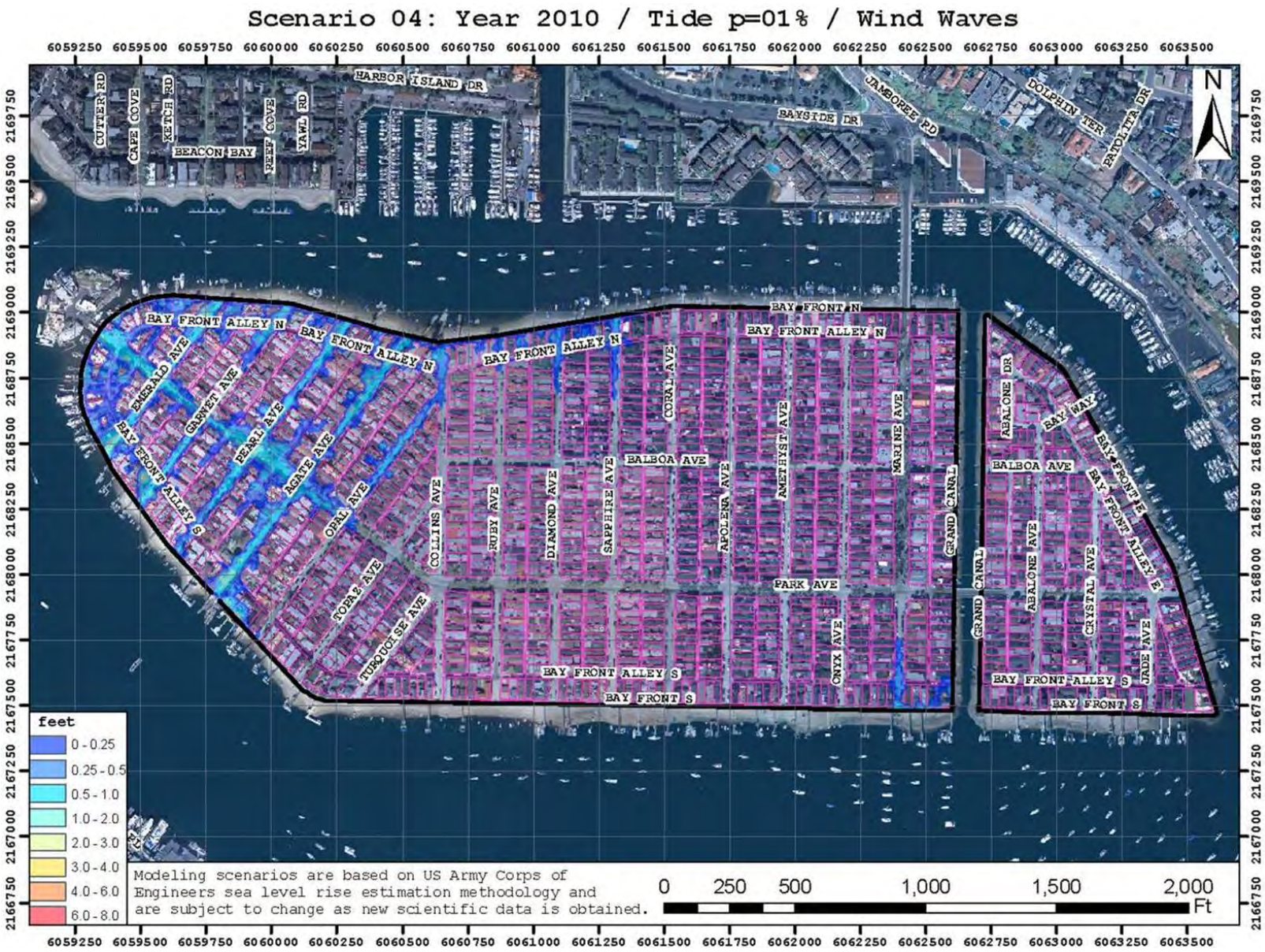


Figure 3.8 Model Prediction of Flood Extent and Flood Depth for Scenario 4

Figure 3.9 Model Prediction of Flood Extent and Flood Depth for Scenario 5

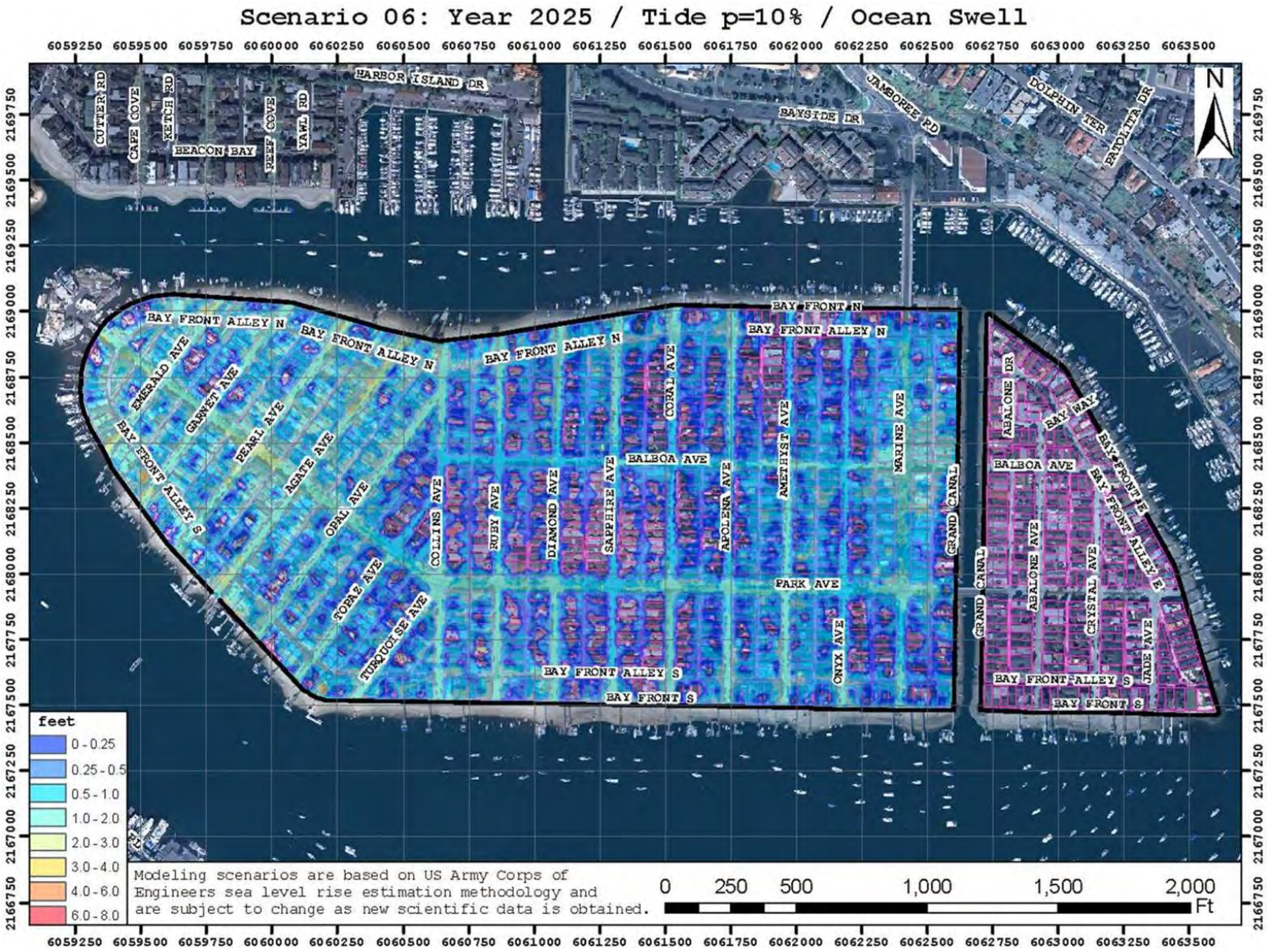


Figure 3.10 Model Prediction of Flood Extent and Flood Depth for Scenario 6

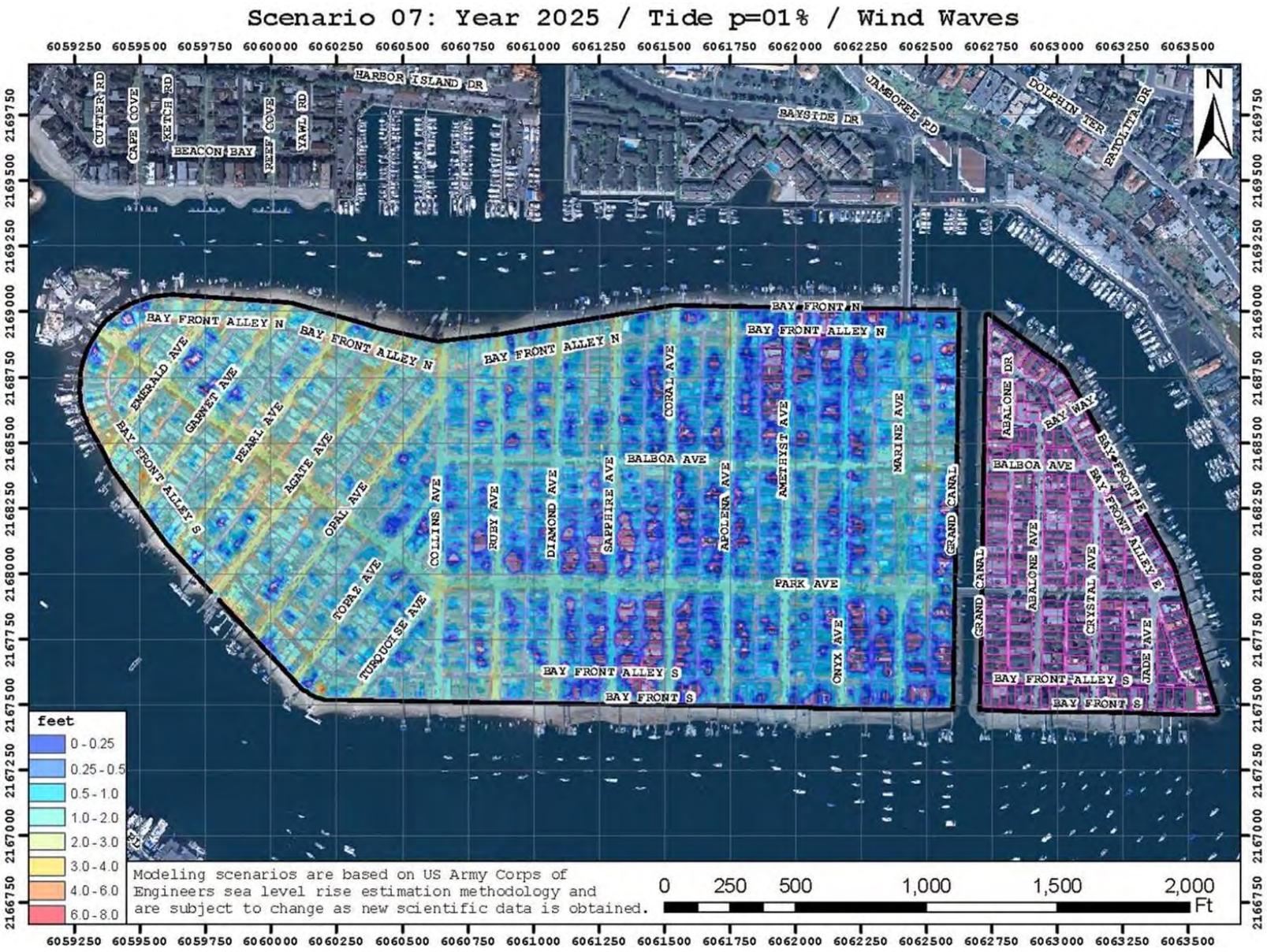


Figure 3.11 Model Prediction of Flood Extent and Flood Depth for Scenario 7

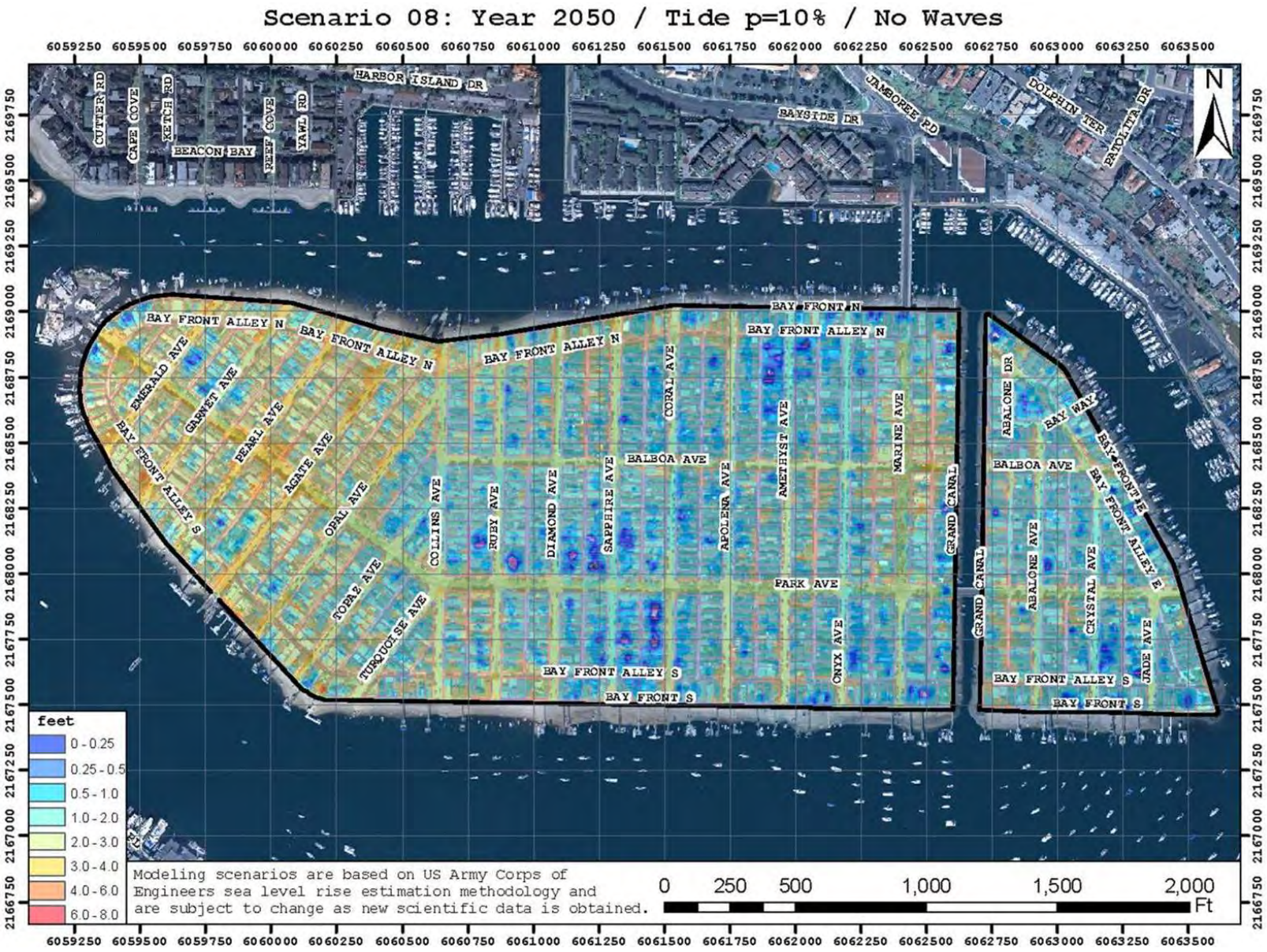


Figure 3.12 Model Prediction of Flood Extent and Flood Depth for Scenario 8

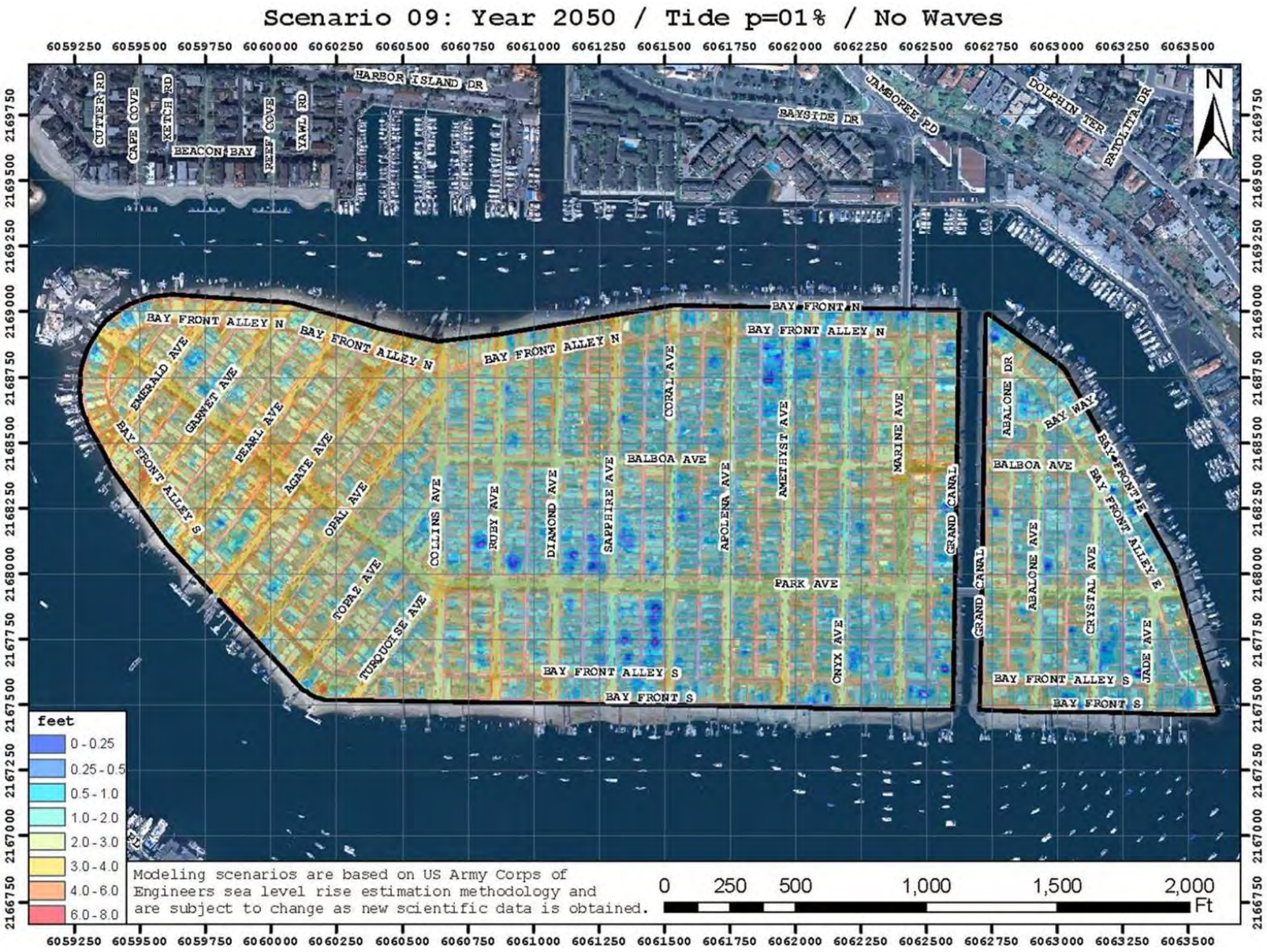


Figure 3.13 Model Prediction of Flood Extent and Flood Depth for Scenario 9

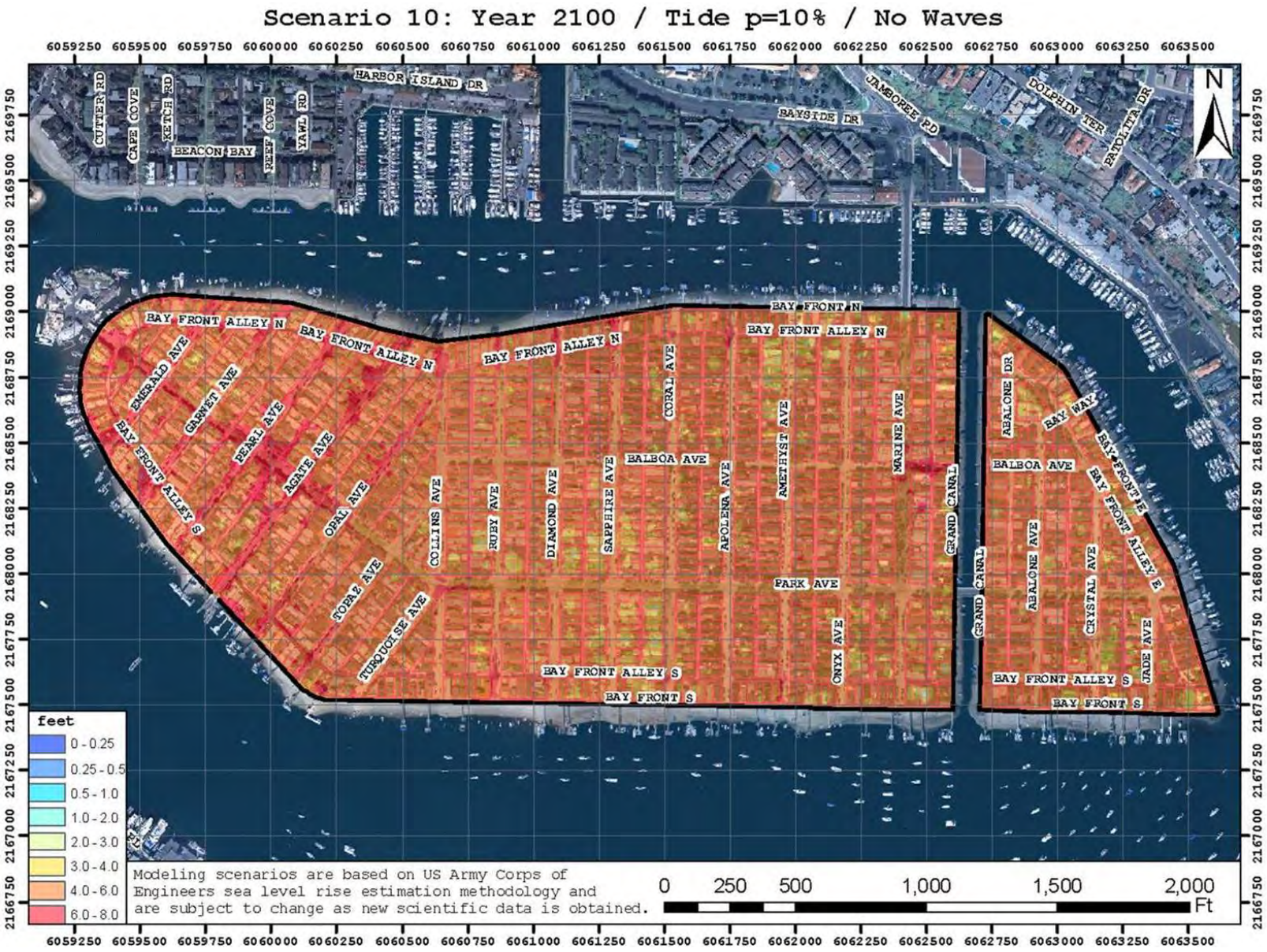


Figure 3.14 Model Prediction of Flood Extent and Flood Depth for Scenario 10

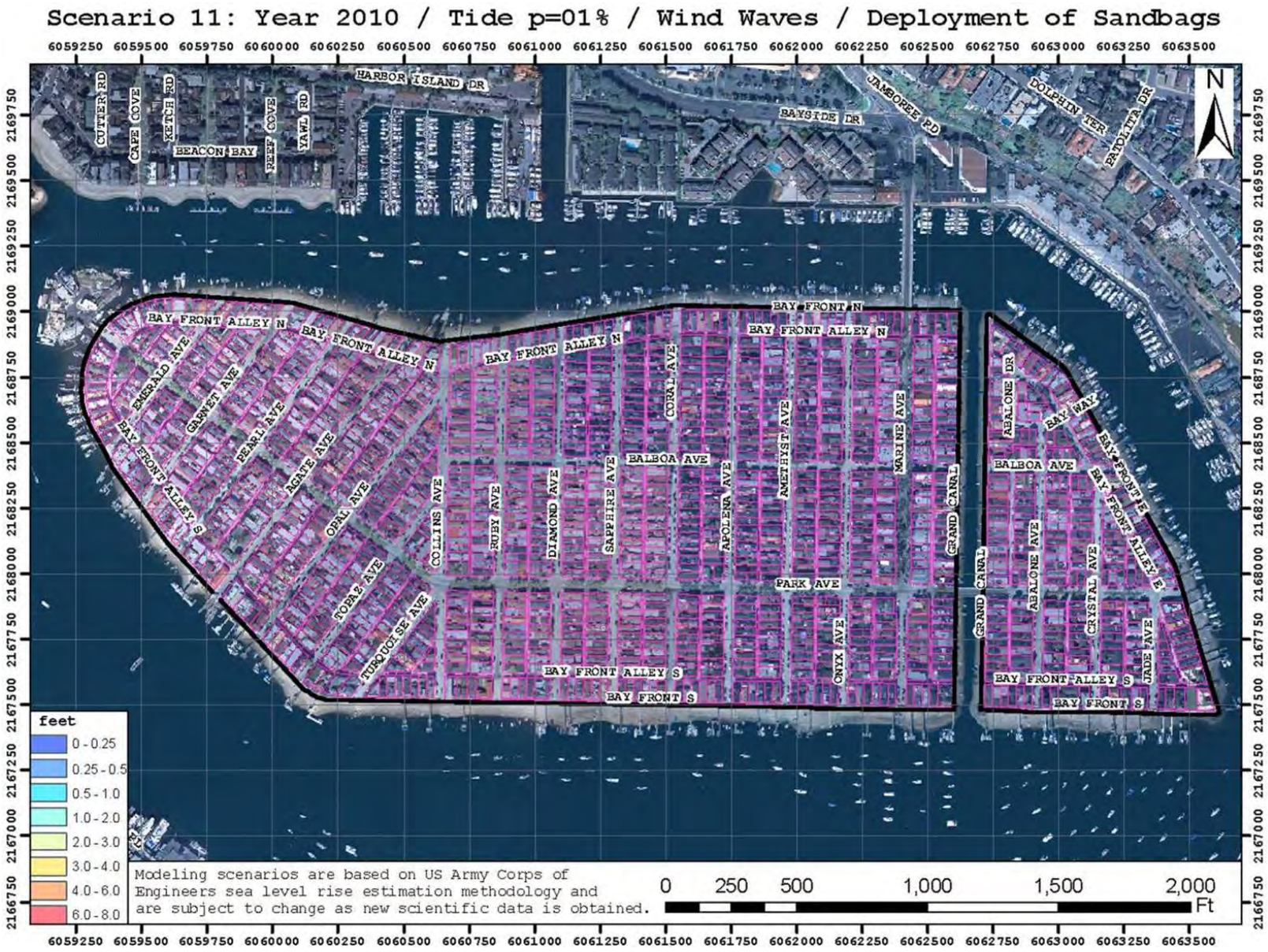


Figure 3.15 Model Prediction of Flood Extent and Flood Depth for Scenario 11

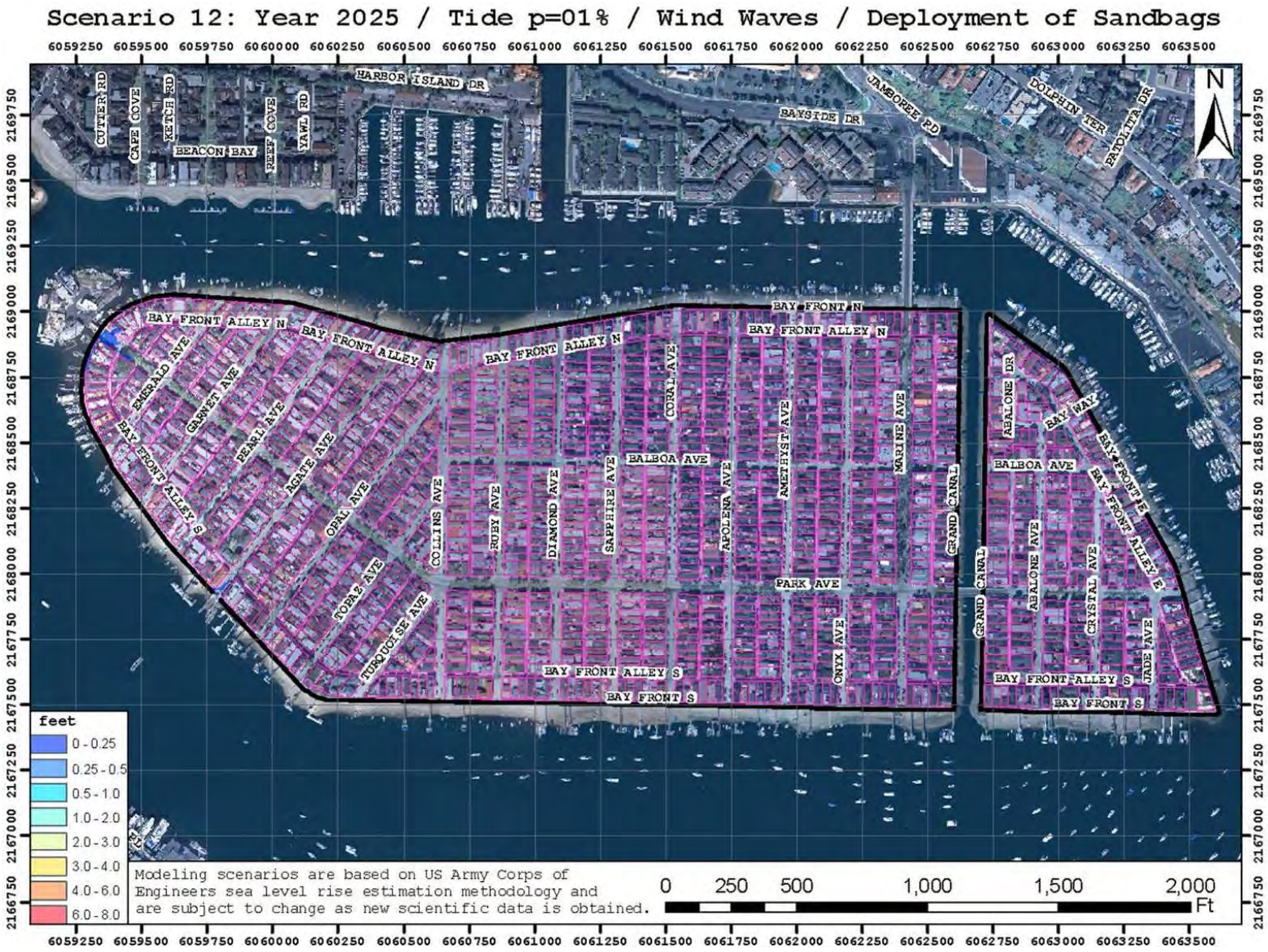


Figure 3.16 Model Prediction of Flood Extent and Flood Depth for Scenario 12

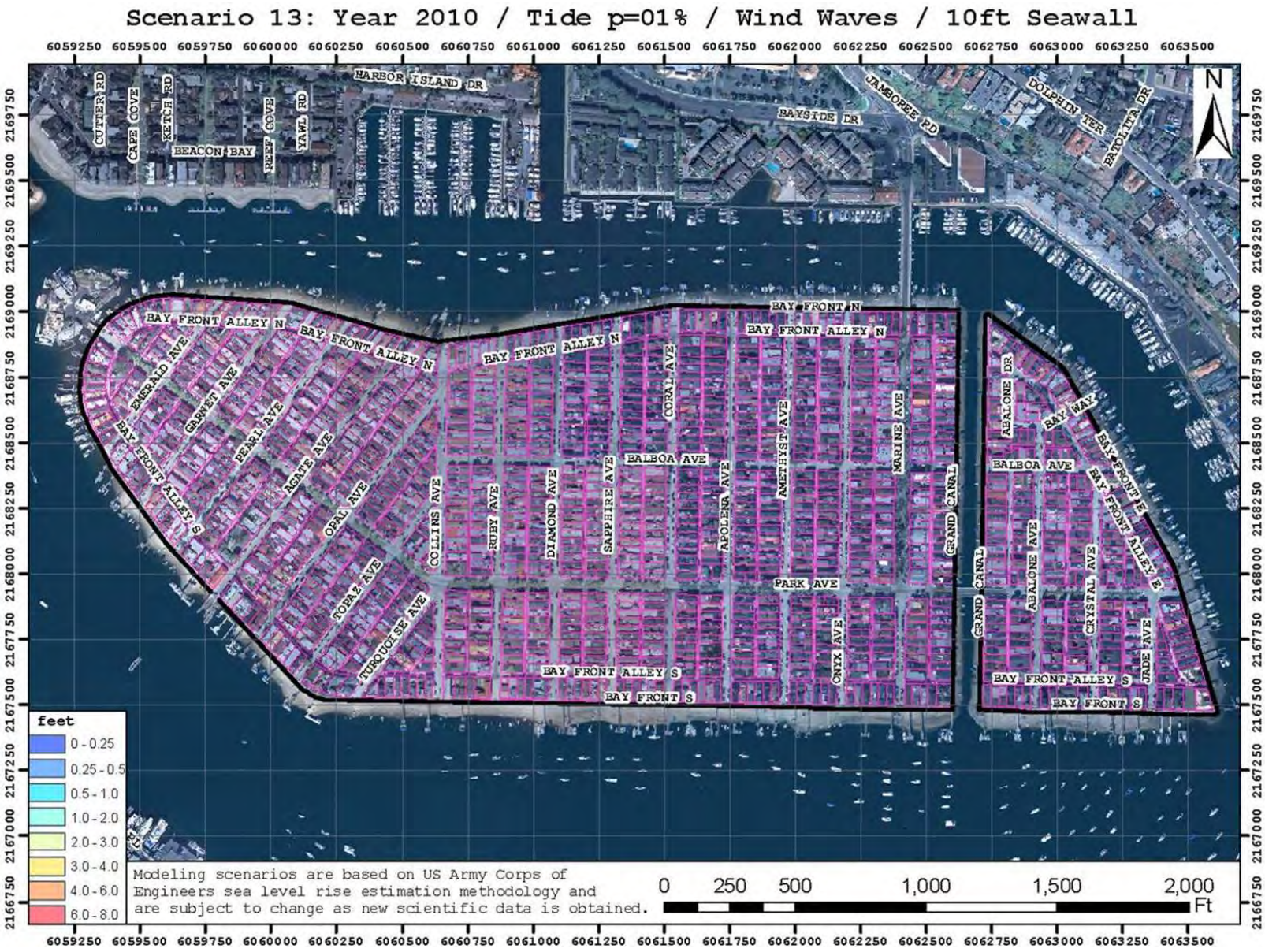


Figure 3.17 Model Prediction of Flood Extent and Flood Depth for Scenario 13

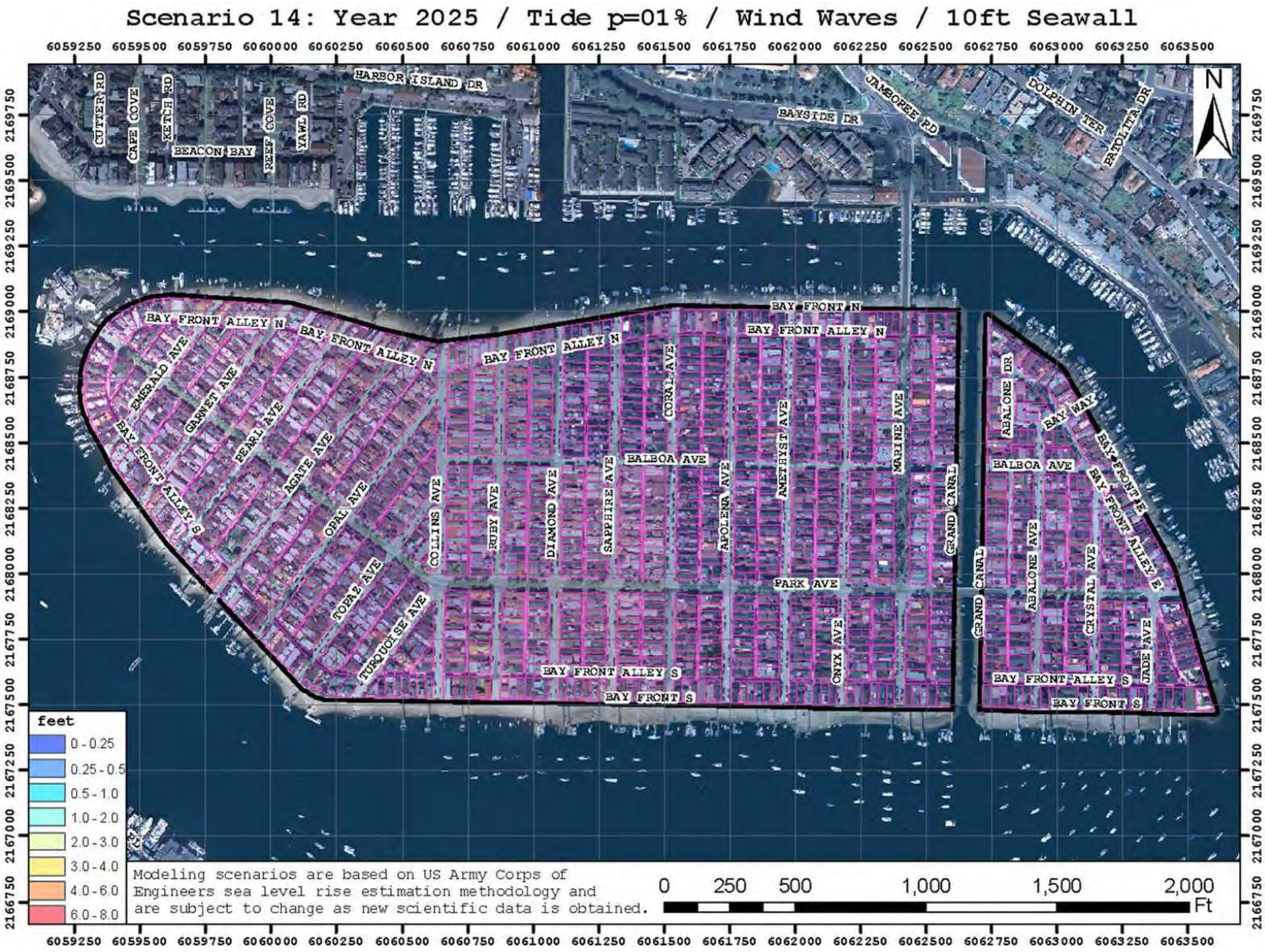


Figure 3.18 Model Prediction of Flood Extent and Flood Depth for Scenario 14

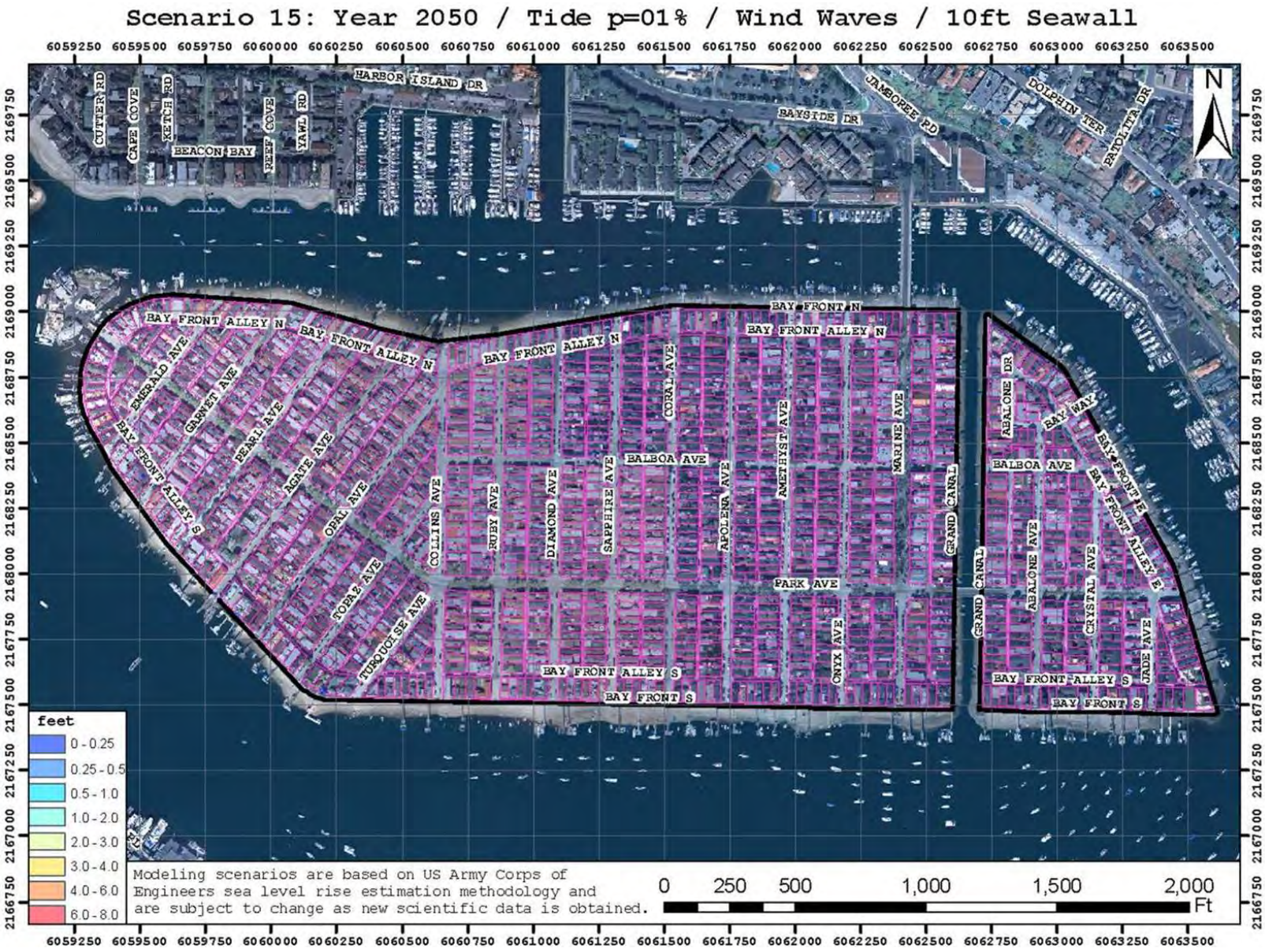


Figure 3.19 Model Prediction of Flood Extent and Flood Depth for Scenario 15

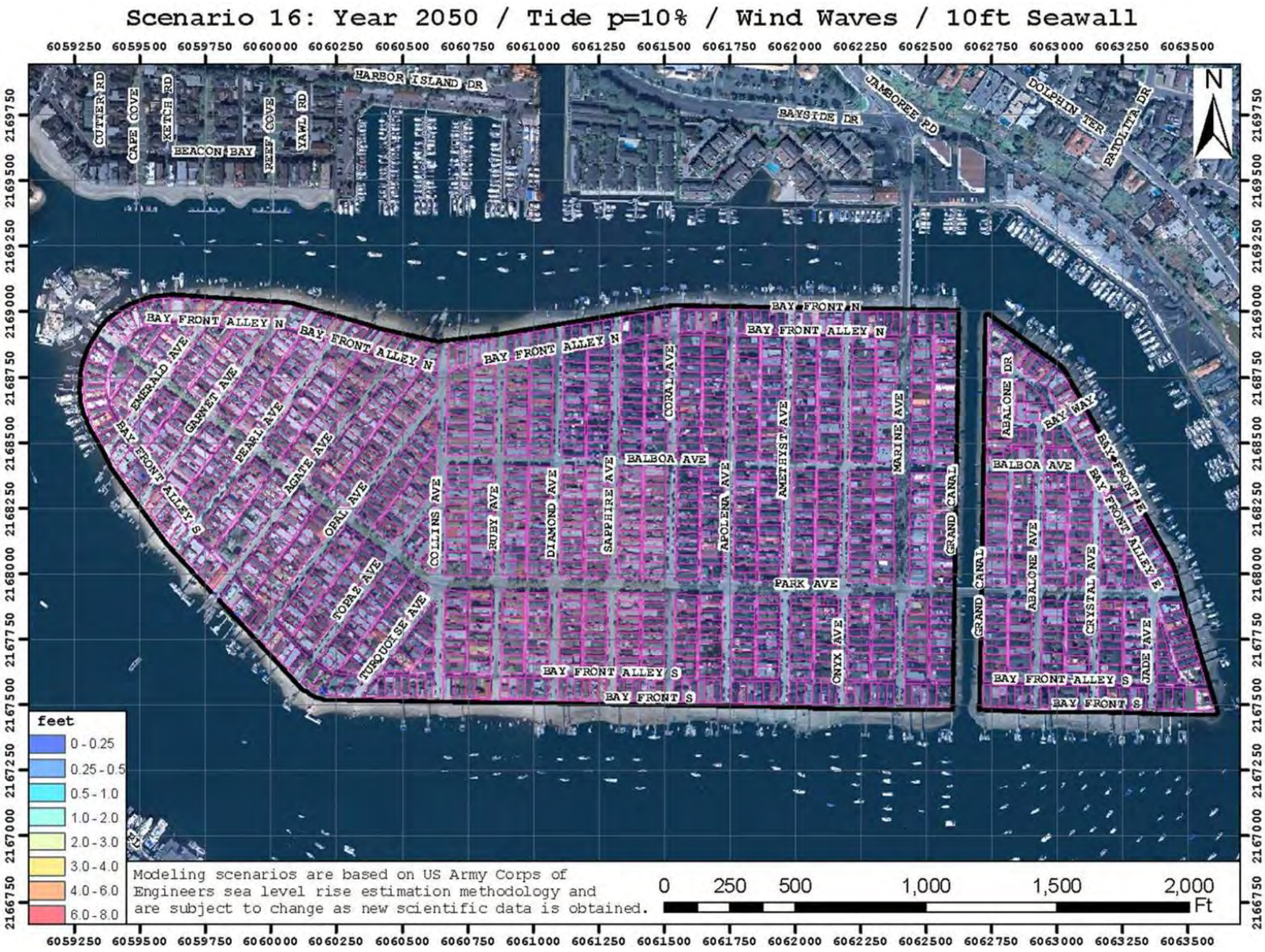


Figure 3.20 Model Prediction of Flood Extent and Flood Depth for Scenario 16

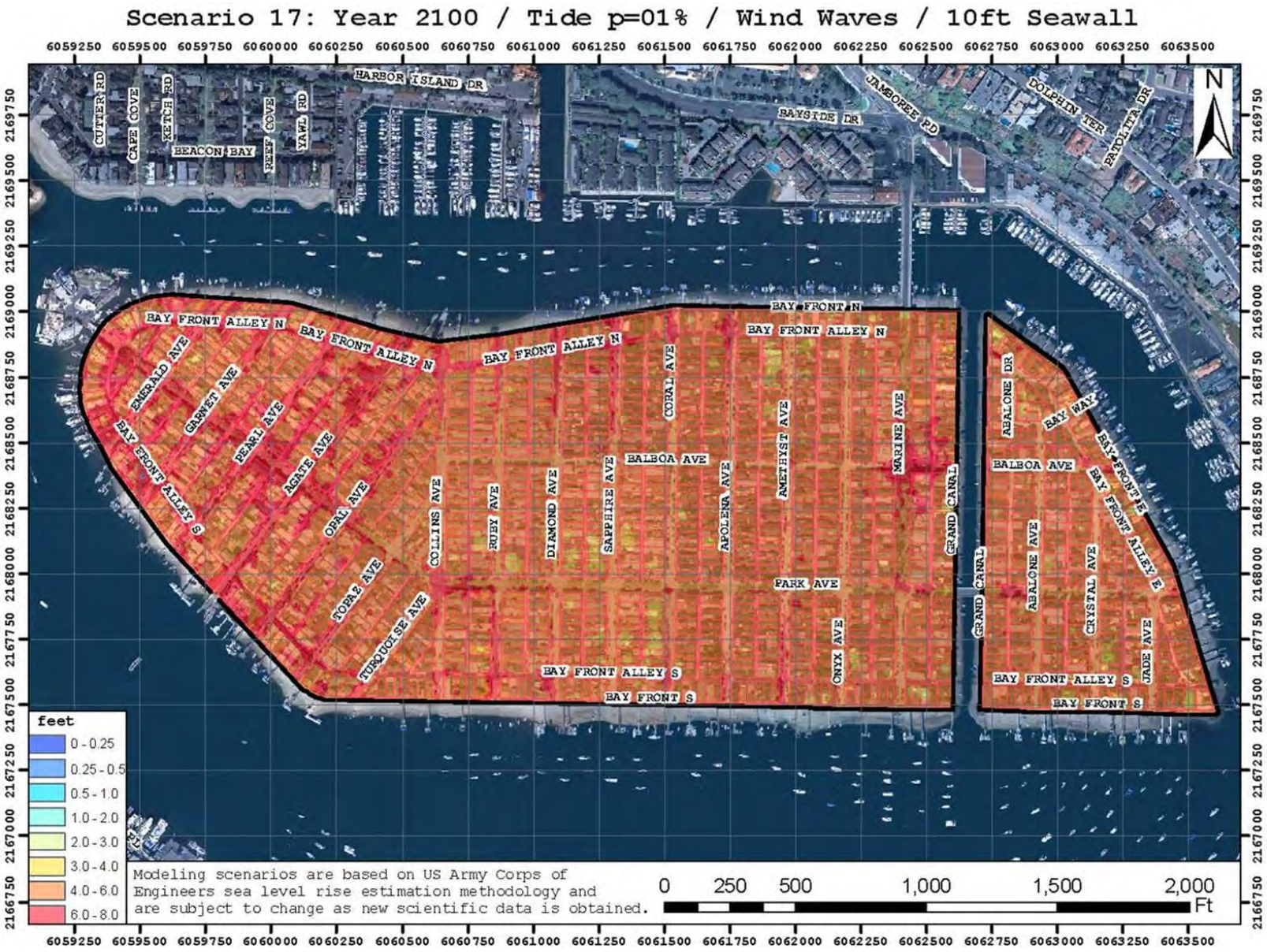


Figure 3.21 Model Prediction of Flood Extent and Flood Depth for Scenario 17