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MEMORANDUM

TO:	Liam Garland, Public Works Director, City of Alameda Public Works Department	DATE:	December 5, 2017
FROM:	Dan Schaaf, P.E.	JOB#:	APWD.16.17
SUBJECT:	City of Alameda Storm Drain Master Plan CIP Update		

Introduction

The City of Alameda (City) has tasked Schaaf & Wheeler with updating existing Storm Drain Capital Improvement Plans (CIPs) identified as a part of previous studies on the existing storm drain system.

This memorandum is organized to show the costs for existing CIPs, newly identified CIPs, and the additional CIP projects necessary to accommodate for increases in the tide from Sea Level Rise. The City has provided Schaaf & Wheeler with various sources where existing CIPs have been identified. Sources of CIPs include:

- Storm Drain Master Plan, Schaaf & Wheeler
- The 2011 Pump Station Assessment Study, Psomas
- The Lagoon Operations Study, Schaaf & Wheeler
- Various Development Plans, Schaaf & Wheeler
- New CIPs identified by City staff
- 18-inch Sea Level Rise Study, Schaaf & Wheeler
- 55-inch Sea Level Rose Study, Schaaf & Wheeler

All of the proposed CIPs are broken into three priority levels for funding and implementation. Descriptions for each priority level are shown in Table 1. Priorities for all CIPs have been evaluated and updated based on input from the City and changes to existing infrastructure over time.

Total Costs, 2017 Costs

Category	Priority			Total
	High	Moderate	Low	
10-yr Storm Total w/o SLR	$ 18,400,000	$ 31,900,000	$ 50,500,000	**$ 100,800,000**
Total w/ 18" SLR Pipe CIPs	$ 18,400,000	$ 35,500,000	$ 50,500,000	**$ 104,400,000**
Total w/ 55" SLR Pipe CIPs	$ 18,400,000	$ 141,300,000	$ 50,500,000	**$ 210,200,000**
Total w/ 55" SLR Pipe CIPs + Inundation	$ 18,400,000	$ 584,900,000	$ 50,500,000	**$ 604,100,000**

Note: 18" SLR costs do not include costs for floodwall or levee improvements

Table 1 – Capital Improvement Priority Levels

Priority Level	Description
High	Projects under this category have either been specifically identified by City staff as high priority or have a large area of flooding where the 10-year flow depth in the street is more than one foot over the top-of-curb. These projects improve locations with the deepest and longest flooding situations in each of the five sections of the City. Areas of significant historical flooding fall into this category.
Moderate	This category has conditions similar to high priority, but has a smaller area affected by flooding. A 10-year design discharge still overtops the top-of-curb; however, the length and depth of flooding is less than that of a high priority improvement.
Low	Low priority improvements are generally smaller projects that consist of placing a few pipe segments. Existing flooding is not necessarily contained within the roadway (top-of-curb); however, the area of flooding is much smaller and/or briefer in duration than that of moderate and high priority projects.

All CIPs include a 50% contingency for design, engineering, and administration and have been updated to September 2017 dollars. Costs updates come from better pipe and connection cost data and adjustments for inflation tracked by the Engineering News Record Construction Cost Index. The updated pipe and connection costs can be found in Table 2.

Table 2 –2017 Pipe and Connection Costs

Diameter (inches)	Dollar per Linear Foot of Pipe	Dollar per Connection
15	$275	$12,800
18	$295	$13,895
21	$315	$12,975
24	$355	$13,050
27	$375	$13,135
30	$405	$13,215
33	$440	$13,575
36	$460	$13,715
42	$510	$13,995
48	$575	$14,275
54	$625	$15,445
60	$680	$16,135
66	$730	$17,160
72	$780	$17,515
78	$845	$18,760
84	$895	$20,000
96	$940	$21,985

Costs are updated from recent area Storm Drain Master Plans by Schaaf & Wheeler.

High Priority Capital Improvements

Several improvements were identified by the City as high priority projects. Descriptions of each project are summarized below.

Veterans Court

The top of the Seawall at Veterans Court (Figure 1A) is lower than FEMA's 100 year flood elevation. In order to protect the area, raising the roadway along Veterans Court or installation of a flood gate is recommended. For planning purposes we have assumed a top of roadway or gate elevation of 12.5 feet in order to account for an 18-inch raise in sea level and 1 foot of freeboard. Raising the road has a greater impact on the overall square footage disturbed as shown in Figure 1B. The preliminary cost estimate for installing a flood gate is slightly higher than raising the road but it would have a smaller square footage disturbed as shown in Figure 1C. The extent of utility relocation and landscaping features can greatly impact the construction costs. Both options assume repaving of Veterans Court.

This work is to add protection for sea level rise and in the event the exiting seawall becomes compromised. It does not include a solution for the flooding and sea level rise effects resulting from inundation along Doolittle Drive. The flooding from Doolittle Drive needs to be further analyzed.

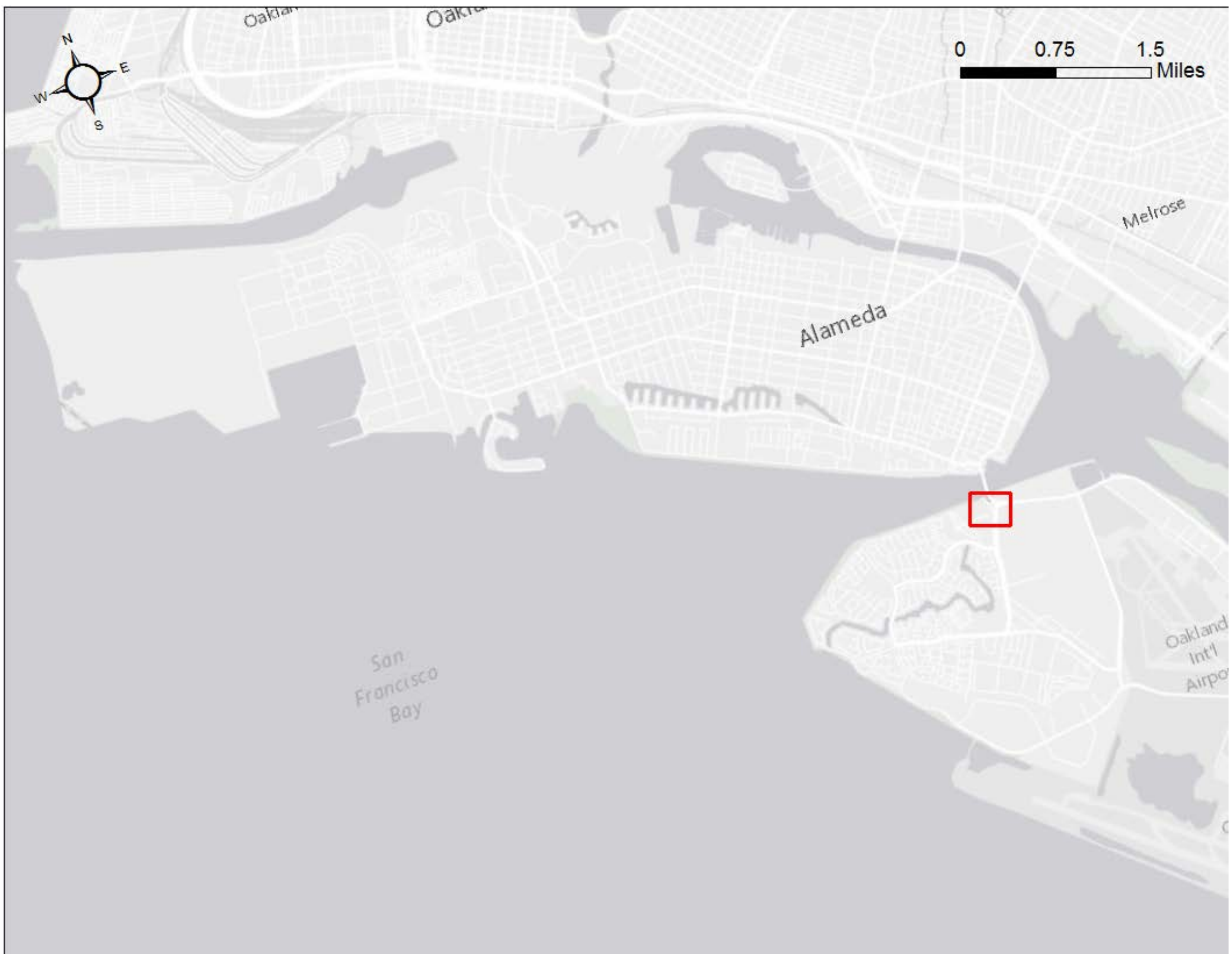

Figure 1A – Veterans Court Location Map

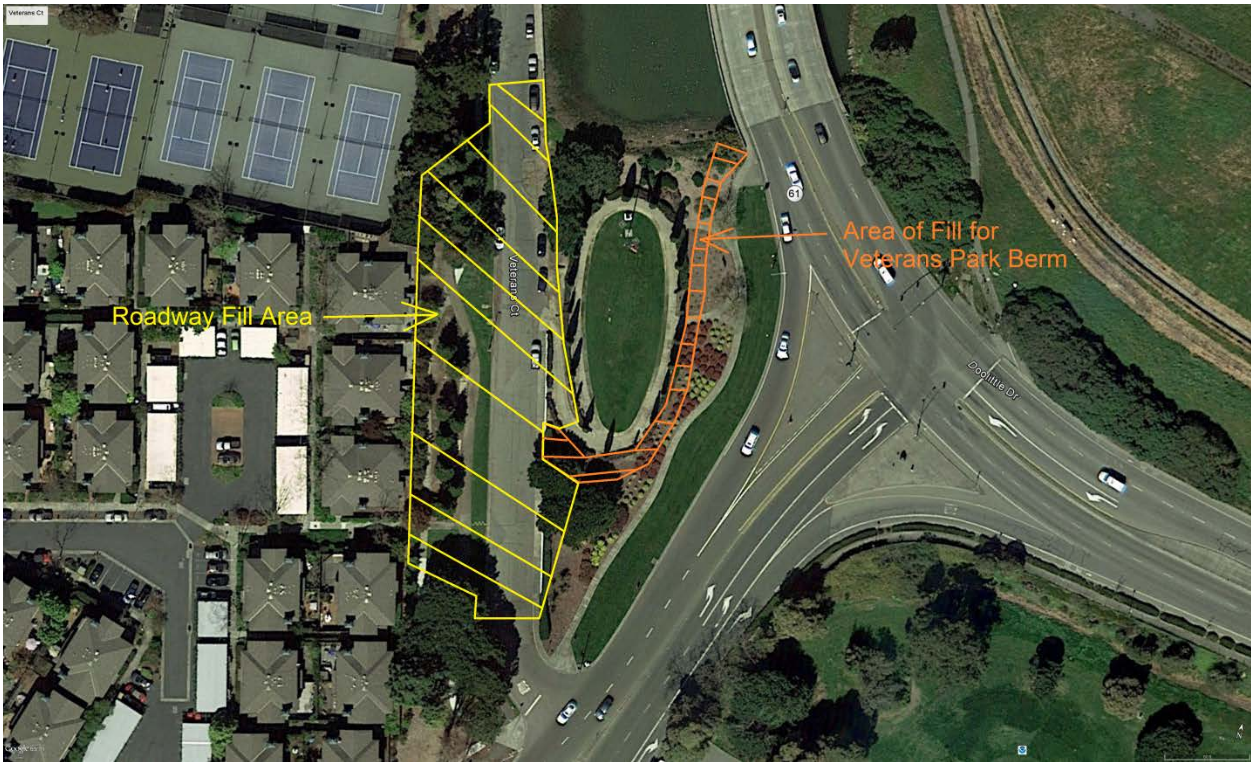

Figure 1B – Veterans Court: Raising Roadway

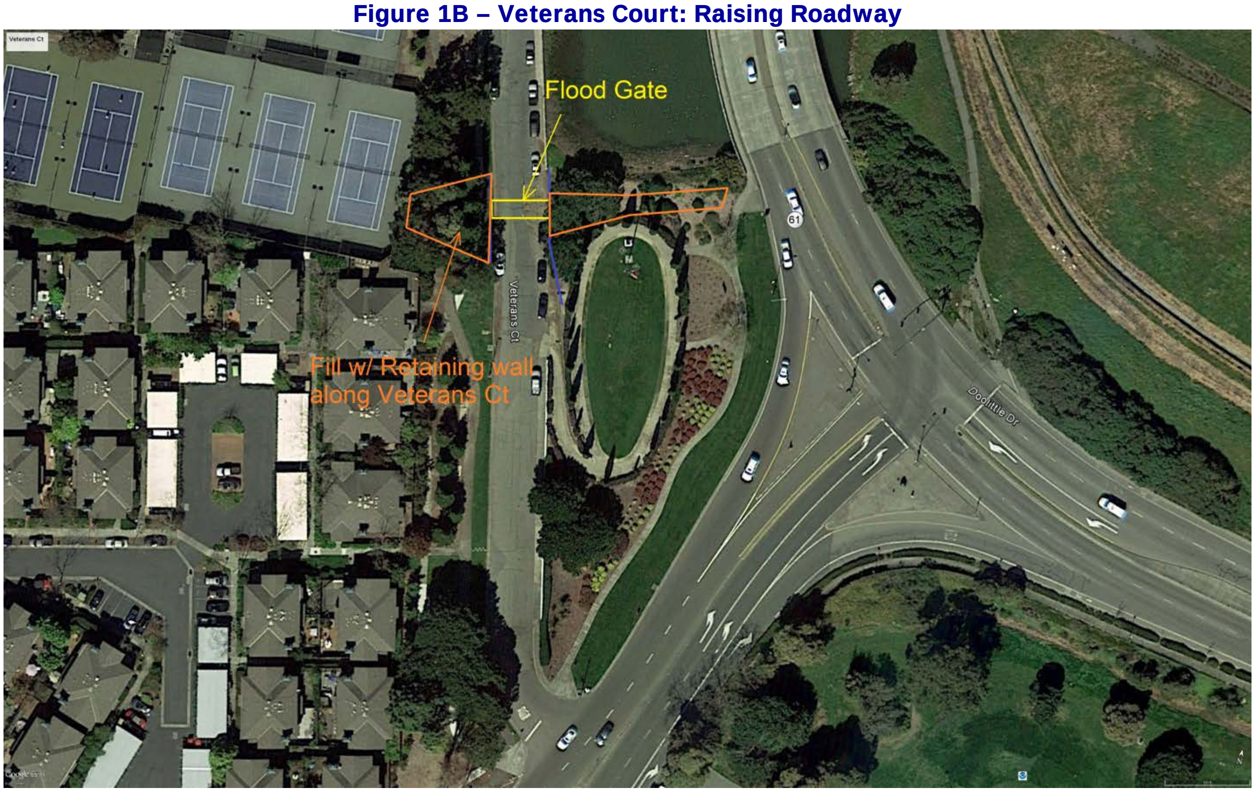

Figure 1C – Veterans Court: Flood Gate

Seawall at Bay Farm Island Gate Structure

The retaining wall at the Bay Farm Island Lagoon Gate Structure (Figure 2A) on the North Shore is lower than the surrounding levees and is vulnerable to flooding as shown on the 2015 Preliminary FEMA Flood Insurance Rate Maps (FIRMs). It is recommended to install a new retaining wall two feet higher than the existing retaining wall in order to be level with the gate structure platform and to remove the homes from the FEMA flood zone. To minimize permitting and costs the new retaining wall should be built behind the existing retaining wall. A taller retaining wall may be needed to account for future sea level raise; however a taller retaining wall currently does not make sense because the surrounding levees would be shorter than the retaining wall. The existing gate structure is shown in Figure 2B.

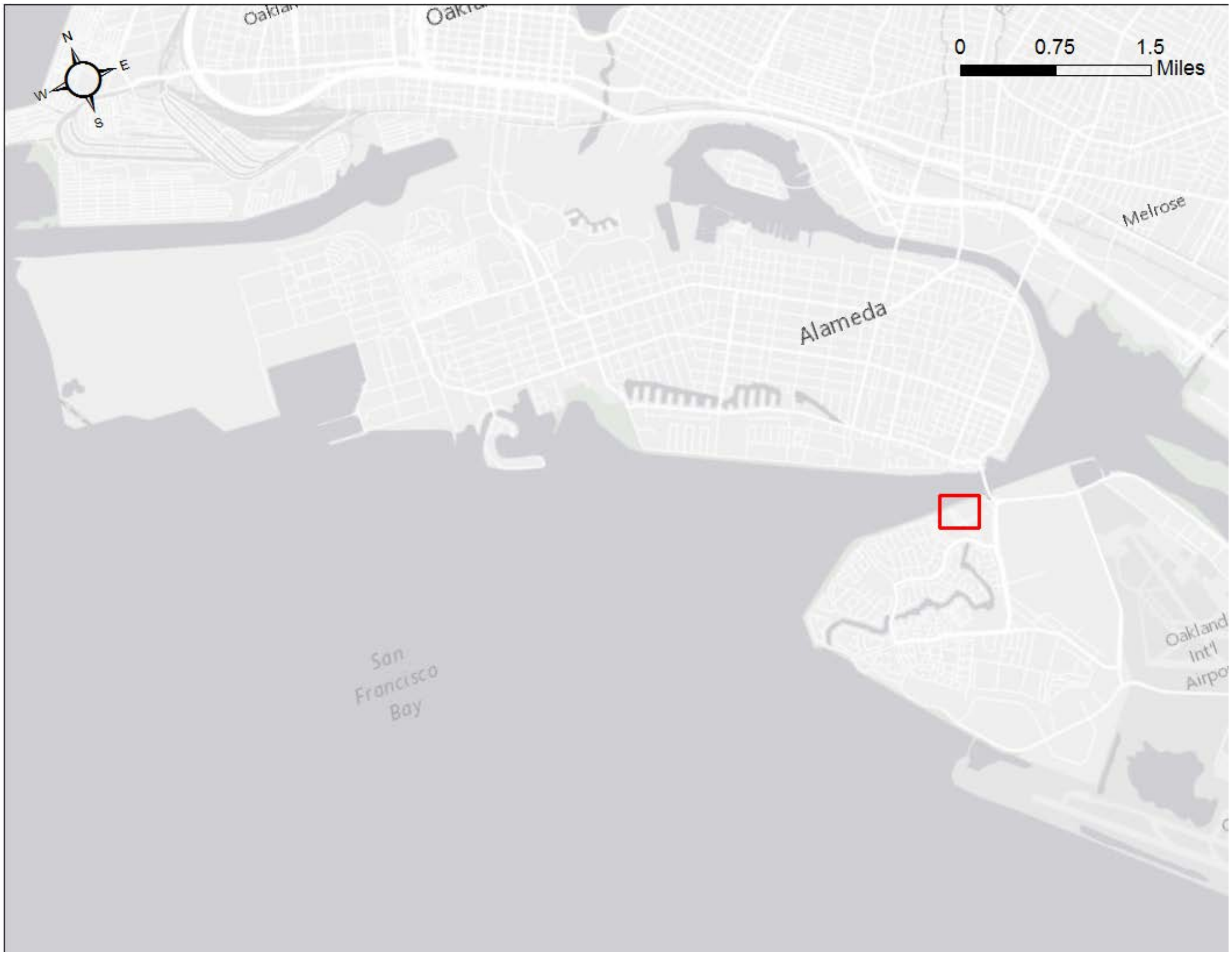

Figure 2A – Bay Farm Island Gate Location Map

Figure 2B – Bay Farm Island Gate Structure

Lagoon Intake Pipe

The existing 24 inch sliplined intake pipe at the intersection of Westline Drive and Shoreline Drive (Figure 3A) is potentially compromised. The intake pipe feeds the existing intake pump shown in Figure 3B. A new 24-inch intake pipe is proposed to replace the existing intake pipe. The new intake pipe should be HDPE and installed below the bottom of the sea floor with approximately 2 feet of cover using dredging or jet trenching construction methods.

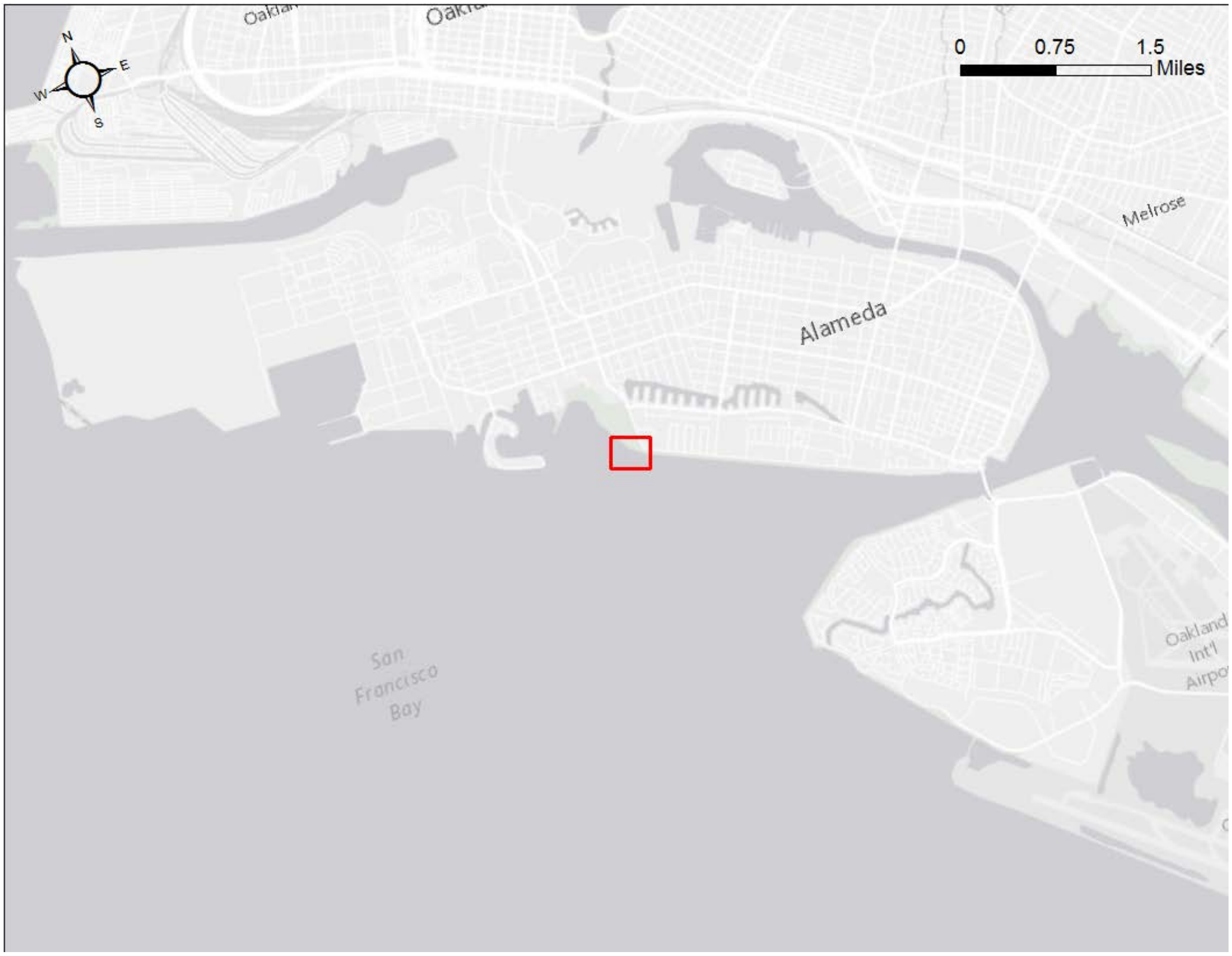

Figure 3A –Lagoon Intake Location Map

Figure 3B –Lagoon Intake Pump

Dredge Existing Sediment in Lagoon #3

The 2014 South Shore Lagoon Dredging Project called for approximately 2,385 cubic yards of sediment to be removed from Lagoon #3 (Figure 4). Lagoon #3 was ultimately excluded from the project due to high levels of contaminants at sampled locations. A portion of dredged material is expected to have contaminants and will need to be disposed of at a Class 2 landfill or a Class 1 landfill that accepts Class 2 contaminants in soil.

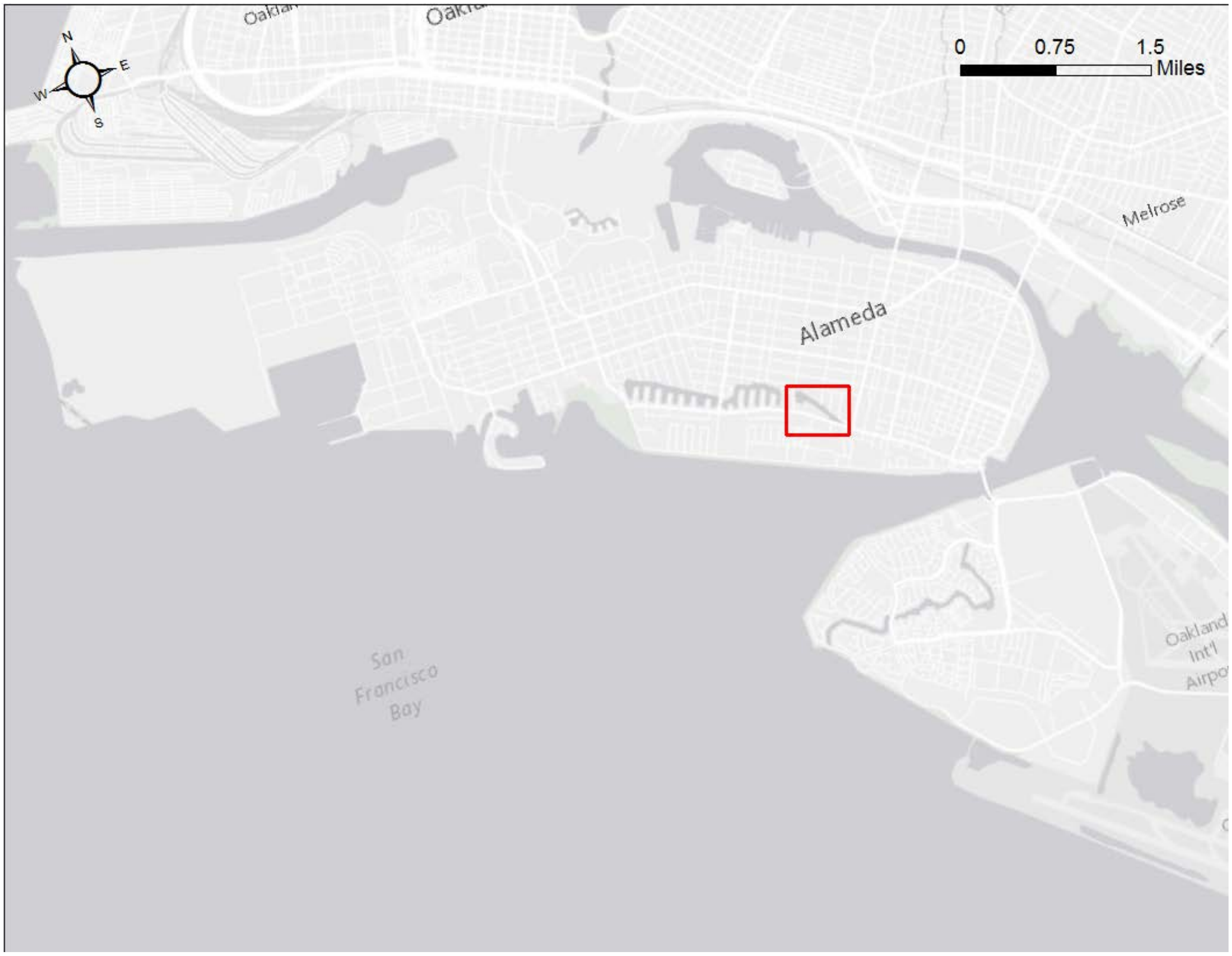

Figure 4 –Lagoon #3 Location Map

Interior Lagoon Outlet Works

The Lagoon outlet flap gate (Figure 5A) does not function properly and has built up sediment. Removal of the sediment and installation of a new flap gate will restore the functionality of the Lagoon outlet. Figure 5B shows the current condition of the gate structure.

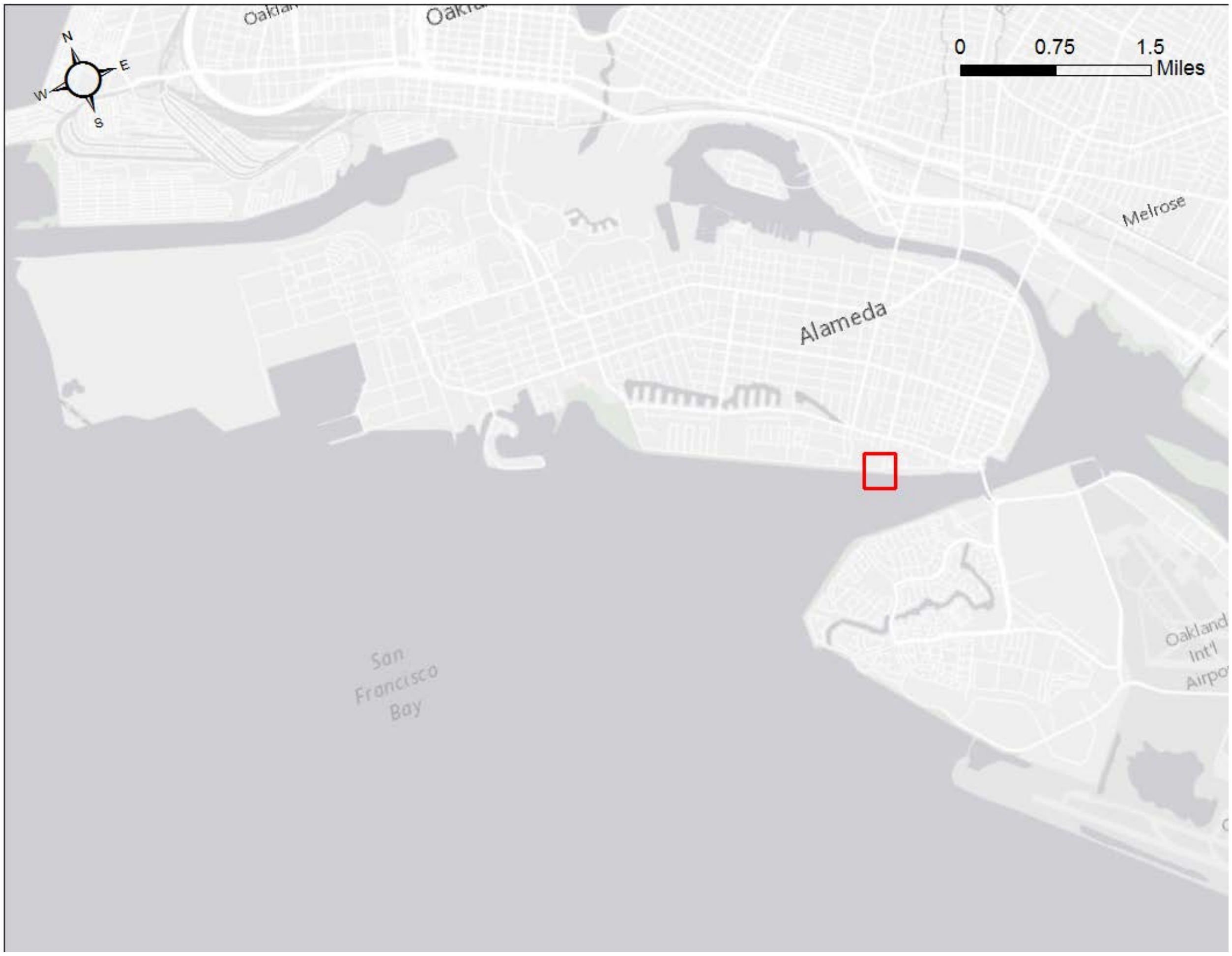

Figure 5A –Lagoon Outlet Location Map

Figure 5B –Lagoon Outlet Condition

Removing Shoreline Drive Outfalls

The storm drain outfalls along Shoreline Drive (Figure 6A) have become less effective in discharging storm runoff to the San Francisco Bay. In addition, some outfalls are damaged. The outfalls are subject to tidal effects, sedimentation and corrosion. This project would remove the existing outfalls and divert flows to the South Lagoon via an RCP pipeline (Figure 6B). This pipeline varies in diameter from 24-inches to 48-inches (Figure 6C) and should have a constant slope and adequate cover.

Figure 6A –Shoreline Drive Outfalls Location Map

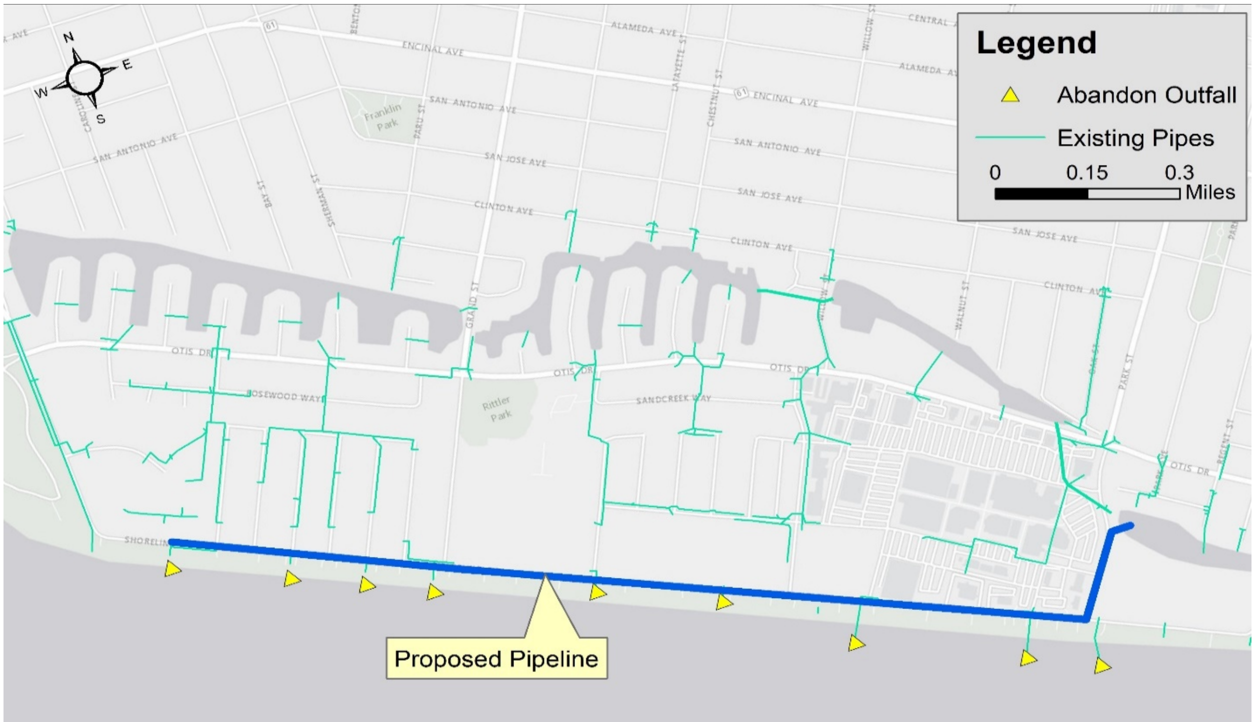

Figure 6B –Shoreline Drive Pipeline

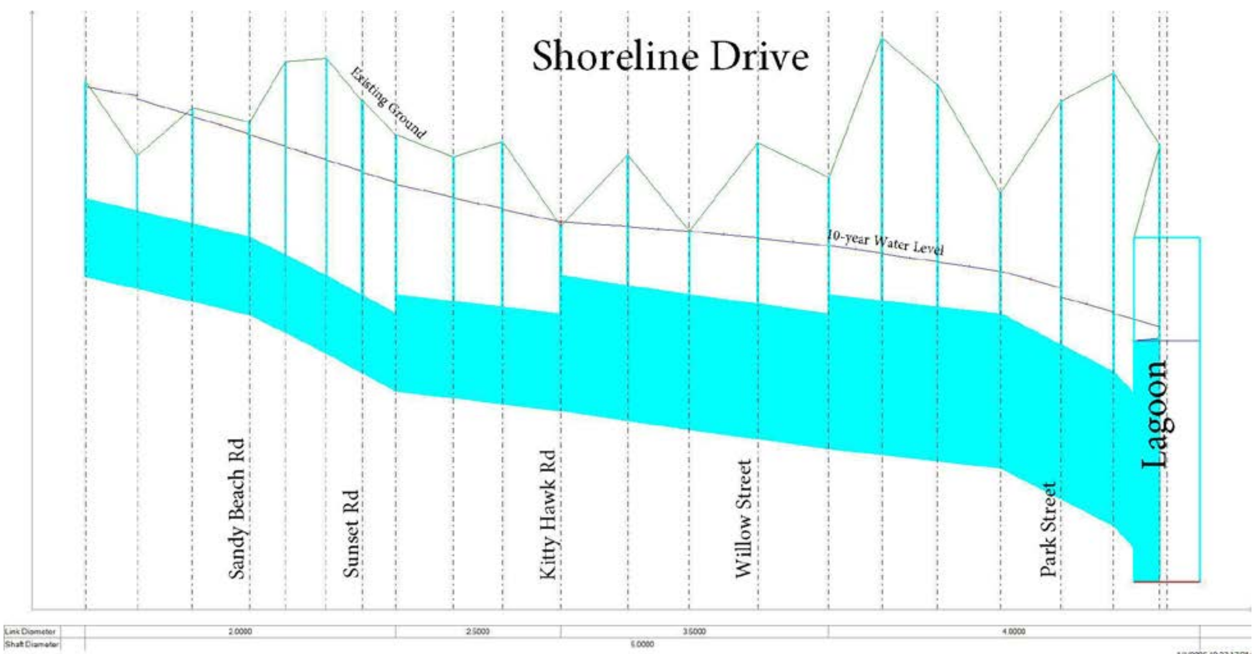

Figure 6C–Shoreline Drive 10-year Profile

CIP Costs

A cost summary for the near term capital improvements described above is shown in Table 3. A more detailed estimate of initial construction costs can be found in Appendix A.

Table 3 – High Priority CIP Priority and Cost

Improvement Name	Probable Construction Cost Subtotal	Total Cost w/ 50% Contingency
Veterans Court Option 1A - Raise Roadway	$1,100,000	$1,800,000
Veterans Court Option 1B - Floodgate	$1,100,000	$1,700,000
Seawall at Bay Farm Island Gate Structure	$ 200,000	$ 300,000
Lagoon Intake Pipe	$ 600,000	$ 900,000
Dredge Existing Sediment in Lagoon #3	$ 700,000	$1,100,000
Interior Lagoon Outlet Works	$ 40,000	$ 60,000
Remove Shoreline Drive Outfalls	$3,700,000	$5,600,000

Existing CIP Cost Updates

The Storm Drain Master Plan (SDMP) for the City of Alameda was originally completed by Schaaf & Wheeler in 2008 and was revised in 2011. The cost updates in this memorandum come from the 2011 version of the SDMP report and include the Pump Station improvements recommended in the Storm Drain Pump Station Assessment Report by Psomas in 2011.

The 2011 SDMP evaluates two design storm scenarios: the 10-year design discharge and the 25-year design discharge. Since it may not be possible to provide a design that meets the desired 25-year standard for the existing storm drain system, it is recommended that the existing CIPs be designed to follow the design criteria listed in Table 4. The design criteria for new CIPs must be evaluated on a case-by-case basis.

Table 4 – Storm Drain Master Plan Design Criteria for Existing Systems

Design Storm Discharge	Design Criteria
10-Year Design Discharge	Pipes shall be sized to carry the 10-yeardischarge without surcharging the pipe. When downstream surcharge effects are included, upstream hydraulic grades shall be no higher than the top of curb elevation at any manhole or inlet.
25-Year Design Discharge	Hydraulic grade shall not exceed the top of curb elevation at any location.

Additional design criteria in the SDMP are used to evaluate the distances between existing storm drain structures. Since City standards allow for distances less than those listed in the SDMP, additional evaluation may be needed to identify areas where existing pipe lengths exceed City standards. The following additional considerations for the existing storm drain are evaluated in the SDMP:

- Manholes shall be spaced no farther than 400 feet apart.
- Catch basins shall be spaced so the maximum width of gutter flow does not exceed eight (8) feet from the face of the curb during the 10-year event; or 400 feet, whichever is less.

The SDMP uses eight (8) drainage sub areas to organize the pipe CIPs. Figure 7 shows the location of each sub drainage area.

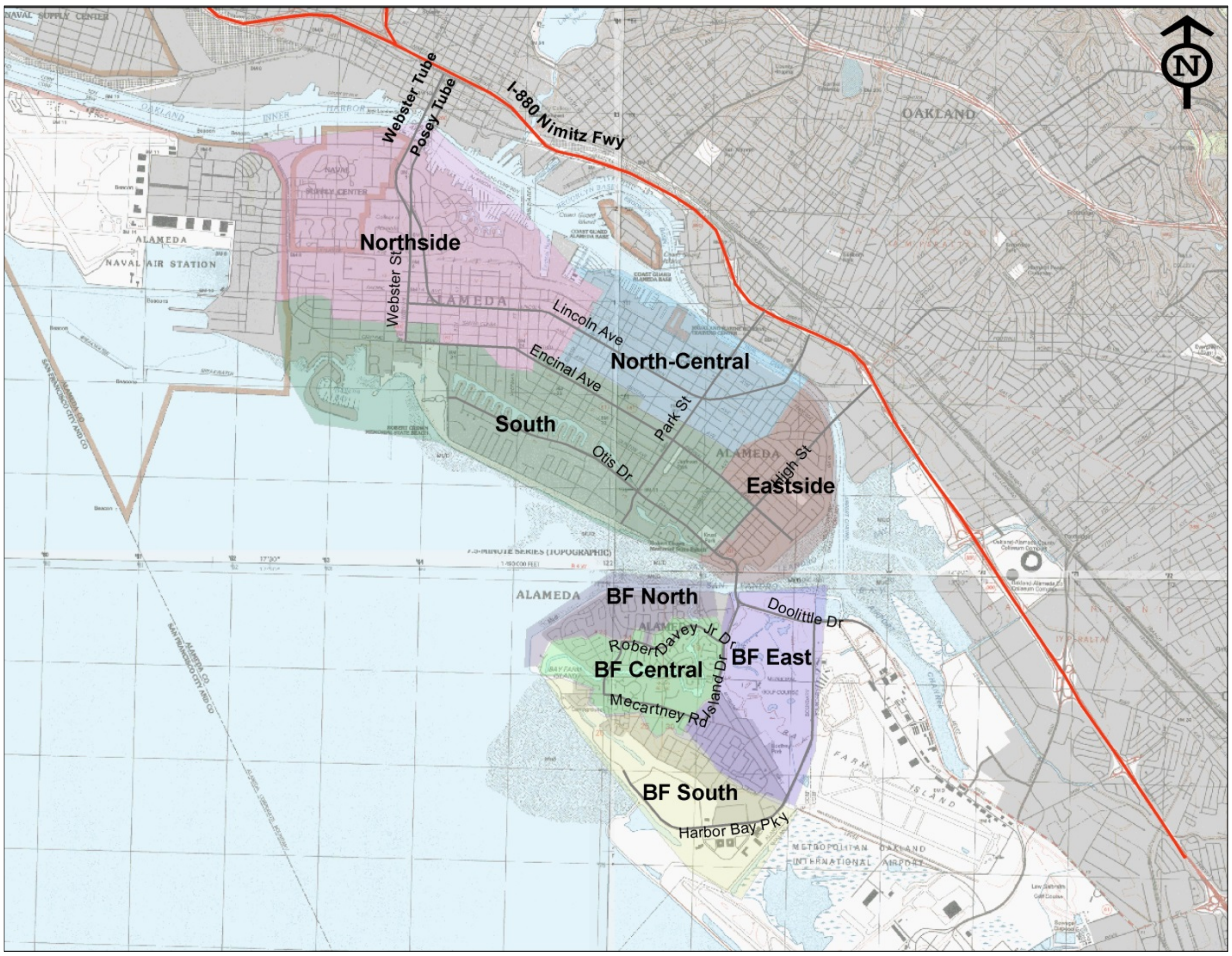

Figure 7 – City of Alameda Storm Drain Master Plan Drainage Sub Areas

Pipe Costs

The existing CIPs for pipe costs are evaluated at the 10-year design level. A figure showing the approximate location of each CIP can be found in Appendix B. The CIPs are organized by sub drainage area and are listed in Tables 5-12. Pipe extensions are considered to be separate projects from existing conditions CIPs and can be found in Table 13.

Table 5 – Alameda Island, Eastside Area, 10-Year Storm Protection CIP, 2017 Costs

Improvement Name	Priority Level	Pipe Length	Connections	Outfalls	Subtotal	Total Cost w/ 50% Contingency
Gibbons (new pipe)	Moderate	3968	11	1	$2,000,000	$3,000,000
Thompson	Low	1344	11	1	$700,000	$1,100,000
High	Moderate	3691	26	1	$2,100,000	$3,200,000
Fernside	Low	2411	14	0	$1,200,000	$1,800,000
Washington	Low	1161	8	0	$ 500,000	$ 800,000
Calhoun	Low	289	4	1	$ 200,000	$ 300,000

Table 6 – Alameda Island, North Central Area, 10-Year Storm Protection CIP, 2017 Costs

Improvement Name	Priority Level	Pipe Length	Connections	Outfalls	Subtotal	Total Cost w/ 50% Contingency
Grand	Med	4106	29	1	$2,200,000	$3,300,000
Willow	Med	3513	19	1	$1,900,000	$2,900,000
Walnut	Low	2763	20	1	$1,500,000	$2,300,000
Oak	Low	2573	13	1	$1,300,000	$2,000,000
Park	Low	637	7	1	$ 400,000	$ 600,000
Everett	Low	1086	8	1	$ 600,000	$ 900,000
Broadway	Low	449	7	1	$ 400,000	$ 600,000
Pearl	Low	790	7	1	$ 500,000	$ 800,000
Tilden	Low	395	5	1	$ 300,000	$ 500,000
Cambridge	Low	986	8	1	$ 600,000	$ 900,000

Table 7 – Alameda Island, Northside Area, 10-Year Storm Protection CIP, 2017 Costs

Improvement Name	Priority Level	Pipe Length	Connections	Outfalls	Subtotal	Total Cost w/ 50% Contingency
Constitution	Moderate	3300	12	1	$2,900,000	$4,400,000
West Atlantic	Low	3400	26	1	$2,600,000	$3,900,000
East Atlantic (1)	Low	700	3	0	$500,000	$800,000
East Atlantic (2)	Low	300	4	1	$400,000	$600,000
New Outfall	Moderate	3700	11	1	$3,100,000	$4,700,000
Main St	Low	500	4	0	$ 300,000	$ 500,000
Webster (2)	Low	100	2	0	$ 90,000	$ 140,000
3rd Street	Low	700	8	0	$ 500,000	$ 800,000
Webster (3)	Low	1500	7	0	$ 700,000	$1,100,000
Chapin	Low	300	4	0	$ 300,000	$ 300,000
Paru	Low	1600	16	0	$1,100,000	$1,700,000
Bay Sherman	Low	2200	21	0	$1,200,000	$1,800,000
Main St (2)	Low	1200	5	0	$ 500,000	$ 800,000
5th Street	Low	1700	13	0	$ 900,000	$1,400,000
Pacific St	Low	1400	7	0	$ 700,000	$1,100,000

Table 8 – Alameda Island, South Area, 10-Year Storm Protection CIP, 2017 Costs

Improvement Name	Priority Level	Pipe Length	Connections	Outfalls	Subtotal	Total Cost w/ 50% Contingency
Fountain	Low	1659	20	1	$1,000,000	$1,500,000
Mound	Low	524	3	1	$ 300,000	$ 500,000
Franciscan	Low	2063	15	0	$ 1,000,000	$1,500,000
Harbor Light	Moderate	3456	18	1	$1,500,000	$2,300,000
Rosewood	Moderate	1295	18	1	$ 700,000	$1,100,000
Pearl	Low	990	7	0	$ 600,000	$ 900,000
Alameda Park	Moderate	2277	7	0	$1,100,000	$1,700,000
3rd	Low	501	7	1	$ 300,000	$ 500,000
Willow	Low	1670	0	1	$ 30,000	$ 50,000
S Shore Center W	Low	1593	6	0	$ 700,000	$1,100,000
Regent	Low	275	6	1	$ 300,000	$ 500,000
Park	Low	320	5	0	$ 300,000	$ 500,000
Page	Low	1983	14	1	$1,000,000	$1,500,000
Webster	Low	1154	8	1	$ 600,000	$ 900,000
Ballena	Low	795	8	1	$ 500,000	$ 800,000
Paru	Low	74	3	0	$ 60,000	$ 90,000
Shoreline	Low	700	7	2	$ 400,000	$ 600,000

Table 9 – Bay Farm Island, Central Area, 10-Year Storm Protection CIP, 2017 Costs

Improvement Name	Priority Level	Pipe Length	Connections	Outfalls	Subtotal	Total Cost w/ 50% Contingency
Dublin Way	Low	1107	9	1	$ 600,000	$ 900,000
Island Drive	Low	69	2	0	$ 50,000	$ 80,000
Verdemar Drive	Low	1460	13	1	$ 700,000	$1,100,000
Robert Davey Jr Dr	Low	1308	3	0	$ 100,000	$ 200,000
Mecartney Road	Low	1855	9	0	$ 800,000	$1,200,000

Table 10 – Bay Farm Island, North Area, 10-Year Storm Protection CIP, 2017 Costs

Improvement Name	Priority Level	Pipe Length	Connections	Outfalls	Subtotal	Total Cost w/ 50% Contingency
Avington	Low	1052	7	1	$ 600,000	$ 900,000

Table 11 – Bay Farm Island, East Area, 10-Year Storm Protection CIP, 2017 Costs

Improvement Name	Priority Level	Pipe Length	Connections	Outfalls	Subtotal	Total Cost w/ 50% Contingency
Camelia	Low	2547	18	0	$1,300,000	$1,200,000
Fitchburg	Low	632	5	0	$ 400,000	$ 600,000

Table 12 – Bay Farm Island, South Area, 10-Year Storm Protection CIP, 2017 Costs

Improvement Name	Priority Level	Pipe Length	Connections	Outfalls	Subtotal	Total Cost w/ 50% Contingency
Holly	Low	1823	7	0	$ 700,000	$ 1,100,000

Table 13 – Pipe Extensions, 10-Year Storm Protection CIP, 2017 Costs

Improvement Area	Pipe Length	Connections	Inlets	Subtotal	Total Cost w/ 50% Contingency
Northside	2567	12	12	$ 900,000	$1,400,000
North Central	2772	11	14	$1,000,000	$1,500,000
South	3418	17	22	$1,200,000	$1,800,000
Eastside	224	2	2	$100,000	$200,000

Pump Station Costs

Pump Station Costs come from the SDMP and the Pump Station Assessment Report. Pump Station locations are shown in Figure 8. Costs were combined and updated to reflect 2017 dollars and are shown in Table 14.

Figure 8 – City of Alameda Pump Station Location Map

Table 14 – Pump Station Improvements Costs by Pump Station

Pump Station	Priority Level	Subtotal	Total Cost w/ 50% Contingency
Arbor Pump Station	High	$ 2,500,000	$ 3,800,000
Bayport Pump Station	Moderate	$ 700,000	$ 1,100,000
Central/ Eastshore Pump Station	Moderate	$ 1,800,000	$ 2,700,000
Golf Course Pump Station	High	$ 700,000	$ 1,100,000
Harbor Bay System I Pump Station	Low	$ 600,000	$ 900,000
Harbor Bay System II Pump Station	Moderate	$ 700,000	$ 1,100,000
Main Street Pump Station	High	$ 200,000	$ 300,000
Northside Pump Station	High	$ 1,500,000	$ 2,300,000
Third Street Pump Station	High	$ 400,000	$ 600,000
Webster Pump Station	High	$ 700,000	$ 1,100,000
		Total	**$15,000,000**

Sea Level Rise CIP Costs

The City of Alameda is susceptible to Sea Level Rise (SLR) due to its location in San Francisco Bay and its relatively low ground elevation. Two studies were completed by Schaaf & Wheeler to analyze the impacts of Seal Level Rise: Climate Change Impacts to Storm Drain Improvements: an addendum to the Storm Drain Master Plan (CCI) for 18-inches of SLR, completed in 2009 and a memorandum for the 55-inch Sea Level Rise completed in 2015.

Sea Level Rise Impacts

The impact from SLR on the City of Alameda comes from both overland inundation from the tide and a decrease in storm drain capacity resulting from increased water surface elevations at the outfalls. Both reports examine the effects of SLR on the existing storm drain system and provide recommended improvements; however, only the 55-inch SLR report provides recommendations for inundation for the 100-year-tide plus SLR. The potential CIPs and costs identified as a part of these studies have been updated for September 2017 dollars.

Updated Sea Level Rise Data

In April 2017, the Ocean Protection Science Advisory Team published updated SLR projections for the State of California. *The Rising Seas in California: an Update on Sea-Level Rise Science Report* provides updated SLR projections for San Francisco Bay for the years 2050, 2100, and 2150. Several different emission scenarios, known as representative concentration pathways (RCP) were analyzed in the report; however, RCP 8.5 is the accepted emission scenario for 2050. Since RCP 8.5 SLR represents the expected SLR if there are “no significant global efforts to limit or reduce emissions,” it is summarized for both 2050 and 2100 SLR in Table 15 below (Griggs, et al., 2017). Both of the existing SLR reports use elevations that fall between the 5% and 0.5% probability scenarios.

Table 15 – RCP 8.5 Sea Level Rise for San Francisco Bay

Feet above 1991-2009 mean	Median	Likely Range	1-in-20 Chance	1-in-200 Chance
Year	*50% probability SLR meets or exceeds…*	*67% probability SLR is between…*	*5% probability SLR meets or exceeds…*	*0.5% probability SLR meets or exceeds…*
2050	0.9	0.6 – 1.1	1.4	1.9
2100	2.5	1.6 – 3.4	4.4	6.9

Source: The Rising Seas in California: an Update on Sea-Level Rise Science Report (Griggs, et al., 2017).

18-Inch Sea Level Rise

The CCI Addendum addresses the impacts from capacity changes in the storm drain system for 18 inches of SLR. The report specifically assesses the 10-year storm with three different outfall water surface elevations:

- The 10-year tide plus 18 inches of SLR
- The 25-year tide plus 18 inches of SLR
- The 100-year tide plus 18 inches of SLR.

The cost summaries from the CCI Report analyze the increase to the CIP necessary to maintain a 10-year level of service. The Addendum uses the 2008 SDMP models updated for 18-inches of SLR. A summary of the overall increase to existing improvement costs are shown in Table 16.

Table 16 –10-Year Storm Protection CIP Plus 18 Inches of Sea Level Rise, 2017 Costs

Location	Additional Subtotal Cost	Total Additional Cost w/ 50% Contingency
Alameda Island	$ 1,900,000	$ 2,900,000
Bay Farm Island	$ 1,100,000	$ 1,700,000
Total	**$ 3,000,000**	**$ 4,600,000**

55-Inch Sea Level Rise

The 55-inch SLR study addresses the impacts from inundation on low-lying areas and capacity changes in the storm drain system for 55 inches of SLR.

Inundation from Rising Tides

Since the City has a ground surface that is very low, 55 inches of SLR has a significant effect on inundation from the tide. The 55-Inch SLR study assesses the inundation on the City of Alameda for three water surface elevation scenarios:

- The 10-year tide plus 55 inches of SLR
- The 25-year tide plus 55 inches of SLR
- The 100-year tide plus 55 inches of SLR.

Overland flooding from the tide plus 55 inches of SLR can be mitigated by constructing improvements around the low areas of the Main Island and Bay Farm Island. Figures 9 and 10 show a combination of raised bike paths, raised roadways, and seawalls that would provide flood protection for the 100-year tide plus the 55 inches of SLR. The projects analyzed as a part of the 55 inch SLR study are larger in both scale and cost. Smaller scale projects due to the inundation from SLR, such as a project that would benefit the area east of Fernside from rising tides, have not been studied and require more detailed analysis.

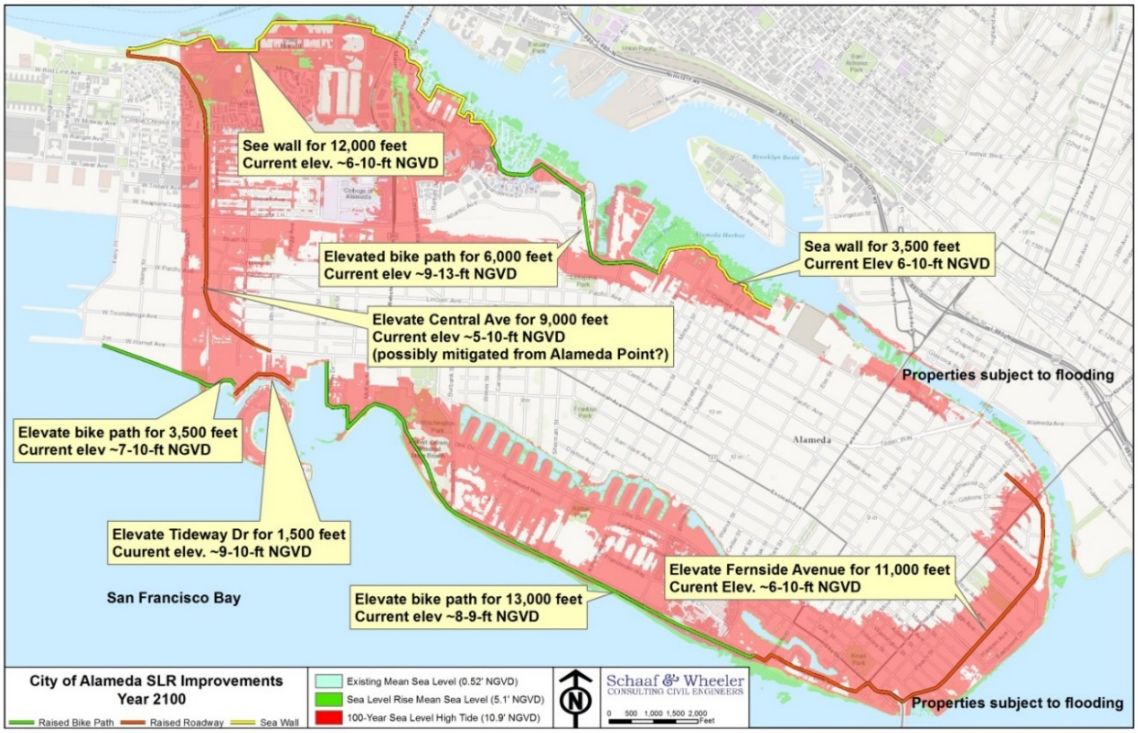

Figure 9 – Main Island Overland Improvements, 100-Year-Tide with 55 Inches of Sea Level Rise

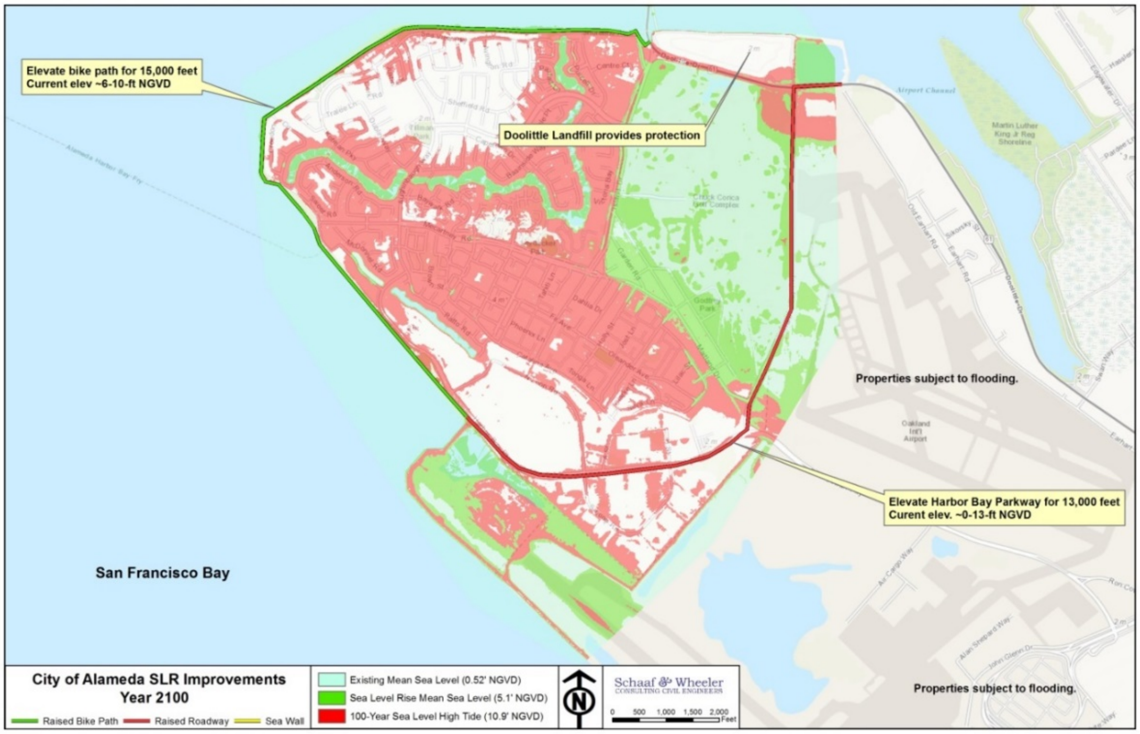

Figure 10 – Bay Farm Island Overland Improvements, 100-Year-Tide with 55 Inches of Sea Level Rise

Levee and Seawall improvement costs are dependent on the type of improvement, the existing soil conditions and the height that the improvements would need to be raised to provide 100-year flood protection with the addition of the 55 inches of SLR. Costs for the improvements for the Main Island and Bay Farm Island are shown in Table 17 below.

Table 17 –100-Year-Tide Overland Improvements Plus 55 Inches of SLR, 2017 Costs

Project ID	Type	Height (feet)	Length (feet)	Total Additional Cost w/ 50% Contingency
Shoreline	Levee	5.3	13,500	$ 63,100,000
Fernside	Levee	4.2	13,000	$ 63,100,000
Main Street	Levee	5.5	8,700	$ 55,200,000
Hornet	Levee	5.9	3,300	$ 9,000,000
Tideway	Levee	6.0	1,000	$ 6,900,000
BFI West	Levee	6.1	15,000	$ 42,600,000
BFI East	Levee	7.9	12,500	$116,200,000
Northside Seawall	Floodwall	9.8	14,300	$ 28,900,000
Clement Seawall	Floodwall	8.5	14,100	$ 18,600,000
Misc. Small Scale Projects	Misc.	n/a	n/a	$ 40,400,000
Total			**95,400**	**$ 444,000,000**

Note: Smaller scale projects assumed to be 10% of the total overland improvement costs. Small scale projects are not shown in Figures 9 and 10.

Storm Drain Capacity Changes Due to Rising Tides

The 55 inch SLR study builds on the 18-inch SLR report by modeling an increase in tidal elevation for three different scenarios:

- The 10-year storm drain model with outfall elevations set to a 10-year tide elevation plus 55 inches of SLR.
- The 25-year storm drain model with outfall elevations set to a 25-year tide elevation plus 55 inches of SLR.
- The 25-year storm drain model with outfall elevations set to a 100-year tide elevation plus 55 inches of SLR.

The cost summaries from the 55-inch SLR Study analyze the increase to the CIP necessary to maintain a 10-year level of service and to maintain a 25-year level of service. Summaries of the overall increase to existing CIP costs are shown in Tables 18 and 19.

Table 18 –10-Year Storm Protection CIP Plus 55 Inches of Sea Level Rise, 2017 Costs

Location	Additional Subtotal Cost	Total Additional Cost w/ 50% Contingency
Alameda Island	$ 58,300,000	$ 87,500,000
Bay Farm Island	$ 23,300,000	$ 35,000,000
Total	**$ 81,600,000**	**$ 122,500,000**

Table 19 –25-Year Storm Protection CIP Plus 55 Inches of Sea Level Rise, 2017 Costs

Location	Additional Subtotal Cost	Total Additional Cost w/ 50% Contingency
Alameda Island	$ 74,600,000	$ 111,900,000
Bay Farm Island	$ 69,500,000	$ 104,200,000
Total	**$ 144,100,000**	**$ 216,100,000**

Conclusion

Project priorities and costs for existing and new CIPs are evaluated within this memorandum. Project priorities are updated based on City staff input and the priority from previous reports. Initial costs for the new near-term CIPs identified have been identified and costs for the existing SDMP CIPs, the report for 18 inches of Sea Level Rise, and the report for 55 inches of Sea Level Rise are all updated to September 2017 dollars. Figure 11 shows the breakdown of total pipe CIP costs with and without the addition of sea-level-rise improvements. A detailed breakdown of the costs is shown in Table 20.

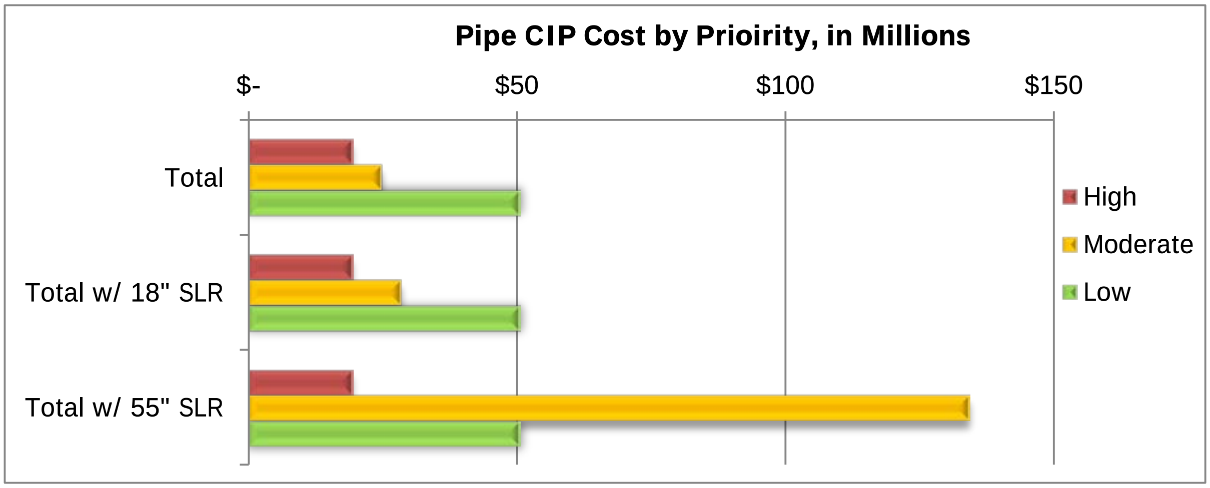

Figure 11 –Total Pipe CIP Costs by Priority, in Millions of Dollars

Table 20 – Total Costs, 2017 Costs

Category	Priority			Total
	High	Moderate	Low	
High Priority CIPs	$ 9,700,000	$ -	$ -	**$ 9,700,000**
SDMP Pipe CIPs	$ -	$ 27,100,000	$ 49,500,000	**$ 76,600,000**
SDMP Pump CIPs	$ 8,700,000	$ 4,800,000	$ 1,000,000	**$ 14,500,000**
18” SLR Pipe CIPs	$ -	$ 3,600,000	$ -	**$ 3,600,000**
55” SLR Pipe CIPs	$ -	$ 105,800,000	$ -	**$ 105,800,000**
55” SLR Inundation CIPs	$ -	$ 444,000,000	$ -	**$ 444,000,000**
10-yr Storm Total w/o SLR	$ 18,400,000	$ 31,900,000	$ 50,500,000	**$ 100,800,000**
Total w/ 18” SLR Pipe CIPs	$ 18,400,000	$ 35,500,000	$ 50,500,000	**$ 104,400,000**
Total w/ 55” SLR Pipe CIPs	$ 18,400,000	$ 141,300,000	$ 50,500,000	**$ 210,200,000**
Total w/ 55” SLR Pipe CIPs + Inundation	$ 18,400,000	$ 584,900,000	$ 50,500,000	**$ 604,100,000**

Note: 18” SLR costs do not include costs for floodwall or levee improvements

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