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Office Of The  
Director of Public Works

May 25, 2016

San Francisco Bay Regional Water Quality Control Board  
Attn: Bruce Wolfe, Executive Officer  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

**Re: Oyster Point Landfill, City of South San Francisco, Requirement for Submittal of  
Technical Reports Pursuant to Water Code Section 13267**

Dear Mr. Wolfe,

Pursuant to the above-referenced 13267 Order issued on December 10, 2015, the City of South San Francisco ("City") submits the enclosed Long-Term Flood Protection Plan for your review ("Long-Term Plan").

I certify under penalty of law that the enclosed document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. In addition to submitting this Long-Term Plan via mail, I have also submitted this Long-Term Plan and all related documents in electronic format to the State Water Resources Control Board's GeoTracker database.

If you have any questions regarding the Long-Term Plan or any of the related documents, please contact me at [Brian.McMinn@ssf.net](mailto:Brian.McMinn@ssf.net) or (650) 877-8550.

Sincerely,

Brian McMinn, P.E., P.L.S.  
Director of Public Works/City Engineer  
City of South San Francisco

Enc.

cc: Vic Pal, SF Bay Regional Water Quality Control Board (vpal@waterboards.ca.gov)  
Mike Futrell, City Manager  
Jason Rosenberg, City Attorney  
Steve McGrath, SMC Harbor District (smcgrat@smharbor.com)  
Greg Acosta, Tetra Tech (greg.acosta@tetratech.com)  
Greg Saul, Tetra Tech (greg.saul@tetratech.com)



Mr. Brian McMinn, P.E., P.L.S.  
Director of Public Works/City Engineer  
City of South San Francisco  
South San Francisco  
550 N. Canal St.  
South San Francisco, California 94080

May 27, 2016  
197-2016-0028

**RE: LONG-TERM FLOOD PROTECTION PLAN FOR THE OYSTER POINT LANDFILL**

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The Long-Term Flood Protection Plan (LTFPP) as presented herein reviews existing data regarding sea-level rise caused by climate change and presents feasible flood protection measures for the Oyster Point Landfill (OPL) in order to mitigate these impacts. This report has been prepared by Tetra Tech BAS (TTBAS) for the OPL to fulfill the requirement of the Regional Water Quality Control Board (RWQCB), as stated below:

“A Long-Term Flood Protection Plan and Implementation Schedule that documents and considers feasible options for achieving protection of the landfill from the 100-year flood in the face of rising sea and tide levels and increased flood frequency and intensity. The plan shall consider the methods developed by the San Francisco Bay Conservation and Development Commission to predict and protect the landfill against future flooding.”

This report considers possible site impacts of increased sea levels assuming current site topography in King Tide conditions. During King Tide events, the bay waters rise about 8 feet above current mean sea level.

**1: SITE INFORMATION**

**A: CURRENT SITE CONDITIONS**

The OPL is a closed waste disposal facility located along the shoreline of the San Francisco Bay (Bay) and is currently used as a recreational area and the location for the Oyster Point Marina (see Figure 6 attached). The Marina is located along the northwestern portion of the site and includes berthing slips, a boat launching ramp, a harbor master office and a boat storage and repair area. The site is access by a roadway that follows the perimeter of the site and includes several parking areas. The remainder of the site is landscaped open space.

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Tetra Tech BAS

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**B: SITE HISTORY**

The OPL is a closed landfill operated between 1959 and 1970 that was used primarily for the disposal of municipal solid waste. Consistent with landfills of the time, the landfill is not lined. Prior to being used as a solid waste landfill, the site was tidal marshland and upland area. The waste prism of the site has resulted in the landform extending 3000 feet into the bay.

After the site ceased operation in 1970, the site underwent various closure activities described as follows (these descriptions are based on the site Waste Discharge Requirements):

- Between 1971 and 1976, a two-foot layer of low permeable soil was placed over the surface of the landfill.
- Between 1979 and 1981, an additional two to three foot landfill cover was installed over the site, and additional bay mud and riprap were placed along the marina side of the site. Bentonite/cement filled trenches were installed along the shoreline of the west beach area and between the landfill and the site's drainage channel. Additional bay mud was placed at the southern boundary of the site to contain leachate seeps that were observed in the area.
- In 1987, a leachate cutoff trench was constructed along the northern landfill boundary between the mole and beach area. Additionally, a gas barrier trench that consisted of a chlorinated polyethylene lined trench filled with compacted soils was constructed along the western landfill boundary.

**C: SITE SETTLEMENT**

As is common with Municipal Solid Waste Landfills, the OPL will likely continue to experience settlement over the site that would increase the impacts of site inundation caused by sea level rise. There are two subsurface layers that are subject to settlement: 1) the refuse prism of the landfill and 2) the old bay muds that are located below the landfill's bottom surface.

Three principal settlement mechanisms exist for a typical municipal waste landfill: consolidation induced settlement resulting from the loss of fluids from the refuse cell; shrinkage related settlement occurring as a result of biochemical decomposition such as fermentation and decay; and compaction related settlement resulting from the reorientation of solids into a denser configuration. In addition to these "classic" settlement mechanisms, dynamic settlement can occur during and shortly after earthquake events, when soil and/or refuse particles may densify due to shaking.

There was a geotechnical investigation of the site performed in 1976 by Woodward-Clyde Consultants that estimated the landfill could experience as much as 6 to 7 feet of settlement (4 to 5 feet of which was caused by the consolidation of the Young Bay Muds) during the site development that occurred in the late seventies. Subsequently, there was a Kleinfelder Geotechnical Report prepared for the site in 2007 that estimated the refuse prism could experience 3 to 4 feet of settlement in the deepest portions of the landfill, and a geotechnical report for the site prepared by

Treadwell and Rollo in 2008 that indicated the Young Bay muds could settle 2 feet in the next fifty years. Based on our review of the existing literature, it appears reasonable to assume that consolidation of the refuse prism and the Young Bay Muds will continue in the future. Tetra Tech BAS recommends that site settlement be monitored at the same frequency that the sea level data is measured, in order that the two mechanisms influencing site inundation can be understood.

## **2: ESTIMATED SEA LEVEL RISE**

The effect of climate change on sea level rise has been well documented; however, there is variation on the projections of future sea-level rise. Therefore, TTBAS considered information from several sources when estimating sea-level rise in the vicinity of the site. These sources include the Intergovernmental Panel on Climate Change (IPCC), San Francisco Bay Conservation and Development Commission (BCDC), and California Department of Water Resources (DWR). While all of these sources were considered, the analysis presented herein is based on the sea level rise data included in the study conducted by San Mateo County. The projections for sea-level rise, with their respective source, are as follows:

- The IPCC predicts a global sea level rise of 20.5 inches to 38.6 inches by the year 2100 (IPCC 2013).
- According to BCDC, the sea-level rise in the San Francisco Bay Area may be as much as 16 inches by 2050 and 55 inches by 2100 (BCDC 2011, Page 44).
- “Tidal observations in San Francisco Bay between 1900 and 2000 show that mean sea level has increased by 7 inches...” (DWR 2013, Page SFB-58).
- “Mean sea levels are projected to rise 5 to 24 inches (12-61 centimeters [cm]) by 2050 and 17 to 66 inches (42-167 cm) by 2100 (National Research Council 2012)” (DWR 2013, Page SFB-106).

The City of South San Francisco is cooperating with San Mateo County and other local agencies to study and prepare for the effects of sea level rise. As part of this effort, the SeaChange San Mateo County project (SMC) was commissioned in 2014, which was a study to determine the community assets and resources that may be impacted by sea level rise. The SMC used the National Resource Projection estimates for sea level rise and combined them with the impacts of a 100-year storm surge. These impacts are as follows:

Year	SLR Range	SLR Most Likely Projection	100 year Extreme Tide	Total Inundation of SLR + 100 YR*
2030	2 to 12 inches	6 inches	40 to 42 inches	<b>48 inches</b>
2050	5 to 24 inches	11 inches**	40 to 42 inches	<b>52 inches**</b>
2100	17 to 66 inches	36 inches	40 to 42 inches	<b>77 inches</b>

\* Projections are from San Mateo Bay Shore ART Sea Level Rise and Overtopping Assessment, March 2016, Page 2-6

\*\* SMC simplified the 2050 Most Likely Sea Level Rise to from 11 inches to 12 inches as noted on page 2-2, San Mateo Bay Shore ART Sea Level Rise and Overtopping Assessment, March 2016.

**A: SITE IMPACTS FROM SEA LEVEL RISE BY 2030**

By the year 2030, the most likely projection for sea level rise in the San Francisco Bay is estimated to rise 6 inches per the SMC. During a 100-year extreme tide event in 2030, the water is projected to rise to a level of 48 inches above current mean bay levels accounting for the projected 6 inches of sea level rise. The SMC prepared regional maps that projected various SLR scenarios and the map that corresponds to the 100-year extreme tide in 2030 conditions is Scenario 4. The portion of the Scenario 4 regional map that depicts the 48” sea level rise at the OPL is shown in Figure 1 below:



Figure 1 - Oyster Point Landfill with 48" sea level rise (image from the SMC Vulnerability Assessment ARCGIS Website)

As can be seen from the image, the limits of inundation are significant and impact the boat ramp and parking areas, the boat storage area and building, as well as the Harbor Master Office.

**B: SITE IMPACTS FROM SEA LEVEL RISE BY 2050**

By the year 2050, the most likely projection for sea level rise in the San Francisco Bay is estimated to rise 12 inches per the SMC. The limits of inundation for the 12-inch sea level rise are shown in Figure 2 below and Figure 7 (attached).

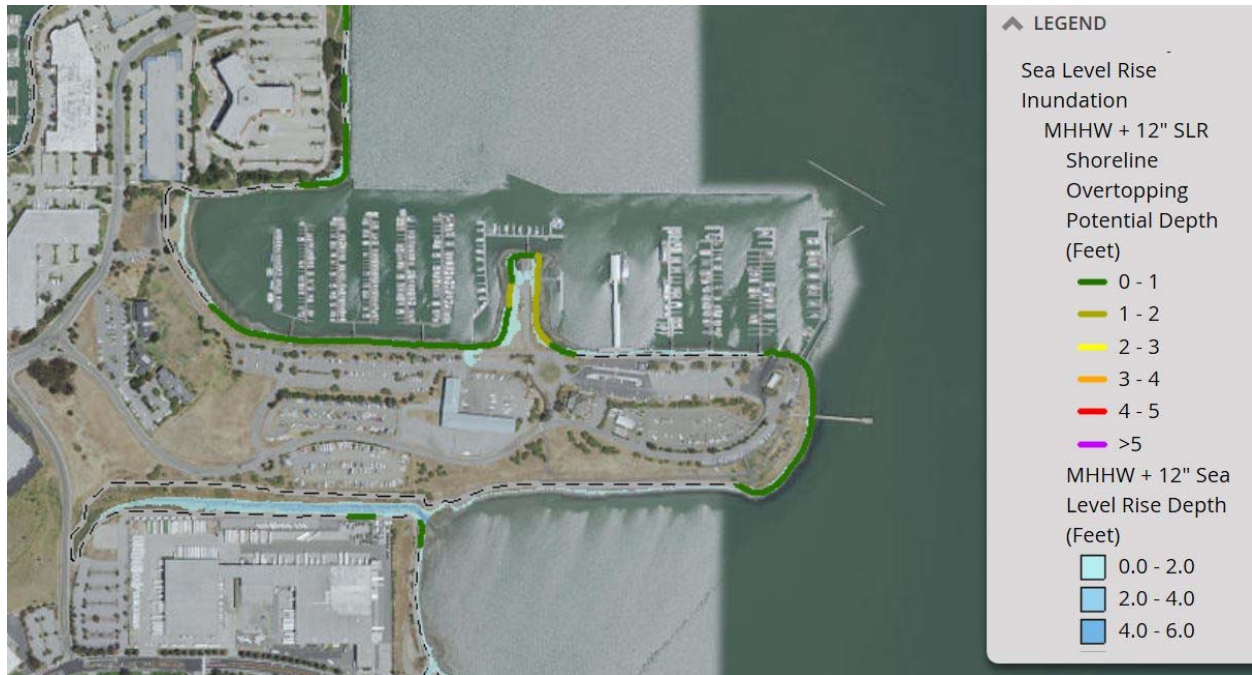


Figure 2 - Oyster Point Landfill with 12" sea level rise (image from the SMC Vulnerability Assessment ARCGIS Website)

During a 100-year extreme tide event in 2050, the water is projected rise to a level of 52 inches above current mean bay levels accounting for the 12 inches of sea level rise. The SMC prepared regional maps that projected various SLR scenarios and the map that corresponds to the 100-year extreme tide in 2050 conditions is Scenario 5. The portion of the Scenario 5 regional map that depicts the 52" sea level rise at the OPL is shown below in Figure 3 and in Figure 8 (attached):



Figure 3 - Oyster Point Landfill with 52" sea level rise (image from the SMC Vulnerability Assessment ARCGIS Website)

As can be seen from the image, the limits of inundation are similar to those the projected for year 2030 with an increase in the expanse and depth of water. The areas most significantly impacted are the boat ramp and parking areas (with almost the entire parking lot underwater), the boat storage area (the entire boat storage lot would be under water) and building, as well as the Harbor Master Office.

**C: SITE IMPACTS FROM SEA LEVEL RISE BY 2100**

By the year 2100, the most likely projection for sea level rise in the San Francisco Bay is estimate to rise 36 inches per the SMC. The limits of inundation for the 36-inch sea level rise are shown in Figure 4 below and Figure 9 (attached).





Figure 4 - Oyster Point Landfill with 36" sea level rise (image from the SMC Vulnerability Assessment ARCGIS Website)

During a 100-year extreme tide event in 2100, the water is projected to rise to a level of 77 inches above current mean bay levels accounting for the 36 inches of sea level rise. The SMC prepared regional maps that projected various SLR scenarios and the map that corresponds to the 100-year extreme tide in 2100 conditions is Scenario 7. The portion of the Scenario 7 regional map that depicts the 77" sea level rise at the OPL is shown below in Figure 5 and in Figure 10 (attached):



Figure 5 - Oyster Point Landfill with 77" sea level rise (image from the SMC Vulnerability Assessment ARCGIS Website)

By 2100, the limits of the site that is inundated with 2 feet of water or more closely matches the limit of site inundation in 2030, and the boat ramp area and the Harbor Master's Office would then be between 4 to 6 feet underwater.

### **3: PROPOSED FLOOD PROTECTION MEASURES**

This section focuses on the methodology of monitoring sea level rise at the site, a discussion of site specific measures being considered at this time, and how any measures being taken to protect the site will be performed by the City in conjunction with the regional measures being taken by the Task Force that is studying sea level rise for the San Mateo County Region.

#### **A: SITE MONITORING AND RECORD KEEPING**

The site should be monitored for settlement and sea level rise at regular intervals as well as during high tide events caused by storms or King Tide Events. Currently, the site is monitored quarterly for Landfill Gas and Stormwater compliance. Since these inspections are already scheduled on a regular basis, the site inspector should visually inspect for low spots and area of settlement in addition to their regular inspection duties. Photographs to document field conditions should be taken regularly to document changes. Ideally, these photographs are taken from the same vantage point during each inspection so that changes will be evident.

Sea levels will be monitored on a regular basis by tracking and reviewing bay level data from the IPCC, the BCDC, and the DWR.

During King Tide or storm events that cause high tides, site conditions will be monitored to determine the extent of site inundation. As with the regular site inspections, site photographs should be taken from the same vantage point so that the extent of inundation can be compared with the tide level rise from event to event and thus document any increases in bay levels relative to the site.

#### **B: POTENTIAL SITE IMPROVEMENTS**

The following measures are being considered by the City and will be evaluated further in the future:

1. Along with modifying the current inspection procedures (as described above) the existing maintenance procedures of the landfill cover will be reviewed and modified to improve site drainage and address settlement issues as they are identified. Maintenance will likely be required to address some ongoing differential settlement due to consolidation and shrinkage associated with the underlying waste material.
2. The site may be regraded to a higher elevation to avoid flooding from rising sea levels and extreme high tide events. Such an operation is problematic due to the susceptibility of the underlying refuse and young bay muds to settlement. Therefore, placement of fill material should be done by over-consolidating the site to stabilize settlement through placing soils to achieve a designed dead load and live loads for a specified time. Soils would be placed on

the site based on an extensive investigation of the OPL's subsurface conditions to determine the extent of potential consolidation of the underlying materials, which has already occurred versus the amount of settlement that remains. The study will include multiple borings or trenches located throughout the site to determine areas that are more susceptible to future settlement as both the refuse material and the Young Bay Muds are subject to differential settlement. If this measure is undertaken, soils would be placed over the surface of the landfill and left for a period of time while settlement of the site is monitored. Once adequate settlement has occurred excess soils would be removed and the site regraded to achieve site grades that would be sufficiently higher than the sea levels to protect the site from flooding. The projections of inundation shown within this report will be updated with newer data as it becomes available and will serve as a basis for determining the desired final grades for the site.

3. The site could be protected from flooding through the construction of structural levees/sea walls constructed of either sheet piles, cast in place concrete wall, or another method of construction. Levees/sea walls have the potential of being more stable if founded on competent underlying strata, which would prevent settlement. This measure will need to include back flow check valves and possibly pumps to address rainfall accumulation behind the levee/sea wall. The projections of inundation shown within this report will be updated with newer data as it becomes available and will serve as a basis for determining the height and the lateral extent of any levee/sea wall.
4. It is also possible to construct an earthen levee; however, construction of an earthen levee is possible but problematic due to the required size of the levee footprint and the possibility of inducing further settlement during construction. As with the structural seawall/levee, this measure will also need to include back flow check valves and possibly pumps to address rainfall accumulation behind the levee/sea wall. The projections of inundation shown within this report will be updated with newer data as it becomes available and will serve as a basis for determining the height and the lateral extent of any levee/sea wall.

These measures require further study and will be developed as part of the regional master plan (discussed further in Section 4A) for protection from sea level rise. The master plan will fully develop the feasibility of each option taking into consideration the relative cost, ongoing maintenance, and compatibility with anticipated uses of the OPL such as the marina, ferry terminal, future developments, and other recreational uses.

#### **4: PLANNING AND IMPLEMENTATION**

This section discusses the specific planning measures for the OPL and marina as well as the city's participation in the coordinated regional planning for sea level rise in the Bay. The formation of a regional JPA, funding, and permitting will also be addressed in the following subsections.

**A: PLANNING PROCESS**

The City of South San Francisco is part of a San Mateo County led effort to plan for sea level rise. City staff and officials participate in the Technical Working Group and the Policy Makers Group. The planning process is multi-stepped and consists of the following: 1) determining inundation for various predicted levels of sea level rise, 2) identify vulnerable infrastructure and community assets within inundation areas, 3) assess the adaptability of the Bay shoreline and infrastructure, 4) develop a master plan for adaptation and protection, and 5) implement the master plan to make communities resilient as sea levels rise. The county-wide effort along with this OPL's Long-Term Flood Protection Plan advances the process through the first three steps of the planning process. Further progress will be reported to the RWQCB at significant milestones leading to the implementation of the long-term plan.

**B: REGULATORY REQUIREMENTS**

The regulatory compliance process for the measures that are implemented at the OPL for protecting the site from flooding due to sea level rise will involve multiple agencies and permits as well as compliance with the California Environmental Quality Act (CEQA). A CEQA determination will determine what level of environmental review will be required for the project ranging from a Categorical Exemption to a full Environmental Impact Report.

The following is a list of regulatory agencies and either the permit that may be required or the regulations that may govern aspects of the project:

- 1) U.S. Army Corps of Engineers
  - a) Clean Water Act
  - b) Section 401 Permit
  - c) Rivers and Harbors Section 10 authorization
- 2) California Regional Water Quality Control Board
  - a) Clean Water Act
  - b) Section 404 Permit
  - c) Revision to Waste Discharge Requirements
  - d) Compliance with State of California Construction General Permit
  - e) Compliance with State of California Industrial or Municipal General Permit
- 3) Bay Conservation and Development and Development Commission
  - a) Consistency with Bay Plan
- 4) CalRecycle and the San Mateo County Health Services Agency (the Local enforcement Agency for the site)
  - a) California Code of Regulations, Title 27
- 5) Bay Area Air Quality Management District
  - a) Assembly Bill 32
  - b) Regulation 8, Rule 34

- 6) United States Fish and Wildlife
  - a) Federal Endangered Species Act
- 7) California Fish and Wildlife (formerly California Fish and Game)
  - a) Section 1602 Streambed Alteration Agreement
  - b) California Endangered Species Act

### **C: FORMATION OF A REGIONAL JOINT POWERS AUTHORITY**

This section discusses the effort being led by the San Mateo County City and the County Association of Governments (C/CAG) to form a Joint Powers Authority (JPA) to address sea level rise on a regional basis. This is a regional issue requiring a seamless approach to prevent inundation due to protection gaps in adjacent agencies. A JPA will also be able to leverage funding for plan implementation.

Concerns about sea level rise due to global climate change led to a call for study and planning on a regional basis by the elected congress representative for San Mateo County along with County Supervisors. An initial study started with the San Francisco International Airport and expanded to include the adjacent cities of South San Francisco and San Bruno. Subsequent grant funding from the Coastal Conservancy allowed for further expansion of studies to include the entire San Francisco Bay frontage within San Mateo County. On September 26<sup>th</sup>, 2014, the San Mateo County Sea Level Rise Vulnerability Working Group (Working Group) held its first meeting to begin the planning process. The working group included participants from affected agencies. Efforts to date have resulted in the development of the inundation and overtopping potential mapping being utilized in this Long Term Plan.

The efforts and input of the Working Group have made it apparent that a coordinated regional effort is needed to adapt the shoreline within San Mateo County to sea level rise. The progress of one agency could be ineffective due to deficiencies in protection in an adjacent agency. Implementation will need to be coordinated and carried out by some form of regional JPA. One possible JPA considered was expansion of the role of the Flood Control Agencies within San Mateo County. Current efforts are being left by the City and County Association of Governments (C/CAG) which is the regional planning agency. C/CAG is funded by, and represents, the 20 municipalities as well as the County of San Mateo. Roles of a JPA considered by the C/CAG let effort include addressing sea level rise as well as, riverine flooding, storm water permit compliance, and storm water as a resource in response to the ongoing drought in California. A JPA could lead to a more consistent and seamless master planning effort as well as lobby for and leverage funding for implementation of protection measures.

The City will continue in the effort to find an appropriate structure of a viable JPA as part of the implementation of the Long-Term Flood Protection Plan.

### **D: FUNDING FOR IMPLEMENTATION**

The City of South San Francisco will explore various funding opportunities to implement the long-term

protection measures described in this plan. Potential funding sources include:

- 1) United States Army Corps of Engineers Continuing Authorities Program
  - a) Section 14 – Emergency Stream Bank Erosion
  - b) Section 204: Beneficial Uses of Dredge Material
  - c) Section 206: Aquatic Ecosystem Restoration
- 2) United States Army Corps of Engineers General Investigations Program
- 3) United States Fish and Wildlife Service Cooperative Conservation Initiative
- 4) California Coastal Conservancy Grants
- 5) CalRecycle Solid Waste Disposal and Codisposal Site Cleanup Program
- 6) Local/Regional Matching Funds

The available sources of funding are likely to change over the course of the next few decades. There will be greater demand for additional funding as the socio-economic impacts from sea level rise increase. Government programs at the federal, state, and local levels will continue to grow more responsive to increasing impacts of sea level rise.

#### **E: IMPLEMENTATION SCHEDULE**

The site is currently implementing measures to mitigate the ponding caused by the site's inundation that occurs during King Tide Events. Aside from the high tides experienced during the King Tide Events, the site is adequately protected for sea levels currently seen at the site. Significant permanent inundation of portions of the landfill are not projected to occur until sometime near the year 2050. In the intervening years, the City will continue in the regional planning effort and potential formation of a JPA to complete the master plan and secure funding for construction of protection measures. The monitoring of the site will be modified to include the inspection procedures for monitoring sea level rise and settlement of areas that will be affected by the same as indicated in section 3.A of this document. The schedule for implementation will be adjusted to address any accelerated settlement or sea level rise above what has been predicted. Therefore, the City of South San Francisco will monitor the impacts of sea level rise at the site and work with local agencies to partner and develop a regional strategy for the San Mateo County Area. If the inspections of the site indicate that action is required to protect the site from flooding caused by sea level rise, the City will contact the RWQCB and submit a work plan with a schedule that is specific to addressing the site impacts.

#### **5: REFERENCES:**

- 1) California Regional Water Quality Board San Francisco Bay Region – Order No. 00-46 Updated Waste Discharge Requirements for the Oyster Point Landfill, June 6, 2000
- 2) Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on its Shoreline, San Francisco Bay Conservation and Development Commission, October 6, 2011.
- 3) Climate Change 2013 The Physical Science Basis, Intergovernmental Panel on Climate Change, <http://www.realclimate.org/index.php/archives/2013/10/sea-level-in-the-5th-ipcc->

report/#sthash.QSDINu53.dpuf

- 4) California Water Plan Update 2013, Volume 2, Department of Water Resources. Website. [http://www.waterplan.water.ca.gov/docs/cwpu2013/Final/Vol2\\_SanFranciscoBayRR.pdf](http://www.waterplan.water.ca.gov/docs/cwpu2013/Final/Vol2_SanFranciscoBayRR.pdf)
- 5) Adapting to Rising Tides: San Mateo County Bayshore Sea Level Rise & Overtopping Analysis, , AECOM May 2015.
- 6) Adapting to Rising Tides: Alameda County Shoreline Vulnerability Assessment. Final Report, AECOM May 2015.
- 7) San Mateo County Vulnerability Assessment Adapting to Rising Tides/Overtopping maps Website <http://smcmaps.maps.arcgis.com/apps/MapSeries/index.html>
- 8) 2015 Semi Annual Report for the Former Oyster Point Landfill, CSS Environmental Services, July 31, 2015

Should there be any questions regarding the content of this plan, please advise.

Sincerely,



Gregory E. Saul, PE  
Civil Engineer