# Vista Grande Watershed Study

August 2006

RMC
Water and Environment

# Vista Grande Watershed Study

**Prepared by:**

RMC
Water and Environment

**August 2006**

## Acknowledgements

The Vista Grande Watershed Study has been prepared through a collaborative approach between the City of Daly City and the City and County of San Francisco. The following city departments participated in developing the Watershed Study:

City of Daly City Department of Public Works

City of Daly City Department of Water and Wastewater Resources

San Francisco Public Utilities Commission

San Francisco Department of Public Works

San Francisco Recreation and Park Department

In addition to RMC Water and Environment, the Vista Grande Watershed Study was developed by a consultant team that included:

Jacobs Associates – Conceptual design and technical review of the Vista Grande tunnel.

Alex Horne Associates – Conceptual design and technical review of the Vista Grande treatment wetlands.

Bartle Wells Associates – Development of local financing options for the Vista Grande Watershed Study.

Gus Yates, Consulting Hydrologist – Characterization of the groundwater hydrology of the project area.

## Table of Contents

**Executive Summary** ..... **ES-1**

**Chapter 1 Introduction** ..... **1-1**
1.1 Intent of Document ..... 1-1
1.2 Study Area and Watershed Description ..... 1-1
*1.2.1 Vista Grande Stormwater Collection System* ..... *1-3*
*1.2.2 Vista Grande Canal and Tunnel* ..... *1-4*
*1.2.3 Lake Merced* ..... *1-8*
1.3 Hydrology ..... 1-10
1.4 Problem Description ..... 1-13
1.5 Organization of Document ..... 1-13

**Chapter 2 Project Approach and Objectives** ..... **2-1**
2.1 Project Approach ..... 2-1
*2.1.1 Stakeholder Involvement* ..... *2-1*
2.2 Study Goal and Objectives ..... 2-2

**Chapter 3 Previous Studies** ..... **3-1**
3.1 Vista Grande Storm Sewer Project Draft Report (Kennedy/Jenks Engineers, 1983) ..... 3-1
3.2 Vista Grande Diversion Feasibility Evaluation, Lake Merced Technical Memorandum No.2 (CH2M Hill, 2001) ..... 3-2
3.3 Vista Grande Stormwater Drainage Basin Hydraulic Capacity Evaluation (CH2M Hill, 2002) 3-3
3.4 Initiative to Raise and Maintain Lake Level and Improve Water Quality (EDAW, September 2004a, b) – Task 3 and 4 Technical Memorandums ..... 3-5

**Chapter 4 Alternatives Considered** ..... **4-1**
4.1 Upstream Alternatives ..... 4-1
*4.1.1 Storm Drain Improvements* ..... *4-1*
*4.1.2 Regional Detention Storage* ..... *4-2*
*4.1.3 Local Detention Storage* ..... *4-10*
*4.1.4 Best Management Practices (BMPs)* ..... *4-12*
4.2 Downstream Alternatives ..... 4-12
*4.2.1 Direct Discharge to Lake Merced* ..... *4-12*
*4.2.2 Detention Basin at Vista Grande Canal* ..... *4-13*
*4.2.3 Detention Basin at Impound Lake* ..... *4-15*
*4.2.4 Constructed Wetlands at Impound Lake* ..... *4-17*
*4.2.5 Structural Control Followed by Treatment Wetlands* ..... *4-19*
*4.2.6 Constructed Wetlands at Vista Grande Canal* ..... *4-20*
*4.2.7 New Parallel Tunnel* ..... *4-22*
*4.2.8 New Tunnel South of County Line* ..... *4-24*
4.3 Alternatives Recommended for Further Evaluation ..... 4-25
4.4 Interim Solutions ..... 4-31
*4.4.1 Diversion to Impound Lake* ..... *4-32*
*4.4.2 Diversion to South Lake* ..... *4-33*
*4.4.3 Bank Armoring* ..... *4-34*
*4.4.4 Recommendations Related to Interim Solutions* ..... *4-35*

**Chapter 5 Preliminary Program Recommendations** ..... **5-1**
5.1 Summary of the Preliminary Program Recommendations ..... 5-1

5.2 Tunnel South of County Line ..... 5-3
*5.2.1 Description & Location ..... 5-3*
*5.2.2 Objectives ..... 5-3*
*5.2.3 Design Assumptions ..... 5-4*
*5.2.4 Preliminary Layout and Facilities ..... 5-8*
*5.2.5 Planning Level Cost Estimate ..... 5-17*
*5.2.6 Operation and Maintenance ..... 5-20*
*5.2.7 Benefits/Objectives Met ..... 5-21*
*5.2.8 Implementation Issues ..... 5-21*
*5.2.9 Implementation Schedule ..... 5-25*
*5.2.10 Summary and Next Steps ..... 5-26*
5.3 Vista Grande Wetland ..... 5-29
*5.3.1 An Overview of Constructed Stormwater Wetlands ..... 5-29*
*5.3.2 Vista Grande Wetland Project Description and Location ..... 5-29*
*5.3.3 Objectives ..... 5-30*
*5.3.4 Design Assumptions ..... 5-30*
*5.3.5 Preliminary Layout ..... 5-30*
*5.3.6 Water Quality Considerations and Treatment Characteristics ..... 5-36*
*5.3.7 Wetland Construction, Operation and Maintenance ..... 5-43*
*5.3.8 Preliminary Capital Costs ..... 5-45*
*5.3.9 Benefits ..... 5-46*
*5.3.10 Implementation Issues ..... 5-49*
*5.3.11 Implementation Schedule ..... 5-53*
*5.3.12 Recommendation and Next Steps ..... 5-53*
5.4 Upstream Storm Drain Improvements ..... 5-55
*5.4.1 Overview of Storm Drain Improvements ..... 5-55*
*5.4.2 Existing System Description and System Constraints ..... 5-55*
*5.4.3 Improvements to Address Storm Drain Capacity Issues ..... 5-55*
*5.4.4 Runoff Reduction Practices ..... 5-58*
*5.4.5 Storm Drain Master Planning ..... 5-58*
*5.4.6 Preliminary Planning Level Cost Estimate ..... 5-59*
*5.4.7 Planning and Implementation Schedule ..... 5-60*
5.5 Ongoing Implementation of Best Management Practices ..... 5-61
*5.5.1 Overview of Stormwater Regulation in Daly City ..... 5-61*
*5.5.2 Regional NPDES Permit Coordination and Implementation ..... 5-61*
*5.5.3 STOPPP Stormwater Management Plan ..... 5-61*
*5.5.4 Daly City Ongoing Implementation of Performance Standards, BMPs, and other NPDES Permit Requirements ..... 5-63*
*5.5.5 Recommendations for Ongoing BMP Implementation Related to Vista Grande Watershed Study ..... 5-67*

**Chapter 6 Implementation Strategies ..... 6-1**
6.1 Funding Strategies ..... 6-1
*6.1.1 Local Financing Options ..... 6-1*
*6.1.2 State and Federal Funding Opportunities ..... 6-2*
6.2 Public Outreach and Community Involvement ..... 6-6
6.3 Regulatory Requirements ..... 6-7
*6.3.1 Local permits ..... 6-7*
*6.3.2 State and Federal Permits ..... 6-7*
*6.3.3 Environmental Documentation ..... 6-14*
*6.3.4 Regulatory Summary and Recommendations ..... 6-15*

6.4 Institutional Arrangements ..... 6-18
6.5 Phasing and Schedule ..... 6-18
*6.5.1 Program Phasing ..... 6-18*
*6.5.2 Overall Implementation Schedule for the Vista Grande Watershed Study ..... 6-18*
6.6 Next Steps ..... 6-22

## List of Tables

Table 1-1 Peak Flows at the Vista Grande Canal ..... 1-11
Table 2-1 Primary and Secondary Objectives Developed for the Vista Grande Watershed Study ..... 2-3
Table 3-1 Alternatives Analyzed in the Vista Grande Storm Sewer Report (Kennedy/Jenks, 1983.) ..... 3-2
Table 3-2 Alternatives Evaluated in the Vista Grande Diversion Feasibility Evaluation (CH2M Hill, 2002) ..... 3-3
Table 3-3 Scenarios Analyzed in the Stormwater Drainage Basin Hydraulic Capacity Evaluation (CH2M Hill, 2002) ..... 3-5
Table 4-1 Summary of Detention Basins Studied in the Vista Grande Hydraulic Capacity Evaluation (CH2M Hill, 2002) ..... 4-4
Table 4-2 Planning Level Cost Estimate for I-280 Cloverleaf Detention Basin ..... 4-5
Table 4-3 Planning Level Cost Estimate for LMGC Detention Basins ..... 4-7
Table 4-4 Planning Level Capital Cost Estimate for Westlake Shopping Center Detention Basin ..... 4-8
Table 4-5 Planning Level Cost Estimate for Park Plaza Drive Detention Basins ..... 4-10
Table 4-6 Planning Level Cost Estimate for Vista Grande Detention Basin ..... 4-15
Table 4-7 Planning Level Cost Estimate for Detention Basin at Impound Lake ..... 4-16
Table 4-8 Impound Lake Planning Level Cost Estimate ..... 4-19
Table 4-9 Structural Control Followed By Treatment Wetlands Planning Level Cost Estimate ..... 4-20
Table 4-10 Vista Grande Wetland Cost Estimate ..... 4-21
Table 4-11 New Parallel Tunnel Cost Estimate ..... 4-23
Table 4-12 Tunnel South of County Line Cost Estimate ..... 4-25
Table 4-13 Comparison of Long-Term Program Improvements ..... 4-27
Table 5-1 Overall Planning Level Cost Estimate for the Vista Grande Watershed Preliminary Program ..... 5-2
Table 5-2 Hydraulic Design Criteria ..... 5-5
Table 5-3 Estimated Costs for Tunnel South of County Line Alternative 1 – John Muir Drive Site ..... 5-18
Table 5-4 Estimated Costs for Tunnel South of County Line Alternative 2 – Doelger Community Center Site ..... 5-19
Table 5-5 Estimated Costs for Tunnel South of County Line Alternative 3 – John Daly Alignment ..... 5-20
Table 5-6 Summary of Permit Requirements for the Tunnel South of County Line ..... 5-23
Table 5-7 Alternative Summary and Comparison ..... 5-26
Table 5-8 Baseline Average Concentrations of Critical Constituents ..... 5-37
Table 5-9 N:P Ratios for South Lake ..... 5-38
Table 5-10 Pollutants Removal for Different Stormwater Inflow Rates at the Vista Grande Wetland ..... 5-40

Table 5-11 Pollutants Removal for Different Recycled Water Inflow Rates at the Vista Grande Wetland ..... 5-42
Table 5-12 Maximum Recommended Wetland Treatment Rates for Stormwater and Recycled Water ..... 5-43
Table 5-13 Vista Grande Wetland Alternative A Planning Level Capital Cost Estimate ..... 5-46
Table 5-14 Scenarios for Providing Supplemental Water to Lake Merced and Effect on Lake Water Level ..... 5-48
Table 5-15 Summary of Permit Requirements for the Vista Grande Wetland ..... 5-50
Table 5-16 Possible Combinations of Water Supplies for Operation of the Vista Grande Wetland ..... 5-54
Table 5-17 Daly City Stormwater Implementation Team ..... 5-64
Table 5-18 Summary of Daly City's Ongoing Implementation of Stormwater BMP, Activities, and Actions Related to the STOPPP SMP for Fiscal Year 2004/2005 ..... 5-65
Table 5-19 Projects Affected by C.3 Provisions for the San Mateo Countywide NPDES permit. ..... 5-67
Table 6-1 Potential Funding Sources ..... 6-3
Table 6-2 State and Federal Legislators ..... 6-5
Table 6-3 Summary of State and Federal Regulatory Requirements ..... 6-16
Table 6-4 Summary of Recommended Institutional Arrangements ..... 6-18

## List of Figures

Figure 1-1 Location of Vista Grande Drainage Basin ..... 1-2
Figure 1-2 Vista Grande Watershed ..... 1-3
Figure 1-3 Vista Grande Watershed Flooding Locations ..... 1-4
Figure 1-4 Upstream End of Vista Grande Canal ..... 1-5
Figure 1-5 Access Road to Vista Grande Canal ..... 1-5
Figure 1-6 Vista Grande Canal Narrow Section ..... 1-6
Figure 1-7 Vista Grande Tunnel Entrance ..... 1-6
Figure 1-8 Vista Grande Canal/Tunnel Interface ..... 1-7
Figure 1-9 Vista Grande Outfall Located on the Beach below Fort Funston – Facing North ..... 1-7
Figure 1-10 South Lake ..... 1-8
Figure 1-11 Trail between South Lake and Impound Lake ..... 1-9
Figure 1-12 Vista Grande Canal Overflow at John Muir Boulevard ..... 1-10
Figure 1-13 Vista Grande Watershed Water Balance ..... 1-11
Figure 1-14 Upstream Flooding in the Vista Grande Watershed ..... 1-12
Figure 1-15 Sheet flow from Vista Grande Canal Overflows ..... 1-12
Figure 3-1 Simulated Lake Level and Water Addition Rates: Seasonal Additions, Multiple-Year Average Hydrologic Conditions ..... 3-7
Figure 3-2 Supplemental Water Requirements for Alternative Lake Levels: Seasonal Additions, Multiple-Year Average Hydrologic Conditions ..... 3-7
Figure 4-1 Location of detention basins modeled in the Vista Grande Hydraulic Capacity Evaluation (CH2M Hill, 2002) ..... 4-3
Figure 4-2 Example of underground reservoir construction ..... 4-4
Figure 4-3 I-280 Detention Basin Location ..... 4-5
Figure 4-4 Location of LMGC Detention Basins ..... 4-6
Figure 4-5 Location of Westlake Shopping Center Detention Basin ..... 4-8
Figure 4-6 Park Plaza Drive Detention Basins ..... 4-9
Figure 4-7 Example of CULTEC Chambers (source: CULTEC, Inc., 2005) ..... 4-11

Figure 4-8 Use of park for detention of storm flows (Source: Clark County Regional Flood Control District, Las Vegas, NV.) ....4-11
Figure 4-9 Location of Vista Grande Detention Basin ....4-14
Figure 4-10 Conceptual Cross Sectional View of Vista Grande Detention Basin ....4-14
Figure 4-11 Schematic of Detention Basin at Impound Lake ....4-16
Figure 4-12 Schematic of Impound Lake Wetlands ....4-18
Figure 4-13 Schematic of Constructed Wetlands at Vista Grande Canal ....4-21
Figure 4-14 New Parallel Tunnel ....4-23
Figure 4-15 New Tunnel South of County Line ....4-24
Figure 4-16 Long-Term Program Components Recommended for Further Evaluation in the Vista Grande Watershed Study ....4-31
Figure 4-17 Location of Interim Solutions Examined for the Vista Grande Watershed Study ....4-32
Figure 4-18 Schematic of Impound Lake Diversion Interim Solution ....4-32
Figure 4-19 Schematic of South Lake Interim Solution ....4-33
Figure 5-1 Long-Term Program Components Recommended for Further Evaluation in the Vista Grande Watershed Study ....5-1
Figure 5-2 Tunnel South of County Line Alternative Map ....5-3
Figure 5-3 Serra Fault Location ....5-5
Figure 5-4 Typical tunnel boring machine ....5-6
Figure 5-5 Typical construction layout ....5-6
Figure 5-6 Typical tunnel portal ....5-6
Figure 5-7 Typical construction shaft ....5-7
Figure 5-8 Alternative 1 Tunnel Profile ....5-9
Figure 5-9 John Muir Drive Site ....5-10
Figure 5-10 Fort Funston Beach Outlet Location ....5-11
Figure 5-11 San Francisco CSO Structure ....5-11
Figure 5-12 Alternative 2 Tunnel Profile ....5-12
Figure 5-13 Doelger Community Center Site ....5-13
Figure 5-14 John Daly Alignment Primary Construction Site ....5-14
Figure 5-15 Alternative 3 Tunnel Profile ....5-15
Figure 5-16 John Daly Alignment Retrieval Location Construction Site ....5-16
Figure 5-17 Thornton State Beach Outlet Location ....5-17
Figure 5-18 Alternative 1 Implementation Schedule ....5-26
Figure 5-19 Typical Processes Occurring in a Treatment Wetland ....5-29
Figure 5-20 Cattail and Bulrush ....5-31
Figure 5-21 Vista Grande Wetland Site Map ....5-32
Figure 5-22 Vista Grande Wetland Layout ....5-33
Figure 5-23 Vista Grande Wetland Profile ....5-34
Figure 5-24 Vista Grande Wetland Cross-Sections ....5-35
Figure 5-25 Area Along Existing Canal Proposed for Construction of Vista Grande Wetland ....5-44
Figure 5-26 Impound Lake Fringe Habitat ....5-49
Figure 5-27 Property Ownership around the Vista Grande Canal ....5-52
Figure 5-28 Vista Grande Wetland Implementation Schedule ....5-53
Figure 5-29 Localized Flooding near Daly City's City Hall ....5-56
Figure 5-30 Implementation Schedule for Storm Drain Improvements a ....5-60
Figure 5-31 Gateway Gardens ....5-63
Figure 6-1 Regulatory Jurisdiction of the U.S. Army Corps of Engineers (CERES, 2002) ....6-8
Figure 6-2 Regulatory Agency Relationships ....6-17
Figure 6-3 General Schedule for the Watershed Study ....6-19
Figure 6-4 Overall Implementation Schedule ....6-21

## Appendices

Appendix A - Vista Grande Watershed Peak Stormwater Discharge for Various Design Storms
Appendix B - July 2005 Stakeholder Workshop Attendance List
Appendix C - Upstream Detention Storage Alternative Supporting Technical Information
Appendix D - Evaluation of Interim Solutions
Appendix E - Tunnel South of County Line Supporting Technical Information
Appendix F - Cost Estimate and Schematics for Vista Grande Wetland Alternative B
Appendix G - Cost Estimate Escalation Information
Appendix H - March 2006 Stakeholder Workshop Attendance List

## List of Abbreviations

| | |
|---|---|
| ac-ft/yr | acre-feet per year |
| AF | acre-feet |
| Basin Plan | San Francisco Bay Basin Plan |
| BASMAA | Bay Area Stormwater Management Agencies Association |
| BCDC | Bay Conservation and Development Commission |
| BMPs | Best Management Practices |
| BOD | Biochemical Oxygen Demand |
| C/CAG | City/County Association of Governments |
| California State Parks | California Department of Parks and Recreation |
| Caltrans | California Department of Transportation |
| CARCD | California Association of Resource Conservation Districts |
| CCC | California Coastal Commission |
| CCSF | City and County of San Francisco |
| CDFG | California Department of Fish and Game |
| CDS | Continuous Deflection System |
| CEQA. | California Environmental Quality Act |
| CERES | California Environmental Resources Evaluation System |
| cfs | cubic feet per second |
| CNPS | California Native Plant Society |
| COPs | Certificates of Participation |
| Corps | US Army Corps of Engineers |
| CSO | San Francisco Combined Sewer Overflow |
| CY | Cubic yards |
| Daly City | City of Daly City |
| DWWR | Daly City Department of Water and Wastewater Resources |
| EA | Environmental Assessment |
| EIR | Environmental Impact Report |
| EIS | Environmental Impact Statement |
| EPA | US Environmental Protection Agency |
| FONSI | Finding of No Significant Impact |
| ft | feet |
| GGNRA | Golden Gate National Recreation Area |
| GO | General Obligation |
| gpd | gallons per day |
| gpm | gallons per minute |
| I-280 | Interstate-280 |
| JARPA | San Francisco Joint Aquatic Resource Permit Application |
| JPA | Joint Powers Authority |
| Kennedy/Jenks | Kennedy/Jenks Engineers |
| kg | kilogram |
| kg/day | kilogram per day |
| LCP | Local Coastal Program |
| LMGC | Lake Merced Golf Club |
| MG | million gallons |
| mg/L | milligram per liter |
| mgd | million gallons per day |
| mL | milliliter |
| MOU | Memorandum of Understanding |
| MPN | Most Probable Number |
| NEPA | National Environmental Policy Act |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |

## List of Abbreviations

| | |
|---|---|
| NPDES | National Pollution Discharge Elimination System |
| NPS | National Park Service |
| NSMCSD | North San Mateo County Sanitation District |
| O&M | Operation and Maintenance |
| Prop 40 | Proposition 40 |
| Prop 50 | Proposition 50 |
| RWQCB | Regional Water Quality Control Board |
| SF city datum | San Francisco city datum |
| SFE | San Francisco Estuary |
| SFPUC | San Francisco Public Utilities Commission |
| SFRPD | San Francisco Recreation and Park Department |
| SMP | Stormwater Management Plan |
| STOPPP | San Mateo Countywide Stormwater Pollution Prevention Program |
| SWMM | Stormwater Management Model |
| SWRCB | State Water Resources Control Board |
| TAC | NPDES Technical Advisory Committee |
| TBM | Tunnel Boring Machine |
| TMDLs | Total Maximum Daily Loads |
| TMs | Technical Memoranda |
| TSS | Total Suspended Solids |
| USFWS | US Fish and Wildlife Service |
| WAM | Watershed and Monitoring |
| WDRs | Waste Discharge Requirements |
| WRDA | Water Resources Development Act |
| WWTP | Waste Water Treatment Plant |

# Executive Summary

# Executive Summary

## Background

The Vista Grande Watershed Study (Study) is being developed jointly by the City of Daly City (Daly City) and City and County of San Francisco (CCSF). The study is intended to serve as a planning level document to identify potential solutions to meet the goal of resolving flooding at the Vista Grande canal and in the Vista Grande drainage basin for the 10-year storm event. The study takes a watershed approach by incorporating stakeholder input into the planning process, developing a set of objectives to help guide the development of alternatives, and looking watershed-wide, at both upstream and downstream alternatives.

Through this analysis, the watershed study recommends a combination of potential solutions that can be implemented as part of a long-term watershed program to solve flooding issues while meeting a number of multi-disciplinary objectives. Planning level cost estimates, conceptual level design, benefits and implementation strategies are evaluated for the preliminary program recommendations identified in the Study.

The alternatives presented in this Study are preliminary, planning level conceptualizations. The intent of this Study is to evaluate these initial alternatives and recommend a general approach to solving the flooding issues in the watershed. The potential projects presented in this document have not been selected for implementation. Further investigation and detailed design would be necessary prior to implementing any of the concepts presented as part of this study.

A number of different stakeholders have been consulted during the development of the Vista Grande Watershed Study. The stakeholder outreach process included meetings with stakeholders interested in the management of stormwater in the Vista Grande watershed, as well as public meetings on July 27, 2005 and March 30, 2006. Some of the organizations and agencies involved in these meetings included:

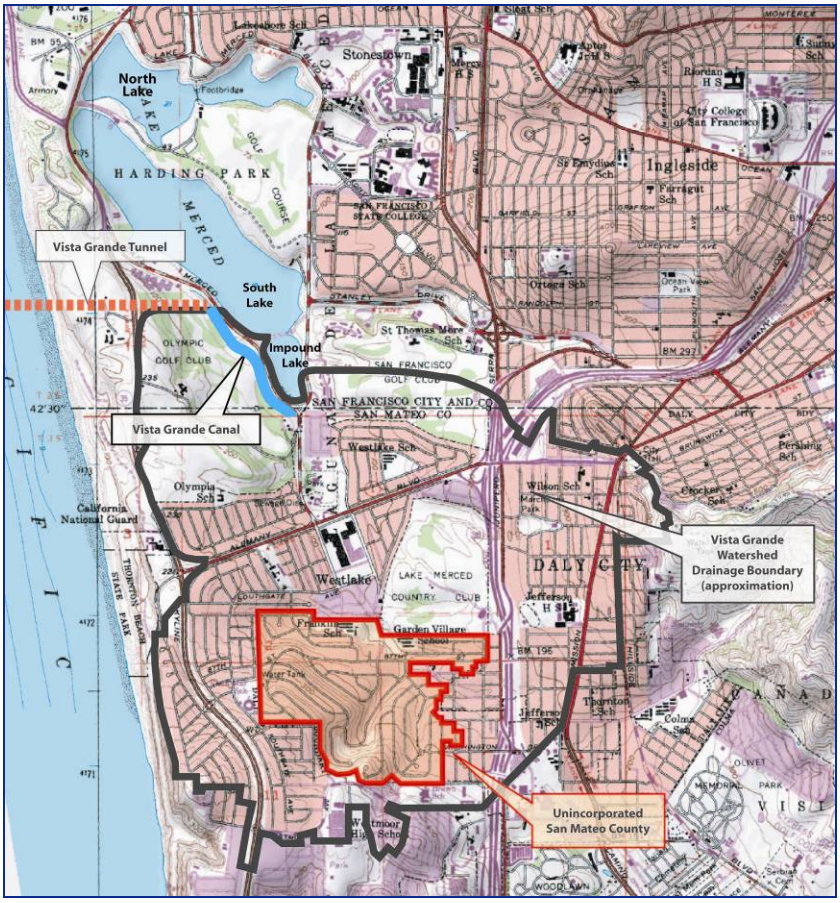
- City of Daly City Department of Public Works
- San Francisco Department of Public Works
- San Francisco Recreation and Park Department
- The Olympic Club
- Regional Water Quality Control Board
- California Coastal Commission
- Golden Gate National Recreation Area
- San Francisco Department of Public Health
- California Native Plant Society
- California State Parks
- San Francisco Public Utilities Commission
- City of Daly City Department of Water and Wastewater
- Lake Merced Task Force's Water Committee
- Friends of Lake Merced
- US Environmental Protection Agency
- US Army Corps of Engineers
- California Department of Fish and Game
- San Mateo County Department of Public Health
- Local Homeowners Associations
- Local Residents

### The Watershed Study Area

The study area includes approximately 2.5 square mile Vista Grande watershed area in Daly City and unincorporated San Mateo County, and the Vista Grande canal and tunnel area in CCSF. This watershed area borders San Francisco County on the north, Colma Creek watershed to the south

and east, and the Pacific Ocean on the west. The watershed is drained through the Vista Grande canal and tunnel which are located in the CCSF near the southern shoreline of Lake Merced. Figure ES-1 illustrates the location of the overall watershed.

**Figure ES-1 Location of the Vista Grande Drainage Basin**




The major hydrologic features associated with the watershed area include the Vista Grande storm drain collection system, the Vista Grande canal and tunnel, and Lake Merced.

### Vista Grande Stormwater Collection System

The Vista Grande portion of Daly City's stormwater collection system drains the northwestern area of Daly City and an unincorporated portion of San Mateo County. The underground collection system routes storm flows northwest to the Vista Grande canal and tunnel for discharge to an outfall structure at the beach below Fort Funston. During large rain events, the Vista Grande storm drain system experiences flooding and/or surcharging conditions throughout the stormwater collection system causing local flooding as shown in Figure ES-2.

**Figure ES-2 Local Flooding in the Vista Grande Watershed**

### Vista Grande Canal and Tunnel

The Vista Grande canal and tunnel are the downstream conveyance structures of the stormwater collection system. The Vista Grande canal, shown in Figure ES-3, is a trapezoidal canal

with a capacity of 500 cubic feet per second (cfs) that runs adjacent to the west side of John Muir Drive, paralleling the southwest shores of Lake Merced.

At the terminus of the canal is the mouth of the Vista Grande tunnel, as shown in Figure ES-4. This tunnel is the primary outlet for stormwater from the Vista Grande watershed, and was constructed in 1897. The tunnel is 3,000-feet-long, with a capacity of 170 cfs. Historically, wet weather flows in excess of the capacity of the canal and tunnel resulted in local flooding and overflows across John Muir Drive into Lake Merced, causing property damage, bank erosion, traffic nuisances, and public safety issues. Stormwater exiting the tunnel discharges to the beach below Fort Funston through a beach outfall structure, as shown in Figure ES-5.

**Figure ES-3 Upstream End of Vista Grande Canal**

**Figure ES-4 Vista Grande Tunnel Entrance**

**Figure ES-5 Vista Grande Outfall Located at the Beach below Fort Funston**

## Lake Merced

Lake Merced is comprised of four lakes: North, East, South, and Impound Lakes. South Lake and Impound Lake are the two lakes directly impacted by the Vista Grande canal overflows. Lake Merced, shown in Figure ES-6, is the largest freshwater lake in San Francisco, and is a valuable natural resource and recreational area for nearby communities. Lake Merced contains the largest expanse of wetland habitat in San Francisco and supports an array of sensitive plant and animal species. Wetland areas, particularly those at Impound Lake, are known to contain sensitive plant species.

**Figure ES-6 Lake Merced**

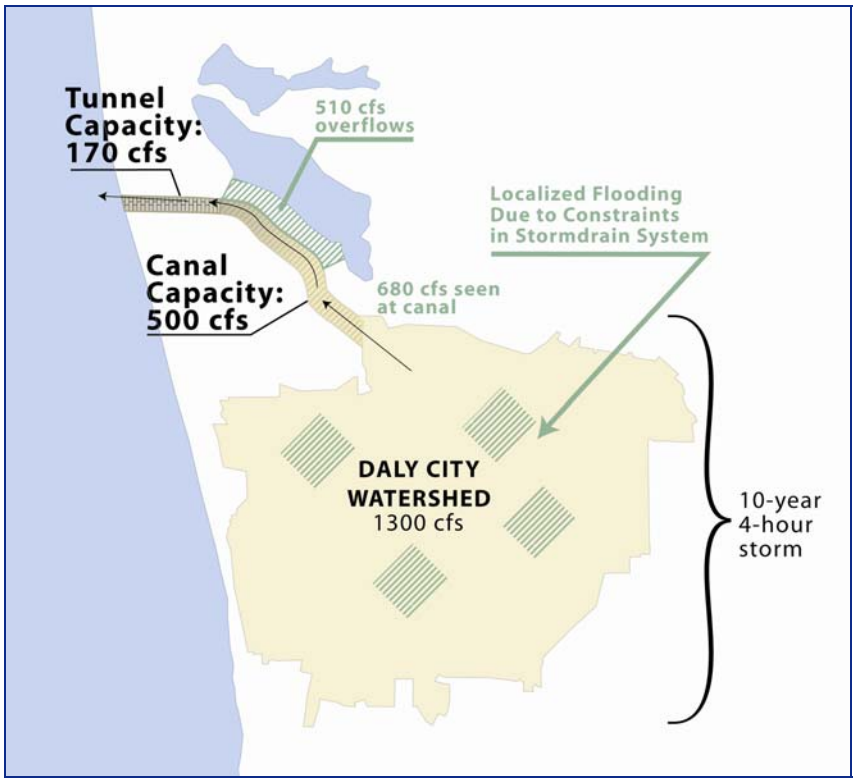
The quality and quantity of water in Lake Merced has been the focus of much study in recent years. Existing lake water quality is eutrophic for a majority of the year with high nutrient levels. Lake Merced's water level fluctuates seasonally but recent studies have concluded that drought, reduction in the natural stormwater flows from the Vista Grande and Lake

Merced watersheds, and groundwater pumping may all contribute to a long-term decline in lake levels. As a result, evaluations have been conducted to examine potential lake level augmentation alternatives, including the potential use of Vista Grande stormwater flows.

### Watershed Hydrology

Previous hydrologic investigations and modeling for the Vista Grande stormwater conveyance system utilized rainfall data from the 10-year, 4-hour storm event to evaluate system performance. The resulting peak flow generated from the upstream collection system to the Vista Grande canal for this event was determined to be approximately 1,300 cfs. However, only a portion of this flow, approximately 680 cfs, is estimated to actually reach the canal under current conditions, as shown in Figure ES-7. The lower than predicted runoff volume downstream is a result of lack of storm drain system capacity, which produced upstream flooding in certain locations within the Vista Grande watershed.

**Figure ES-7 Vista Grande Watershed Water Balance**




The capacities of the Vista Grande canal and tunnel are approximately 500 and 170 cfs, respectively. Therefore, both are inadequate to covey the 680 cfs peak flow seen at the mouth of the canal during the design storm event. As a result, and as show in Figure ES-7 above, 510 cfs cannot be contained in the existing canal conveyance infrastructure. This lack of conveyance capacity results in surcharging at the tunnel entrance and flooding across John Muir Drive, as shown in Figure ES-8.

**Figure ES-8 Sheet Flow from Vista Grande Canal Overflows**

## Study Goal and Objectives

The overall goal of the Study is to define improvements to resolve flooding at the Vista Grande canal and the residential areas of the watershed for a 10-year storm event in a manner that maximizes benefits and minimizes costs. In order to meet this goal, a number of objectives, listed in Table ES-1, have been developed to serve as the foundation for the identification, development and, ultimately, the selection of, conceptual projects to alleviate flooding issues at Vista Grande canal and within the drainage basin.

**Table ES-1 Primary and Secondary Objectives Developed for the Vista Grande Watershed Study**

| Resource Area | Objectives |
|---|---|
| **PRIMARY OBJECTIVES** | |
| Flood Protection | Eliminate overflows from Vista Grande canal for the 10-year design storm<br>Eliminate flooding throughout the Vista Grande drainage basin for the 10-year design storm |
| Erosion Reduction | Eliminate erosion along John Muir Drive and the banks of Lake Merced for the 10-year storm event<br>Stabilize existing bank erosion as part of an overall flood protection and erosion reduction program |
| Public Safety | Eliminate flood flows and standing water on public roadways and property throughout the Vista Grande drainage basin<br>Incorporate public safety measures into improvements |
| Water Quality Protection | Manage stormwater discharges to ensure public health protection<br>Manage stormwater discharges to ensure beneficial uses of receiving waters |
| **SECONDARY OBJECTIVES** | |
| Water Supply Enhancement | Maximize recharge of the Westside Groundwater Basin<br>Utilize stormwater to augment surface water supplies for appropriate uses |
| Lake Merced Level Enhancement | Utilize stormwater as appropriate to restore Lake Merced to desired levels<br>Utilize stormwater as appropriate to maintain desired Lake Merced levels |
| Habitat Enhancement | Enhance Lake Merced shoreline and wetland habitats<br>Protect aquatic habitats of Lake Merced |
| Recreation and Public Education | Protect and enhance recreational features<br>Incorporate educational features into improvements |

## Preliminary Program Recommendations

The intent of this Study is to establish a general approach to flood protection within the watershed. In order to establish this approach and develop preliminary program recommendations, a number of upstream and downstream alternatives were analyzed. These alternatives were reviewed from a watershed perspective by looking at how potential upstream improvements might impact downstream improvements, and evaluating land availability and the

site constraints of the alternatives. Through this approach, the benefits and limitations of each alternative were identified.

As a result of this alternatives analysis, a preliminary program was developed that includes four major components:

- Tunnel South of County Line
- Vista Grande Wetland
- Upstream Storm Drain Improvements
- Ongoing implementation of Best Management Practices (BMPs) in compliance with the San Mateo Countywide National Pollutant Discharge Elimination System (NPDES) permit.

These four preliminary program components, shown conceptually in Figure ES-9, will solve the flooding issues within Daly City and along the Vista Grande canal while providing additional watershed benefits, such as Lake Merced lake level and habitat enhancement, in accordance with the goals and objectives of the watershed study. The preliminary alternatives and the preliminary program components have been evaluated at a planning level only and none of the potential projects presented in this document have been selected for implementation. Further investigation and detailed design would be necessary prior to implementing any of the concepts presented as part of this study.

For this study, the Tunnel South of County Line was evaluated for the 25-year, 4hr storm; the Storm Drain Improvements option was based on protection for the 10-year, 4hr storm. These levels of protection were used to establish a base line for the preliminary alternatives comparison and planning level cost estimates only. The final design storm for any alternative would be determined as part of future analyses associated with the development of that alternative.

**Figure ES-9 Long-Term Program Components Recommended for Further Evaluation in the Vista Grande Watershed Study**

Planning level cost estimates were developed for each preliminary program component and escalated to the midpoint of construction. The overall preliminary program is expected to cost from $118,000,000 to $165,000,000, as shown in Table ES-2.

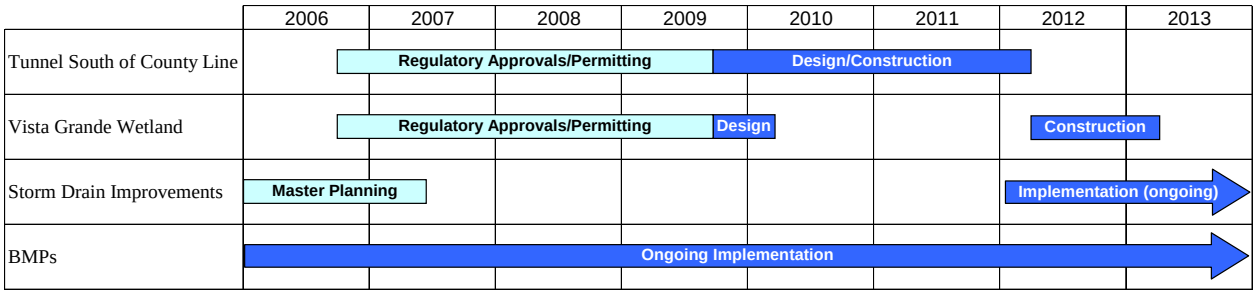
**Table ES-2 Total Cost Estimate for the Vista Grande Watershed Study**

| Preliminary Program Component | Planning Level Cost Estimate Range[a] |
|---|---|
| Tunnel South of County Line | $72,000,000 - $104,000,000 |
| Vista Grande Wetland | $11,000,000 |
| Storm Drain Improvements | $35,000,000 - $49,000,000 |
| Ongoing Best Management Practices | Not Applicable [b] |
| **Total Cost for the Vista Grande Watershed Study** | **$118,000,000 - $165,000,000** |

a. Costs have been escalated to the midpoint of construction for each preliminary program component at a rate of 5% per year.
b. BMP implementation will be ongoing in accordance with the San Mateo County NPDES permit.

The preliminary program components build on each other to solve the flooding problems in the Vista Grande watershed. Developing program components together will improve their effectiveness as a comprehensive watershed-wide solution. Figure ES-10 shows the proposed schedule. This implementation schedule includes only permitting, design and construction phases and is dependent on funding availability. A brief description of each preliminary program component follows.

**Figure ES-10 General Schedule for the Watershed Study**

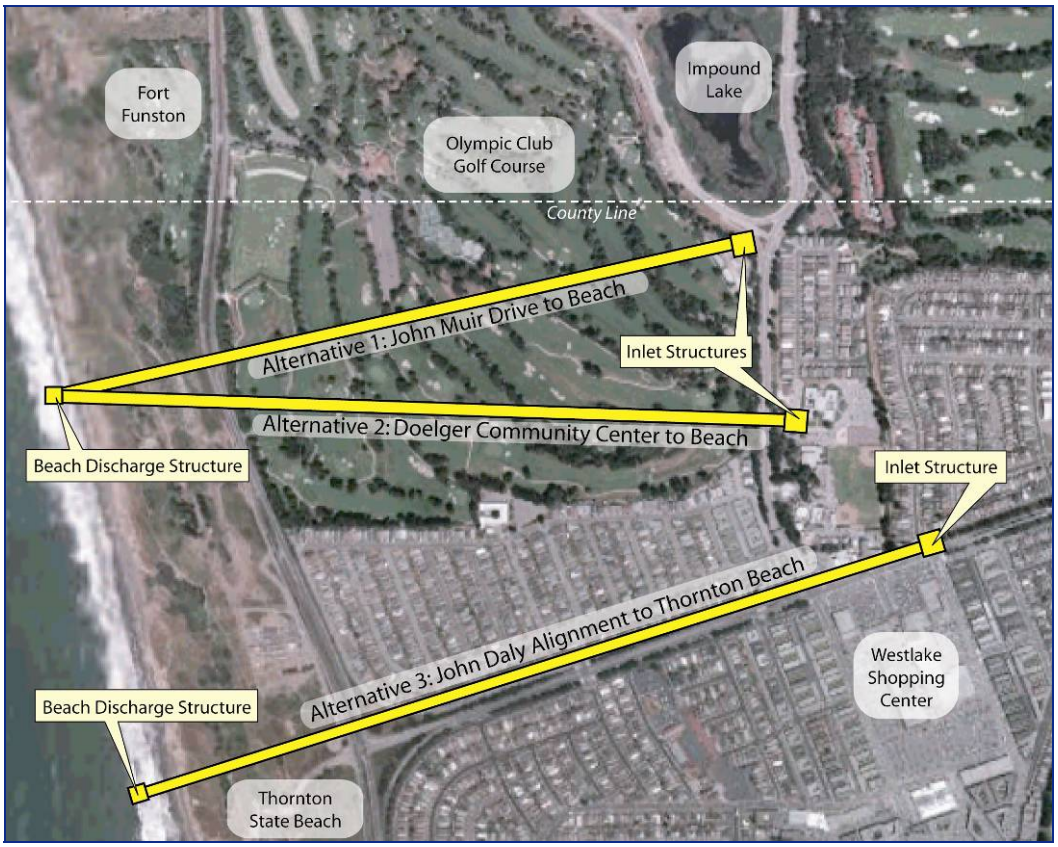



## Tunnel South of County Line

The Tunnel South of County Line is the recommended long-term, downstream flood protection component to the Study. There are three alternate alignments for the tunnel identified as part of the Study (Figure ES-11). There is no preferred alternative at this point, and all three alignments will merit further investigation as part of the permitting and predesign process.

The primary objective of the Tunnel South of County Line is to eliminate flooding in the Vista Grande watershed. The existing Vista Grande canal and tunnel do not have adequate capacity to convey stormwater flows for design storm conditions. This insufficient capacity is responsible for recent overflows and flooding across John Muir Drive into Lake Merced. The new tunnel will circumvent the canal and tunnel by taking flow from the existing storm drain system before it is released into the canal, thereby providing flood protection and ensuring public safety in the Lake Merced area. The elimination of downstream flooding will reduce Lake Merced bank erosion and protect the water quality of the lake. Additionally, with the long-term, upstream component of improving the Daly City storm drain system to provide conveyance for the 10-year design storm event, increased flow will be conveyed downstream. The new tunnel will be sized to convey these increased flows.

**Figure ES-11 Tunnel South of County Line Alignment Map**




While the 10-year storm return period has become standard in California for the design of street drainage facilities, the 25-year or greater return period is used where flooding has the potential to cause property damage or endanger human health. As such, the Tunnel South of County Line was sized using the peak design flow rate for the 4-hour, 25-year event for this preliminary study. The final design storm would be determined as part of a detailed alternatives analysis to determine the optimal design for the Tunnel South of County Line. Table ES-3 provides additional hydraulic design criteria for the tunnel.

**Table ES-3 Hydraulic Design Criteria**

| Criteria | Value | Units | Description |
|---|---|---|---|
| Tunnel Design Capacity | 1,500 | cfs | 4-hour, 25-year storm event |
| Tunnel Interior Diameter | 15.0 | ft | Based on preliminary design calculations |
| Tunnel Length | 4,400-5,400 | ft | Based on preliminary tunnel layouts |
| Tunnel Material | Concrete | - | |
| Manning's n | 0.013 | - | Average value for concrete pipe |
| Initial Invert Elevation | 8 | ft | Based on SF city datum |
| Final Invert Elevation | 4 | ft | Based on SF city datum |
| Slope | 0.0008 | - | Based on invert elevations and tunnel lengths |
| Velocity | <10 | fps | To reduce wear and tear on tunnel |

The construction of the Tunnel South of County Line would be conducted with an Earth Pressure Balance (EPB) tunnel boring machine, as shown in Figure ES-12. The tunnel boring machine operates primarily underground so there are minimal impacts on the surface to traffic and the surrounding community.

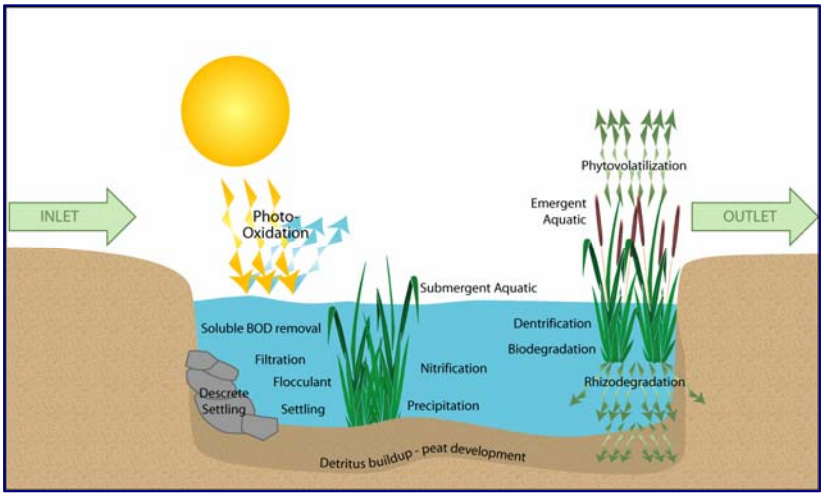
**Figure ES-12 Typical Tunnel Boring Machine**

## Vista Grande Wetland

The Vista Grande constructed wetland is a downstream component recommended to provide water quality improvement for stormwater diverted to Lake Merced. Constructed stormwater wetlands are designed to mimic and improve on the treatment mechanisms of natural wetlands to provide effective treatment of stormwater runoff. Constructed wetlands remove pollutants through a variety of physical and biological mechanisms as shown in Figure ES-13. Additionally, wetlands can provide the added benefits of habitat enhancement, aesthetics, and recreational and educational opportunities.

The Vista Grande Wetland, which would be constructed at the location of the existing Vista Grande canal, is designed to treat a portion of the stormwater diverted from the Vista Grande drainage basin. Water flowing through the wetland would be treated to a level of appropriate quality for diversion to Lake Merced for lake level augmentation. Implementation of the Vista Grande Wetland would need to occur after implementation of the Tunnel South of County Line, since the design requires the abandonment of the existing Vista Grande canal.

**Figure ES-13 Typical Processes Occurring in a Treatment Wetland**




The Vista Grande Wetland is designed to meet several of the objectives of the Study in order to provide multi-faceted benefits and enhance watershed activities. The primary objective met by the wetland is to provide a supply water of an acceptable quality and quantity to augment Lake Merced water levels. In addition, the wetland would provide additional habitat for local and migratory birds adjacent to existing habitat along Lake Merced, and would provide additional recreational and educational opportunities for the users of Lake Merced.

### *Design Criteria and Layout*

The proposed Vista Grande Wetland is located between the northeast limits of the Olympic Golf Course and John Muir Drive, in an 8 acre area along the existing Vista Grande canal as shown in Figure ES-14.

The Vista Grande Wetland design consists of three cells, each approximately 1,100 feet long, with an active treatment area of 5.5 acres. Cell No.1 and No. 3 would be planted with cattail,

while Cell No. 2 would be planted with bulrush. The cattail in Cell No. 1 and the bulrush in Cell No. 2 would be broken up by a deep open-water pool in each cell. Flow control facilities would limit stormwater flows into the wetland to a maximum of 2.0 mgd (3.1cfs). Stormwater would flow by gravity through the wetland into each consecutive treatment cell. It is assumed that water from the last cell would flow by gravity into South Lake through the existing Lake Merced overflow structure. The preliminary layout of the Vista Grande Wetland is provided in Figure ES-15.

**Figure ES-14 Area Along Existing Canal Proposed for Construction of the Vista Grande Wetland**

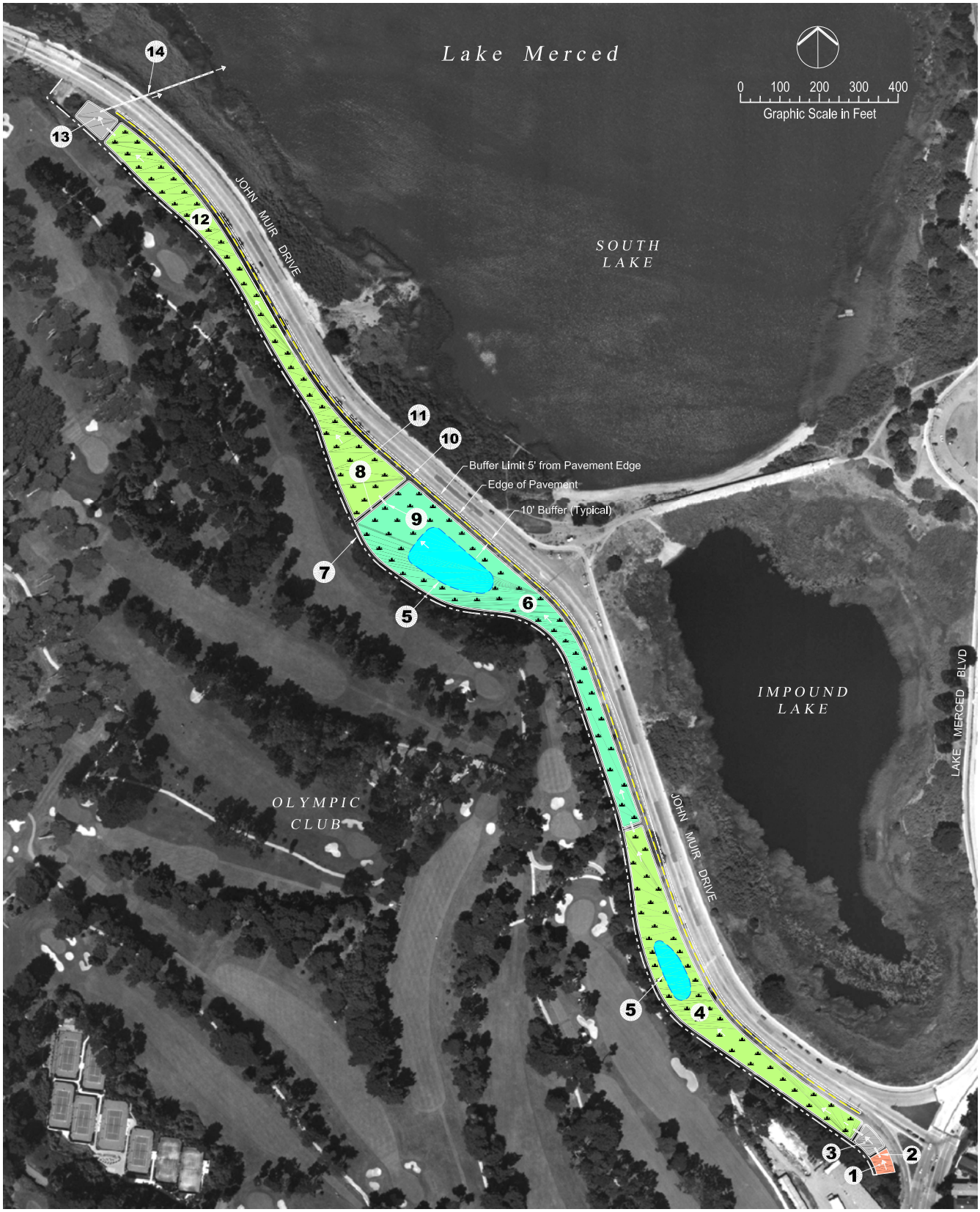
The water quality of both the source water and receiving waters are important considerations in the design of treatment wetlands. As such, the water quality of Lake Merced, the receiving water, and Vista Grande stormwater, the primary source water, have been considered as part of the wetland design. Additionally, because wetlands need a year-round source of water, the water quality of recycled water, a potential alternate source water supply during dry periods, was also considered in the wetland design. The inflow rate of each of the source waters varies based on the chemistry of the source water and water quality requirements of Lake Merced. As such the Vista Grande Wetland design would be able to treat up to 1.9 mgd of stormwater and 0.85 of recycled water (assuming Lake Merced is nitrogen limited) and still provide water of appropriate quality for Lake Merced lake level augmentation, as shown in Table ES-4.

**Table ES-4 Maximum Recommended Wetland Treatment Rates for Stormwater and Recycled Water**

| Water Supply | Flow (mgd) | Estimated Chlorophyll in Lake Merced (mg/L) [a] | | Coliform bacteria in L. Merced (MPN/100 mL) [b] | |
|---|---|---|---|---|---|
| | | With wetland | Ambient | With wetland | Ambient |
| **Stormwater** | | | | | |
| | 1.9 | 0.029 | 0.029 | 2,113 | 1,250 |
| **Recycled Water** | | | | | |
| | 0.85 | 0.027 | 0.029 | NA [c] | 1,250 |

a. Chlorophyll "a" levels based on the limiting nutrient. Nitrogen appears to be the limiting element for plant growth in Lake Merced based on the bioavailable N:P ratio of 0.5 where < 10 = N-limiting, > 15 = P-limiting. If P becomes the limiting nutrient, then water volumes would need to be reduced by about two-thirds to half.
b. The fecal coliform standard for non-contact recreation is 2,000 MPN/mL. Values are based on a simple die-off model but wetlands would actually remove more pathogens due to physical and biological processes.
c. NA = Not applicable, water source is disinfected at the waste water treatment plant (WWTP) prior to entry to the wetland.

There are multiple benefits associated with implementation of the Vista Grande Wetland. An important benefit is the use of the wetland for Lake Merced level enhancement. The variability of the water supply, the wetland treatment capacity and hydrologic conditions will combine to dictate the additional volume to Lake Merced and resulting lake level enhancement. Various water supply scenarios were considered for the purpose of this analysis based on a 5.5 acre wetland treatment capacity. For all scenarios, it is estimated that the lake level would be maintained at a minimum of about 8 feet SF city datum during normal year conditions and 5 feet SF city datum during dry year conditions.




FILE: OVGW-LAYOUT.dwg DATE: 02-20-2005 PROJECT: RMC – VISTA GRANDE WETLANDS

Aerial Photo: 2001

LEGEND:

1. Tunnel / Wetland Interface
2. 8" Drain Pipe into Tunnel / Wetland Interface
3. Settling Basin
4. Wetland - Cell No. 1 Shallow Water with Emergent Cattails
5. Area of Excavated Deep Water Pool
6. Wetland - Cell No. 2 Shallow Water with Emergent Bullrush
7. Olympic Club / Wetland Project Boundary
8. Wetland Cell Partition Berm (Typical)
9. 8" Cell Drain Pipe with Valve (Typical)
10. Traffic Barrier at ℄ of 10' Buffer
11. Wetland Access Road
12. Wetland - Cell No. 3 Shallow Water with Emergent Cattails
13. Outlet Basin
14. 8" Drain Pipe into South Lake

**Figure ES-15**
**Lake Merced**
**Vista Grande Wetlands**
**Project Layout Plan**

In addition, the Vista Grande Wetland provides habitat and recreation benefits. Because of its proximity to South Lake and Impound Lake, it is likely that the Vista Grande Wetland will provide an extension of the nearby wetland habitat for local and migratory bird populations. The Vista Grande Wetland will incorporate an access road for maintenance purposes, which could be used as a public trail for recreational and educational benefits.

## Upstream Storm Drain Improvements

The watershed area drained by the Vista Grande stormwater conveyance system regularly experiences localized flooding during the wet weather season due to capacity constraints throughout the system. Flooding is a public safety concern that causes property damage and traffic issues (Figure ES-16). As such, storm drain improvements are recommended as an upstream component of this Study.

**Figure ES-16 Localized Flooding near Daly City's City Hall**

Although implementation of the downstream tunnel is necessary to solve backwater and overflow issues at the canal, subsequent upstream solutions must be implemented to ensure a 10-year level of protection watershed-wide. The 10-year storm event was selected for this initial evaluation because 10-year level protection is the standard level of protection provided by most Bay Area communities. The actual level of protection to be used in the development of a storm drain master plan would be determined as part of future analyses associated with storm drain master planning. Upstream improvement options may include conveyance solutions, such as pipe or box replacements or new pump stations, or implementation of local detention storage. Any conveyance improvements to the upstream storm drain system will increase flows downstream, and therefore, must be implemented after downstream improvements are constructed.

In order to implement storm drain improvements, Daly City will need to develop a storm drain master plan to identify capital improvement projects necessary to convey the design storm event (the 10-year storm event was used for this study) throughout the storm drain system. Daly City has already begun a key component of the master planning process by developing a model of the Vista Grande storm drain system that includes all major pipes within the drainage basin. Additionally, in winter 2006, Daly City completed a flow monitoring program, which will be used to calibrate the storm drain system model.

## Best Management Practices

**Figure ES-17 Ongoing Nonstructural BMP Implementation in Daly City**

As part of the implementation of the long-term components in the Study, it is intended that Daly City will continue to implement BMPs and other activities in compliance with San Mateo Countywide Stormwater Management Plan and Countywide Stormwater National Pollutant Discharge Elimination System (NPDES) permit. Implementation of BMPs by Daly City under the countywide NPDES will include nonstructural BMPs, such as those related to municipal maintenance, commercial/industrial/illicit discharge, new development and construction,

integrated pest management and watersheds and monitoring, as shown in Figure ES-17.

Additionally, as part of provision C.3 of the countywide NPDES permit, Daly City will continue to include conditions of approval in permits for applicable new development and redevelopment projects. The goal of the C.3 requirements is to address pollutant discharges and changes in runoff flows from new development and significant redevelopment projects, through implementation of post-construction and treatment measures, source control, and site design measures, to the maximum extent practicable. Such BMPs may include implementation of design characteristics to maximize infiltration where appropriate, providing landscape characteristics that slow runoff and maximize potential detention or retention, and minimization of impervious land cover.

## Program Implementation Strategies

Implementation of the projects identified in this Study will be an involved, multi-year process. Successful implementation will depend on securing funding, developing a public outreach plan, complying with regulatory requirements, and establishing long-term agreements between the involved parties.

## Financing Strategies

Financing a project of this magnitude requires a well planned strategy for acquiring funds from a variety of sources. Innovative local financing techniques combined with State and Federal funding opportunities will generate the support necessary to make these projects a reality.

Because of the unique nature of stormwater projects and relevant California law, potential revenue sources are restricted, and must be approved by voters. However, once a revenue source has been secured, it can be used to borrow funds through a debt issuance that can then be used to finance the projects. In addition, ongoing revenue streams are available for pay-as-you-go improvements on a continuing basis, as well as operating and maintenance expenses. The general approach for each of the long-term components of the Study is provided in Table ES-5.

**Table ES-5 General Approach for funding Vista Grande Watershed Study components**

| Component | Funding Approaches |
|---|---|
| Tunnel South of County Line | The tunnel must be funded at one time, as phasing of construction costs is not a realistic option. Potential funding options include debt financing and/or State or Federal appropriations or grants. Debt financing would require an identified, steady revenue stream, such as service charges or parcel charges. Addtionally, State and Federal funding may be required to help with the costs of the tunnel. |
| Storm Drain Improvements | Storm drain improvements are most appropriately funded through a pay-as-you-go financing strategy. Revenues to fund these improvements may be funded from sewer service charges and/or new drainage service charges. |
| Vista Grande Wetland | Because of the enhancment benefits of this project, there would likely be opportunities for State and Federal grant fuding to help cover the costs of the Vista Grande Wetland. |

The preliminary program recommendations of the Vista Grande Watershed Study integrate several water management elements, including flood protection, stormwater management, water quality and treatment, wetlands creation, and habitat creation. As a result, these preliminary program recommendations would potentially be eligible for funding through a variety of State and Local funding mechanisms such as Proposition 40 or 50 funding. Communication and support from State and Federal legislators will be essential to acquire funding through these

programs. Additionally, the Study components should be included in the Bay Area Integrated Regional Water Management Plan (IRWMP).

## Regulatory Requirements

Regulatory compliance will include compliance with local jurisdictions including the CCSF, Daly City, and San Mateo County, environmental documentation under the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), as well as compliance with a number of requirements to secure the appropriate State and Federal permits. Securing the appropriate State and Federal permits and agreements will be a significant part of implementing the projects identified in this Study. The permitting process is extensive and will require a significant investment of time and resources in the project. Overall the permitting process is expected to take approximately three years. Advance preparation and coordination with the agencies can help maximize efficiency in this process. Anticipated State and Federal permit requirements are provided in Table ES-6.

**Table ES-6 Summary of State and Federal Regulatory Requirements**

| Agency | Permit or Requirement | Project Component Regulated |
|---|---|---|
| US Army Corps of Engineers | §404 Clean Water Act Permit | Tunnel, Wetland |
| | §10 Rivers and Harbors Act Permit | Tunnel, Wetland |
| US Fish and Wildlife Service | §7 Endangered Species Act Consultation | Tunnel, Wetland |
| National Marine Fisheries Service | §7 Endangered Species Act Consultation | Tunnel |
| San Francisco Regional Water Quality Control Board | §401 Clean Water Act Permit | Tunnel, Wetland |
| | §402 Clean Water Act Permit - NPDES: General Construction Activity Stormwater Permit | Tunnel, Wetland, Storm Drain Improvements |
| | Waste Discharge Requirements (WDRs) | Waived if §401 Permit required, Tunnel Inlet |
| CA Department of Fish and Game | Streambed Alteration Agreement (§1602 permit) | Wetland |
| CA Coastal Commission and/or Daly City Local Coastal Program, CCSF Local Coastal Program | Coastal Development Permit or Public Works Plan | Tunnel, Wetland |
| Golden Gate National Recreation Area and/or CA State Parks | Special Use Permit | Tunnel Construction |
| | Right-of-Way Permit | Tunnel |
| CA Department of Transportation | Encroachment Permit | Tunnel |
| CA State Lands Commission | General Lease – Right-of-Way | Tunnel, Wetland |

## Public Outreach and Community Involvement

The education and involvement of the community is essential to the successful implementation of the preliminary program laid out in the Study. A successful outreach strategy will help generate public understanding and support for the program. Effective public outreach requires a well developed, cohesive approach; ad hoc, sporadic actions are unlikely to result in the desired public understanding for the program. Key steps in development of an outreach program for the Study components include:

- Appointment of a public outreach coordinator
- Identification of community interests and concerns that must be addressed
- Establishment of clear and specific goals for outreach and community involvement
- Development of program message to raise community awareness and identify program benefits
- Identification of effective methods for distribution of messages to the public
- Establishment of a method to evaluate effectiveness of the program

Public support is necessary for the preliminary program's overall success. Therefore developing and implementing a well thought out program through proactive and ongoing stakeholder outreach to involve the public will improve support for the project, ease project financing, and increase the efficiency of the implementation process.

## Institutional Arrangements

The Study involves many different organizations each with their own needs and interests and will require the long-term cooperation of many of the involved parties. Coordination agreements between the key agencies will need to be established to ensure a long-term commitment to the program and may be necessary to secure funding and regulatory approval for the project components as part of a comprehensive watershed plan. In addition, it will be necessary to secure the appropriate right-of-ways to the project areas. Table ES-7 summarizes the relationships that are involved in implementing the Study. This Study continues past cooperative efforts between CCSF and Daly City on resolving integrated water resources issues involving recycled water, groundwater, stormwater, and Lake Merced. However, participation of CCSF as a joint sponsor of this report should not be interpreted as a commitment by CCSF to contribute funding for projects outside of its jurisdiction.

**Table ES-7 Summary of Recommended Institutional Arrangements**

| Agencies | Relationship |
|---|---|
| City of Daly City<br>&<br>San Mateo County | Stormwater from the portion of unincorporated San Mateo County that is located within the Vista Grande Drainage Basin contributes to the current capacity problems. An arrangement between the County and Daly City will be necessary to ensure the County participates in the funding and implementation of the tunnel and storm drain improvements. |
| City of Daly City<br>&<br>City and County of San Francisco | Historic conflicts over the flooding at the Vista Grande canal require that these two agencies enter into a Memorandum of Understanding (MOU) that clarifies each city's commitment to the program and establishes a plan for ongoing communication. |
| City of Daly City<br>&<br>Golden Gate National Recreation Area and/or California State Parks | The City of Daly City will need to establish a right-of-way agreement with GGNRA and/or California State Parks for the tunnel and its outlet structure depending on the final alignment selected. In addition a Special Use Permit will be required for access through the park area during the construction phase. |
| City of Daly City<br>&<br>Private property owners | An easement for the tunnel alignment will need to be obtained. When the final tunnel alignment is selected, the affected property owners would need to be identified and the appropriate easements secured (e.g. the Olympic Club if the John Muir Drive to Beach alignment is selected). |

| | |
|---|---|
| City of Daly City and/or the City and County of San Francisco<br>&<br>The Olympic Club | A portion of the Olympic Club near the wetland may need to be regraded to convey overland runoff into the upstream end of the wetland. Based on the conceptual level design of the Vista Grande Wetland, this grading is expected to be limited to the area immediately surrounding the Vista Grande canal, and is not expected to modify active portions of the golf course or interfere with course play. An agreement with the Olympic Club will need to be established to perform this work or the land will need to be acquired. |

## Next Steps

As discussed previously, the intent of this Study is to establish a general approach to flood protection within the watershed. Since this is a planning level document, the preliminary alternatives included in the preliminary program have not been selected for implementation and acceptance of this Study by the agencies does not constitute adoption of these alternatives. Rather, it is recommended that the agencies accept this study as a general approach for further investigation to solve flooding in the Vista Grande watershed.

The next steps in developing the preliminary program recommendations identified in this Study include:

- Defining the Recommended Program
- Defining a funding approach and establish a financing plan
- Maintaining coordination between key agencies
- Conducting preliminary design of the Recommended Program components
- Obtaining required permits and regulatory approvals
- Conducting final design of the Recommended Program components
- Constructing the Recommended Program components
- Performing maintenance on the Vista Grande drainage basin until a long-term solution is implemented

In order to streamline the implementation process, several critical path items have been identified within these next steps and are described in Table ES-8, below.

**Table ES-8 Next Steps**

| Element | Steps |
|---|---|
| Continued Development and Refinement of the Preliminary Program Recommendations | The Vista Grande Watershed Study is a planning level document. As such, each of the preliminary long-term program components will require further planning and investigation including:<br><br><u>Storm Drain Improvements</u><br>• Calibrate existing model based on flow monitoring data<br>• Conduct storm drain modeling to evaluate local storage and define design flow criteria<br>• Develop a storm drain master plan<br><br><u>Tunnel South of County Line</u><br>• Conduct site survey and geotechnical investigation<br>• Evaluate inlet hydraulics and need for interim bypass facilities<br>• Evaluate the location and conceptual design for the beach outlet structure<br>• Identify alternative locations and mechanisms for spoils disposal<br>• Conduct alternatives analysis to refine concepts and define preliminary recommendations<br>• Conduct CEQA/NEPA analyses and finalize recommendations<br><br><u>Vista Grande Wetland</u><br>• Conduct water quality monitoring to define seasonal variations in quality with respect to potential constituents of concern<br>• Quantify dry-weather stormwater flows in the Vista Grande canal<br>• Conduct alternatives analysis to refine concepts and define preliminary recommendations<br>• Conduct CEQA/NEPA analyses and finalize recommendations |
| Funding | Further investigation and identification of the funding strategies will be essential to identify and secure the necessary backing to implement the preliminary program. Pursuing a variety of funding sources and developing a detailed financing plan will be necessary. |
| Coordination between Agencies | Successful implementation of the Vista Grande Watershed Study will depend on establishing a successful working arrangement between the key agencies. Clearly defining the long-term relationships between the interested parties may be necessary to secure funding and regulatory approval for the project components as part of a comprehensive watershed plan. |
| Regulatory Requirements / Permitting | Securing the appropriate permits and regulatory agreements is necessary prior to program implementation. This is expected to be a lengthy and involved process, thus it is essential to begin as soon as possible. Arranging or attending an interagency meeting will jumpstart this process, and will ensure that all of the appropriate regulatory requirements are met. In addition, the agencies should consider preparing a public works plan with the CA Coastal Commission, since a public works plan may make the permitting process more efficient. |
| Maintenance | Maintenance of the Vista Grande drainage system, especially the Vista Grande canal and the Vista Grande tunnel, will be essential in minimizing flooding damages until a long-term program is in place. This maintenance should include a pre-storm season walkthrough of the canal and adjacent areas to identify debris and other maintenance activities to be conducted prior to the storm season. Maintenance during storm events could be enhanced by installing a mechanical device to catch and remove debris to maintain flow through the canal and tunnel. |

# Chapter 1

# Introduction

# Chapter 1 Introduction

The Vista Grande Watershed Study is being developed jointly by the City of Daly City (Daly City) and City and County of San Francisco (CCSF). The goal of the study is to define improvements to resolve flooding issues in the watershed in a manner that maximizes benefits and minimizes costs. Both primary and secondary objectives were developed to guide project development in order to meet the study goal. The primary objectives of flood protection, erosion reduction, public safety, and water quality protection address the flooding issues associated with the Vista Grande canal and the watershed storm drain system. The secondary objectives of water supply enhancement, Lake Merced level enhancement, habitat enhancement, recreation, and public education, take advantage of emerging local opportunities and stakeholder input to consider multiple benefits when developing project concepts.

This watershed study evaluates a number of alternatives to address flooding issues within the Vista Grande watershed. Through this analysis, the study recommends a preliminary combination of potential solutions that can be implemented as part of a long-term watershed program to solve flooding issues within the watershed while addressing a number of secondary objectives. Planning level cost estimates, conceptual level design, benefits and implementation strategies are evaluated for the preliminary program recommendations identified in this Vista Grande Watershed Study.

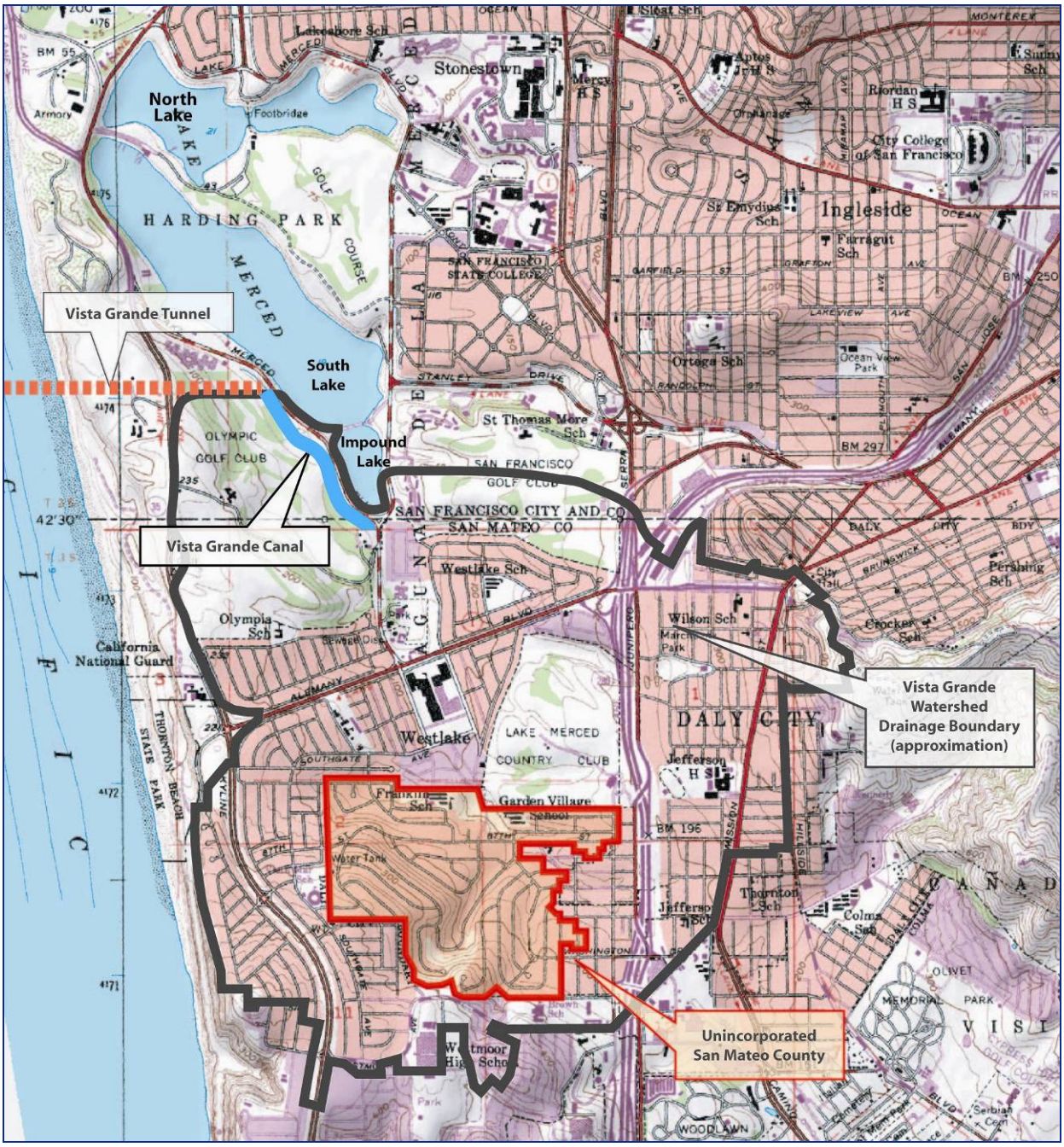
## 1.1 Intent of Document

The intent of the Vista Grande Watershed Study is to establish a general approach for further investigation to provide flood protection within the watershed. In order to establish this approach, a number of preliminary options were evaluated to identify potential solutions to the flooding problems within the Vista Grande watershed. The Watershed Study's preliminary program recommendations were based on the findings of this initial alternatives analysis. The preliminary alternatives presented in this study have been evaluated at a planning level only and none of the alternatives have been selected for implementation. Further investigation and detailed design would be necessary prior to implementing any of the concepts presented as part of this study. Chapter 6 Implementation Strategies presents information on the next steps for developing the findings of this study and implementing a comprehensive watershed program to solve flooding issues in the watershed.

## 1.2 Study Area and Watershed Description

The study area includes the Vista Grande watershed area in northwestern San Mateo County. This watershed is approximately 2.5 square miles in area and borders San Francisco County on the north, Colma Creek watershed to the south and east, and the Pacific Ocean on the west. The watershed is drained through the Vista Grande canal and tunnel which are located in the City and County of San Francisco near the southern shoreline of Lake Merced. Figure 1-1 illustrates the location of the overall watershed including Lake Merced, Vista Grande drainage area, canal, and tunnel.

**Figure 1-1 Location of Vista Grande Drainage Basin**




This Vista Grande watershed is a densely developed urban community surrounded by hills on the east, west, and south, as shown in Figure 1-2. The primary land uses are residential, commercial, and recreational land with a high percentage of impervious surfaces, such as roads, roofs, and parking lots. The watershed contains portions of two large golf courses, and completely encompasses a third. The major hydrologic features associated with the watershed area include the Vista Grande storm drain collection system, the Vista Grande canal and tunnel, and Lake Merced. Each is described in more detail below.

**Figure 1-2 Vista Grande Watershed**

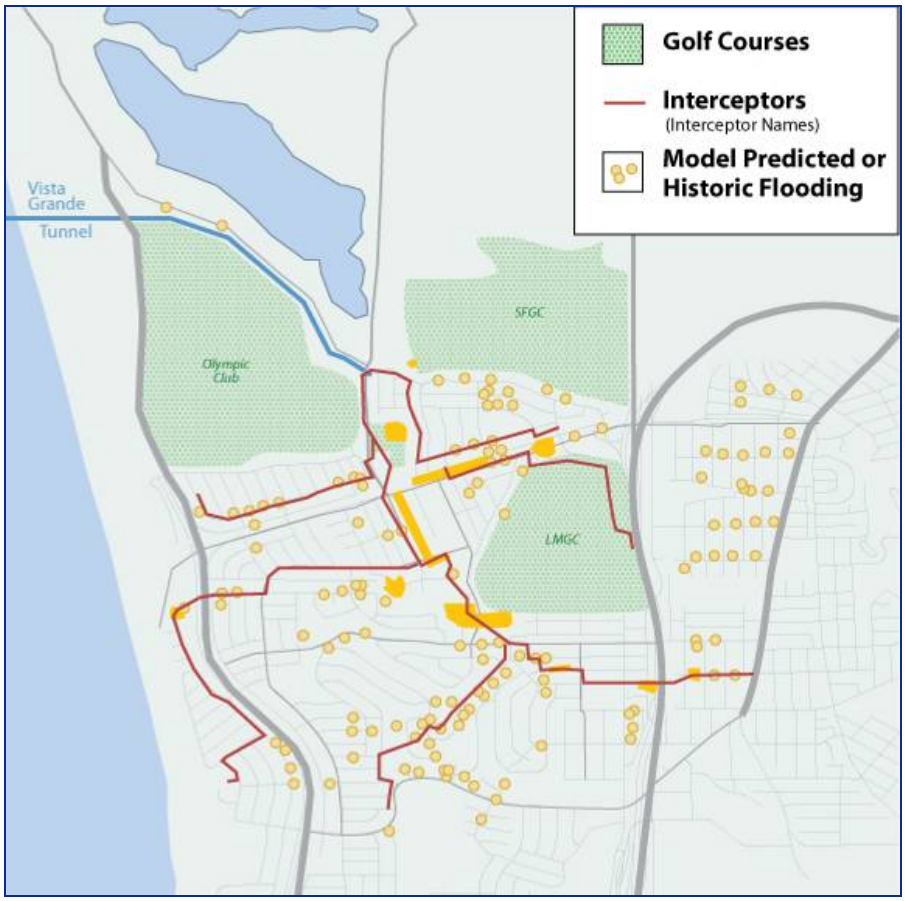
Source: Google, 2006

### 1.2.1 Vista Grande Stormwater Collection System

As shown in Figure 1-1, the Vista Grande portion of Daly City's stormwater collection system drains the northwestern area of Daly City and an unincorporated portion of San Mateo County. This underground collection system routes storm flows northwest to Vista Grande canal and tunnel for discharge to an outfall structure at the beach below Fort Funston. The existing Vista Grande storm drain system is comprised of storm sewers, box culverts, manholes, catch basins, and flow equalizations facilities, with approximately 30 miles of pipe, ranging in size from 6 to 72 inches diameter, plus some box culverts (CH2M Hill, 2002.) Pipe materials include reinforced concrete, vitrified clay, corrugated metal, and plastic. The system is currently maintained by Street Division of the Daly City Public Works Department.

The Vista Grande storm drain system experiences flooding and/or surcharging conditions along major trunk lines and throughout the stormwater collection system, typically several times each winter (CH2M Hill, 2002.) Locations of the major trunk lines that experience flooding and areas of model predicted or known flooding in the basin are shown in Figure 1-3.

**Figure 1-3 Vista Grande Watershed Flooding Locations**




### 1.2.2 Vista Grande Canal and Tunnel

The Vista Grande canal and tunnel are located near Lake Merced, as shown in Figure 1-1 and are the downstream conveyance structures of the Vista Grande stormwater collection system for Daly City and unincorporated San Mateo County.

The Vista Grande canal runs adjacent to the west side of John Muir Drive, paralleling the southwest shores of Lake Merced, as shown in Figure 1-4, Figure 1-5, and Figure 1-6. The canal is a 3,600-foot-long trapezoidal channel lined with brick. The canal tapers downstream; therefore, its dimensions vary, and are 7 feet deep by 4 feet wide with a flow capacity of 500 cubic feet per second (cfs) in some places and 11 feet deep by 11 feet wide with a flow capacity of 900 cfs in other places (CH2M Hill, 2002). The side slopes of the channel are approximately 1:1. Historically, wet weather flows in excess of the capacity of the canal and tunnel result in local flooding and overflows across John Muir Drive into Lake Merced. This flooding has caused property damage, bank erosion, traffic nuisances, and public safety issues.

**Figure 1-4 Upstream End of Vista Grande Canal**

**Figure 1-5 Access Road to Vista Grande Canal**

**Figure 1-6 Vista Grande Canal Narrow Section**

At the terminus of the canal is the mouth of the Vista Grande tunnel, as shown in Figure 1-7 and Figure 1-8. This tunnel is the primary outlet for stormwater from the Vista Grande watershed, and was constructed in 1897. The tunnel is a 3,000-foot-long, 7-foot by 4-foot egg-shaped gravity conduit with an average cross-sectional area of 22.25 square feet (CH2M Hill, 2002). The tunnel has a non-surcharged capacity of 170 cfs. Stormwater exiting the tunnel discharges to the beach below Fort Funston through a beach outfall structure, as shown in Figure 1-9.

**Figure 1-7 Vista Grande Tunnel Entrance**

**Figure 1-8 Vista Grande Canal/Tunnel Interface**

**Figure 1-9 Vista Grande Outfall Located on the Beach below Fort Funston – Facing North**

During dry weather conditions, North San Mateo County Sanitation District (NSMCSD) discharges treated secondary wastewater effluent to the upstream end of the tunnel. Wastewater discharges are regulated under NSMCSD's wastewater National Pollution Discharge Elimination System (NPDES) permit (Order#99059) and are discharged beyond the beach structure through an ocean outfall structure

that extends 2,500 feet out into the Pacific Ocean. During wet weather conditions, NSMCSD bypasses the Vista Grande tunnel and places the effluent in a force main below the Olympic Club to bypass the tunnel for discharge through the ocean outfall.

### 1.2.3 Lake Merced

As seen in Figure 1-1, Lake Merced is located just north of the San Mateo County line. This lake is owned, managed, and monitored by the San Francisco Public Utilities Commission (SFPUC), and it can be utilized as an emergency non-potable water supply. The San Francisco Recreation and Park Department (SFRPD) manages the surface of the Lake Merced tract pursuant to a 1950 resolution adopted by the SFPUC and the SFRPD. Lake Merced is comprised of four lakes: North, East, South, and Impound Lakes. South Lake and Impound Lakes are the two lakes directly impacted by the Vista Grande canal overflows.

Lake Merced is the largest freshwater lake in San Francisco, and is a valuable natural resource and recreational area for nearby communities on the peninsula, as shown in Figure 1-10 and Figure 1-11. Lake Merced contains the largest expanse of wetland habitat in San Francisco and supports of array of sensitive plant and animal species, and provides a valuable refuge for migratory birds (SFRPD, 2005). Wetland areas, particularly those at Impound Lake, are known to contain sensitive plant species, and for this reason Impound Lake and its associated wetlands are considered priority areas for conservation by the SFRPD Natural Areas Program (SFRPD, 2005.)

**Figure 1-10 South Lake**

**Figure 1-11 Trail between South Lake and Impound Lake**

The quality and quantity of water in Lake Merced has been the focus of much study in recent years. Existing lake water quality is eutrophic for a majority of the year with high nutrient levels (EDAW, September 2004a). Lake Merced's water level fluctuates seasonally as a result of changes in temperature and precipitation. However, recent studies have concluded that drought, reduction in the natural stormwater flows from the Vista Grande and Lake Merced watersheds, and increases in local groundwater pumping may all contribute to a long-term decline in lake levels (CH2M Hill, 2002). As a result, evaluations have been conducted to examine potential water supply augmentation alternatives, including the potential use of Vista Grande stormwater flows, for the purpose of increasing the water surface elevation of Lake Merced.

Uncontrolled overflows to Lake Merced from flooding at the Vista Grande canal and tunnel can occur during wet weather events, as shown in Figure 1-12. These uncontrolled overflows can impact water quality in Lake Merced through the introduction of constituents of concern commonly found in stormwater including oil and grease, total coliform, total suspended solids, metals, and nutrients (CH2M Hill, 2001). Also, bank erosion caused by flood flows can increase sediment loading to the Lake.

**Figure 1-12 Vista Grande Canal Overflow at John Muir Boulevard**

## 1.3 Hydrology

Previous hydrologic investigations and modeling for the Vista Grande watershed stormwater conveyance system utilized rainfall data for the 10-year, 4-hour storm to evaluate system performance. The resulting peak flow generated from the upstream collection system to the Vista Grande canal for a 10-year, 4-hour storm event was determined to be approximately 1,300 cfs (Kennedy/Jenks, 1983).

The 10-year storm event return period has become standard in California for street drainage design as it provides a balance between level of service and affordability. Where flooding has the potential to cause property damage or endanger human health, flood control systems are usually designed to protect against a 25-year or greater storm event. Previous hydrologic investigations had not modeled the resulting peak flow at the Vista Grande canal for a 25-year, 4-hour storm. As part of the Vista Grande Watershed Study, the peak flow for a 25-year, 4-hour storm event was calculated. Table 1-1 presents the peak flows at the Vista Grande canal for varying design storms.

**Table 1-1 Peak Flows at the Vista Grande Canal [a]**

| Design Storm | Peak Flow (cfs) | Source |
|---|---|---|
| 5-year, 4-hour | 1,140 | Kennedy/Jenks, 1983 |
| 10-year, 4-hour | 1,300 | Kennedy/Jenks, 1983 |
| 25-year, 4-hour | 1,500 | Calculated [b] |

Footnotes:

a. For the investigations discussed herein, it was assumed that the storm event was uniformly distributed over the entire Vista Grande watershed.

b. The 25-year rainfall was obtained from the 25-year, 6-hour isopluvial map for Northern California from NOAA Atlas 2, Volume XI. The volume of rainfall (in inches) was converted to a rainfall intensity (inch/hour) for a 4-hour storm using the unit rainfall distribution curve developed for the Richmond-Sunset rain gauge station (Kennedy/Jenks, 1983). Then, the rational formula (Q=CiA) was used to determine peak discharge (cfs) for each of the three drainage areas encompassed by the Vista Grande watershed, assuming an overall watershed area of 1,673 acres and an average C-value of 0.71.

Although 1,300 cfs is the peak flow generated by the Vista Grande watershed during a 10-year, 4-hour storm, only a portion of that flow, approximately 680 cfs, is estimated to actually reach the canal under current conditions as shown in Figure 1-13 (Kennedy/Jenks, 1983; CH2M Hill, 2002). The lower than predicted runoff volume downstream is a direct result of the lack of storm drain system capacity, which produces upstream flooding in portions of the Vista Grande watershed as shown in Figure 1-14.

**Figure 1-13 Vista Grande Watershed Water Balance**

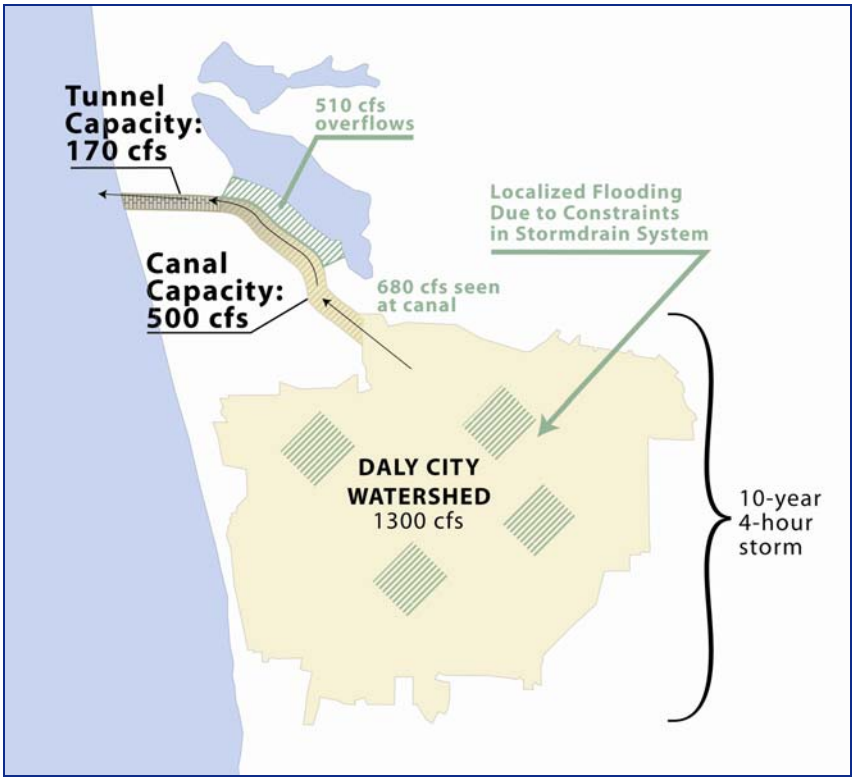


**Figure 1-14 Upstream Flooding in the Vista Grande Watershed**

The capacities of the Vista Grande canal and tunnel are approximately 500 cfs and 170 cfs (CH2M Hill, 2002), respectively. Therefore each are inadequate to convey the 680 cfs peak flow seen at the mouth of the canal during the 10-year, 4-hour storm event. As a result, 510 cfs cannot be contained in the existing canal conveyance infrastructure. The lack of conveyance capacity in the canal and tunnel results in surcharging at the tunnel entrance and flooding across John Muir Drive, as shown in Figure 1-15.

**Figure 1-15 Sheet flow from Vista Grande Canal Overflows**

## 1.4 Problem Description

Stormwater flows in excess of the Vista Grande stormwater conveyance system capacity frequently result in localized flooding and overflows during the wet weather season. Flooding along the Vista Grande canal causes traffic issues and safety concerns along John Muir Drive, road and property damage, bank erosion along Lake Merced, and overflows to Lake Merced which can result in water quality impacts to the lake. Additionally, backwater conditions at the canal combined with capacity constraints throughout the storm drain system, result in flooding of the upstream portions of the watershed in Daly City. These conditions result in additional public safety concerns and potential traffic impacts and property damage. As such, the Vista Grande Watershed Study utilizes a watershed approach to examine a number of potential upstream and downstream solutions to address flooding throughout the watershed area.

## 1.5 Organization of Document

The Vista Grande Watershed Study is organized as follows:

- Chapter 1 Introduction: Provides background information on the watershed and the hydrology, and states the nature of the problem.
- Chapter 2 Project Approach and Objectives: Discusses the project approach and objectives that were developed for the Vista Grande Watershed Study.
- Chapter 3 Previous Studies: Provides a summary of the key studies completed to date.
- Chapter 4 Alternatives Considered: Provides an inventory of the alternatives proposed dating to solve flooding in the Vista Grande watershed. The alternatives are organized into upstream alternatives, downstream alternatives, alternatives recommended for further evaluation, and interim alternatives.
- Chapter 5 Preliminary Program Recommendations: Provides a conceptual level analysis of the various components of the preliminary program recommendations. The preliminary program recommendations include a Tunnel South of the San Mateo County Line, a wetland at the Vista Grande canal, upstream storm drain improvements and ongoing implementation of Best Management Practices (BMPs).
- Chapter 6 Implementation Strategies: Discusses implementation strategies for the preliminary program recommendations, including an approach to program funding, public outreach, regulatory requirements, institutional arrangements, implementation schedule and next steps.

# Chapter 2

# Project Approach and Objectives

# Chapter 2 Project Approach and Objectives

The Vista Grande Watershed Study is a joint study between Daly City and the CCSF. The study focuses on addressing flooding issues throughout the Vista Grande drainage area in a manner that minimizes cost and maximizes benefits. As such, a watershed approach is taken for the planning effort which includes both stakeholder involvement and development of project objectives to help the identification and evaluation of preliminary project alternatives. This chapter describes the project approach, including stakeholder involvement, and outlines the goals and objectives of the Vista Grande Watershed Study.

## 2.1 Project Approach

The Vista Grande Watershed Study is intended to serve as a planning level document to identify conceptual solutions to meet the goal of resolving flooding at the Vista Grande canal and in the Vista Grande drainage basin for the 10-year storm event. The study takes a watershed approach by incorporating stakeholder input into the planning process, developing a set of objectives to help guide the development and selection of potential solutions, and looking watershed-wide, at both upstream and downstream options, for potential solutions to addressing flooding in the watershed. Because flooding affects multiple agencies and areas within the watershed, and because potential solutions may have an interface with Lake Merced and a number of environmental and regulatory considerations, stakeholder coordination was an important component of the project.

### 2.1.1 Stakeholder Involvement

A number of different stakeholders have been consulted with in development of the Vista Grande Watershed Study. The stakeholder outreach process included meetings with different stakeholders interested in management of stormwater in the Vista Grande watershed area to discuss background issues, potential project concepts, and regulatory and environmental issues. The organizations and agencies involved in these meetings included:

- City of Daly City Department of Public Works
- San Francisco Department of Public Works
- San Francisco Recreation and Park Department
- The Olympic Club
- Regional Water Quality Control Board
- California Coastal Commission
- Golden Gate National Recreation Area
- San Francisco Department of Public Health
- California Native Plant Society
- California State Parks
- San Francisco Public Utilities Commission
- City of Daly City Department of Water and Wastewater
- Lake Merced Task Force's Water Committee
- Friends of Lake Merced
- US Environmental Protection Agency
- US Army Corps of Engineers
- California Department of Fish and Game
- San Mateo County Department of Public Health
- Local Homeowners Associations
- Local Residents

In addition to the smaller group meetings to discuss the objectives and project concepts, a public meeting was held on July 27, 2005 in Daly City to provide attendees with information on the Vista Grande Watershed Study, the goals of the study, and different alternatives being analyzed as part of the study. Stakeholders were invited to submit comments on planning process and the alternatives being analyzed as part of the study. Both previously contacted stakeholder groups and the general public were invited to the

workshop, with over 25 stakeholders attending. The list of stakeholder attendees is included in Appendix B. In addition to the July 2005 workshop, a second public workshop was held on March 30, 2006, coinciding with the release of the Draft Watershed Study to the public for review and comment. The list of stakeholder attendees for the March 2006 workshop is included in Appendix H.

## 2.2 Study Goal and Objectives

As stated above, the overall goal of the Vista Grande Watershed Study is to define improvements to resolve flooding at the Vista Grande canal for the 10-year storm event in a manner that maximizes benefits and minimizes costs. In order to meet this goal, a number of objectives have been developed to serve as the foundation for the identification, development and, ultimately, the selection of, conceptual projects to alleviate flooding issues at Vista Grande canal and within Vista Grande drainage basin. The objectives were developed with input from Daly City and the CCSF, and other stakeholder groups with an interest stormwater management in the Vista Grande watershed.

Both primary and secondary objectives have been developed to specifically define projects that meet the project goal. Primary objectives are designed to address the flood protection issues associated with flooding at the Vista Grande canal and in the drainage basin including erosion, public safety and water quality concerns. Secondary objectives are developed to take advantage of emerging opportunities and stakeholder input to consider multiple benefits when developing project concepts including water supply enhancement, Lake Merced lake level enhancement, habitat protection and recreation and public education opportunities. The primary and secondary objectives are listed in Table 2-1 below.

**Table 2-1 Primary and Secondary Objectives Developed for the Vista Grande Watershed Study**

| Resource Area | Objectives |
|---|---|
| **PRIMARY OBJECTIVES** | |
| Flood Protection | Eliminate overflows from Vista Grande canal for the 10-year design storm<br>Eliminate flooding throughout the Vista Grande drainage basin for the 10-year design storm |
| Erosion Reduction | Eliminate erosion along John Muir Drive and the banks of Lake Merced for the 10-year storm event<br>Stabilize existing bank erosion as part of an overall flood protection and erosion reduction program |
| Public Safety | Eliminate flood flows and standing water on public roadways and property throughout the Vista Grande drainage basin<br>Incorporate public safety measures into improvements |
| Water Quality Protection | Manage stormwater discharges to ensure public health protection<br>Manage stormwater discharges to ensure beneficial uses of receiving waters |
| **SECONDARY OBJECTIVES** | |
| Water Supply Enhancement | Maximize recharge of the Westside Groundwater Basin<br>Utilize stormwater to augment surface water supplies for appropriate uses |
| Lake Merced Level Enhancement | Utilize stormwater as appropriate to restore Lake Merced to desired levels<br>Utilize stormwater as appropriate to maintain desired Lake Merced levels |
| Habitat Enhancement | Enhance Lake Merced shoreline and wetland habitats<br>Protect aquatic habitats of Lake Merced |
| Recreation and Public Education | Protect and enhance recreational features<br>Incorporate educational features into improvements |

# Chapter 3

# Previous Studies

# Chapter 3 Previous Studies

The Vista Grande stormwater conveyance system and watershed area has been evaluated in a number of reports and studies for the CCSF, the Daly City and San Mateo County over the last twenty years. This chapter summarizes key studies conducted on the Vista Grande stormwater conveyance system and watershed area. Many of the alternatives developed through these previous studies have been used as the technical basis for development and analysis of the alternatives included in the Vista Grande Watershed Study.

## 3.1 Vista Grande Storm Sewer Project Draft Report (Kennedy/Jenks Engineers, 1983)

In 1983, Kennedy/Jenks Engineers (Kennedy/Jenks) prepared a report for Daly City on the Vista Grande Storm Sewer System. The purpose of the study was to analyze the capacity of the Vista Grande stormwater conveyance system, present findings of deficiencies, and identify potential implementation alternatives to reduce flooding. As part of this study, Kennedy/Jenks:

- Evaluated the capacity of the existing stormwater conveyance system for three design storms (5-year, 4-hour storm; 10-year, 4-hour storm; 25-year, 4-hour storm).
- Estimated the probable collection system flows generated by each design storm.
- Developed and evaluated solutions for capacity limitations at the tunnel.
- Identified recommended system improvements to increase storm flow capacity.

The stormwater conveyance system analyses identified surcharging throughout Vista Grande drainage basin. Modeling results demonstrated the peak volumes of surcharge at the Vista Grande tunnel caused by the 5- and 10-year (4-hour) storms to be 24 million gallons (MG) and 26 MG, respectively, with 12 to14 MG of flooding demonstrated in other areas of the system. As a result, Kennedy/Jenks identified a number of collection system conditions that contribute to inadequate conveyance capacity and made recommendations to alleviate these issues.

The study analysis focused on eight alternatives to increase downstream conveyance capacity for the Vista Grande watershed as summarized in Table 3-1.

**Table 3-1 Alternatives Analyzed in the Vista Grande Storm Sewer Report (Kennedy/Jenks, 1983.)**

| Alternative | Description |
|---|---|
| Alternative 1: New Parallel Tunnel | Construction of a 3,500 feet long tunnel parallel to the existing tunnel location, passing under Olympic Club to a new Fort Funston outfall. |
| Alternative 1A: New Tunnel at County Line | Construction of a new 1,000 feet long box culvert under Olympic Club (bypassing the existing canal) and new 3,500 feet long Tunnel at County Line. This option would construct needed infrastructure within San Mateo County only. |
| Alternative 2: Tunnel Pressurization | Utilization of a new pump station at the tunnel to pump stormwater through the tunnel; or installation of a pressurized pipeline within tunnel. (Alternative deemed not technically or practically feasible.) |
| Alternative 3: Storage Basin at Lake Merced | Construction of a 38 MG concrete rectangular storage basin/channel adjacent to Vista Grande canal along John Muir Drive |
| Alternative 4: Storage Basin at Westlake Park | Construction of a 38 MG underground storage basin under Westlake Park. Pumps would be required to drain the basin to the existing canal. (Since development of the study, the Daly City wastewater treatment plant has been constructed at this location.) |
| Alternative 5: Multiple Storage Basin Sites | Construction of five surface or underground detention basins throughout City at or near localized flooding sites including the southeast corner of the Olympic club, Westlake Park, the northwest corner of Lake Merced Golf Club (LMGC), the southwest corner of LMGC, and Benjamin Franklin Middle School. |
| Alternative 6: Disposal to Other Storm Drain Systems | Disposal of stormwater to other conveyance systems including San Francisco and Colma Creek collection systems. (Alternative deemed not feasible due to institutional and practical constraints) |
| Alternative 7: Overflow Structures at Lake Merced | Construction of five to eleven smaller overflow structures across John Muir Drive to divert flows in excess of tunnel capacity to Lake Merced. |

After evaluating the alternatives based on engineering feasibility, risk analyses, and cost, Kennedy/Jenks recommended Alternative 7, Overflow Structures at Lake Merced, for implementation since it was the least costly alternative. However, if environmental approvals for this alternative could not be gained, Kennedy/Jenks recommended implementing the one of the new tunnel improvements (Alternative 1 or 1A). It was noted that implementation of one of these alternatives would also require environmental and discharge approvals, as well as detailed site investigation, surveying, geotechnical investigation, tunnel and box culvert design, property acquisition, and financial consulting services for project financing.

## 3.2 Vista Grande Diversion Feasibility Evaluation, Lake Merced Technical Memorandum No.2 (CH2M Hill, 2001)

In 2001, CH2M Hill completed the Vista Grande Diversion Feasibility Evaluation Project for the City of Daly City, San Mateo County, and the CCSF. This project evaluated the feasibility of, and options for, diverting treated stormwater from Vista Grande canal to Lake Merced. The goals were to reduce flooding problems at the canal and implement water supply delivery to Lake Merced for lake level increase. The study examined the hydraulic and water quality issues associated with the diversions and potential water quality treatment options for the diversions.

From the evaluations, a suite of eight alternatives was developed, and the advantages and disadvantages of each were investigated. The alternatives are summarized in Table 3-2.

**Table 3-2 Alternatives Evaluated in the Vista Grande Diversion Feasibility Evaluation (CH2M Hill, 2002)**

| Alternative | Description |
|---|---|
| Alternative1: Direct Discharge | Diversion of flows from the canal to South and Impound Lakes through series of overflow structures with trash gates. This alternative was based on that originally developed by Kennedy/Jenks (1983). The alternative was dropped for consideration due to water quality and regulatory constraints. |
| Alternative 2: Structural Control Measures | Installation of overflows structures and three 150 cfs continuous deflection system (CDS) units for limited water quality treatment before diversion to Lake Merced. |
| Alternative 3: Constructed Wetlands | Construction of surface flow treatment wetlands to treat stormwater before diversion to Lake Merced. |
| Alternative 4A: Vista Grande Detention Basin | Construction of a 38 MG concrete storage basin adjacent to Vista Grande canal along John Muir Drive. This alternative was originally developed by Kennedy/Jenks (1983). |
| Alternative 4B: Impound Lake Detention Basin | Diversion of stormwater flows into Impound Lake for storage. This alternative considered the storage available below hydraulic connection with South Lake. |
| Alternative 5: Depth Filters | Utilization of sedimentation/filter basin and chambers that treat stormwater; would be constructed in combination with storage for peak flows. |
| Alternative 6: Grassy Swales | Utilization of densely vegetated areas that intercept sheet flow. |
| Alternative 7: Infiltration Basins | Utilization of basins designed for infiltration and percolation of captured flow to groundwater. |
| Alternative 8: Other Technologies | This alternative considered three other types of technologies including membrane filtration, chemical precipitation, and disinfection. |

These alternatives were analyzed and ranked based on environmental, financial, real estate, construction, and operation and maintenance issues and feasibility. The evaluation revealed that no single alternative would address all objectives. Therefore, implementation of the two highest ranked alternatives, Structural Control Measures and Constructed Wetlands, was determined to be the preferred alternative. As developed for the study, the preferred alternative would include diversion of up to 330 cfs to Lake Merced through CDS units, followed by treatment wetlands. Approximately 23 acres of treatment wetlands would be developed along the southern shoreline of South Lake and the entire shoreline of Impound Lake. The preferred alternative assumed that coliform levels in Vista Grande stormwater would be lowered to 20,000 MPN/100 mL. This preferred alternative was the basis for the Lake Merced Pilot Stormwater Enhancement Project conducted by SFPUC and Daly City in 2004 and 2005 (CH2M Hill, 2004; NSMCSD, October 2005.) The study did not develop cost estimates for the alternatives analyzed or the recommended alternative.

## 3.3 Vista Grande Stormwater Drainage Basin Hydraulic Capacity Evaluation (CH2M Hill, 2002)

In 2001/2002, CH2M Hill performed a hydraulic capacity evaluation of the Vista Grande watershed stormwater conveyance system for the Daly City and San Mateo County. This evaluation was conducted in support of the Vista Grande Diversion Feasibility Evaluation (CH2M Hill, 2001). The study examined

the stormwater system performance under the 10-year, 4-hour design storm conditions, estimated the benefit of flow diversion to Lake Merced, and provided potential system improvements to correct system deficiencies. The focus of the improvements was implementation of large upstream detention basins in Daly City.

To examine system performance for the design storm, a computer stormwater management model (SWMM) was developed. This effort involved compiling existing collection system data, such as system configuration, pipe diameters, length, elevations, slope, and other physical parameters, as well as understanding known system constraints and areas of flooding, and determining land use and percent impervious area system-wide. As part of the calibration of the model, flow monitoring at Vista Grande canal was conducted by TRS Consultants during the 1998-1999 wet weather season. The report noted that this stormwater model was designed specifically for the Vista Grande canal. As a result, calibration of the model was only performed at one point in the canal, and the variables that defined the storm drain collection system upstream of the canal were not fine-tuned. Such uncertainties in this modeling effort supported the recommendation that further flow monitoring, collection system data verification, and calibration be completed for future efforts related to the stormwater collection system. The hydraulic capacity modeling of the existing stormwater system demonstrated localized flooding beyond those noted by City staff, and identified specific surcharging pipe segments deficient in capacity.

The hydraulic evaluation of potential recommendations to correct Vista Grande drainage system deficiencies involved modeling several scenarios developed as potential solutions to the localized flooding upstream and canal overflows downstream. It was noted that the Vista Grande tunnel was the existing limitation of the system, and that modifying or replacing it was currently cost prohibitive, and therefore, upstream stormwater detention basins were investigated as a potential solutions for flooding in the Vista Grande drainage basin. The eight proposed alternatives and findings of the models are summarized in Table 3-3. It is important to note that all upstream detention scenarios modeled (Scenarios 5 through 8) assumed that Scenario 4, which included diversion of 330 cfs from the canal to Lake Merced, would be implemented.

**Table 3-3 Scenarios Analyzed in the Stormwater Drainage Basin Hydraulic Capacity Evaluation (CH2M Hill, 2002)**

| Scenario | Description |
|---|---|
| Scenario 1: Divert of Mission Street Flow to Colma Creek Drainage Basin | Scenario 1, which is already being implemented, included diversion of flows from Mission Street into the Colma Creek drainage basin. |
| Scenario 2: Sliplining of the Lake Merced Blvd. 60-inch Storm Pipe | This scenario involved sliplining of large pipe south of treatment plant to address structural integrity of the pipe; sliplining of the pipe would reduce the pipe diameter to approximately 48 inches. |
| Scenario 3: Flow diversion from the Vista Grande canal to Lake Merced | This alternative would include the diversion of approximately 330 cfs from Vista Grande canal to Lake Merced. |
| Scenario 4: System Following Implementation of Scenarios 1, 2, and 3 | This model scenario included implementation of Scenarios 1, 2, and 3. This scenario served as the baseline scenario from which scenarios 5, 6, 7, and 8 were modeled. |
| Scenario 5: Detention Basin at Junipero Serra Freeway (I-280) Cloverleaf | Involved installation of 1.6 MG detention basin at the southwest portion of John Daly Blvd. and I-280 cloverleaf. (This basin location was dropped due to site constraints and limited hydraulic benefit.) |
| Scenario 6: Lake Merced Golf Club (LMGC) Detention Basins | This scenario involved installation of 3 detention basins at LMGC, resulting in 4.3 MG of detention storage. |
| Scenario 7: Westlake Shopping Center Detention Basin | This scenario involved installation of one 36 MG detention storage basin under Westlake Shopping Center. |
| Scenario 8: Park Plaza Drive Detention Basins | This scenario involved installation of two detention basins: a 7.5 MG basin at Franklin Middle School and a 6.3 MG basin at Garden Village Elementary School. (The Garden Village basin was dropped due to constructability issues and limited hydraulic benefit.) |

The study found the Westlake Shopping Center Detention Basin was the only basin that provided significant hydraulic system benefit. The other detention basin locations, (LMGC, and Franklin Middle School) provided benefit to localized flooding and potential for groundwater recharge. Although not thoroughly analyzed, the study also suggested that retention of stormwater at the Olympic Club could provide some groundwater recharge and stormwater benefit. As a result, the study recommended development of detention basins at Westlake Shopping Center and the two golf courses. The study recommended two approaches to implementation – developing an official stormwater management plan or initiating discussions with property owners to learn their receptiveness to the recommended on-site stormwater retention alternatives. The study did not develop cost estimates for the recommended alternatives.

In conjunction with detention basin implementation planning, CH2M Hill recommended that the City obtain the data needed to further calibrate the SWMM model. This would aid in the proper quantification of detention basin benefits and would help to prioritize additional storm drain system improvements necessary to alleviate upstream flooding.

## 3.4 Initiative to Raise and Maintain Lake Level and Improve Water Quality (EDAW, September 2004a, b) – Task 3 and 4 Technical Memorandums

These technical memoranda (TMs) were completed as part of a series of TMs to gain understanding on the lake ecosystem, lake and groundwater interactions, and to provide information in support of maintaining and augmenting water levels and water quality improvement in Lake Merced. Four water

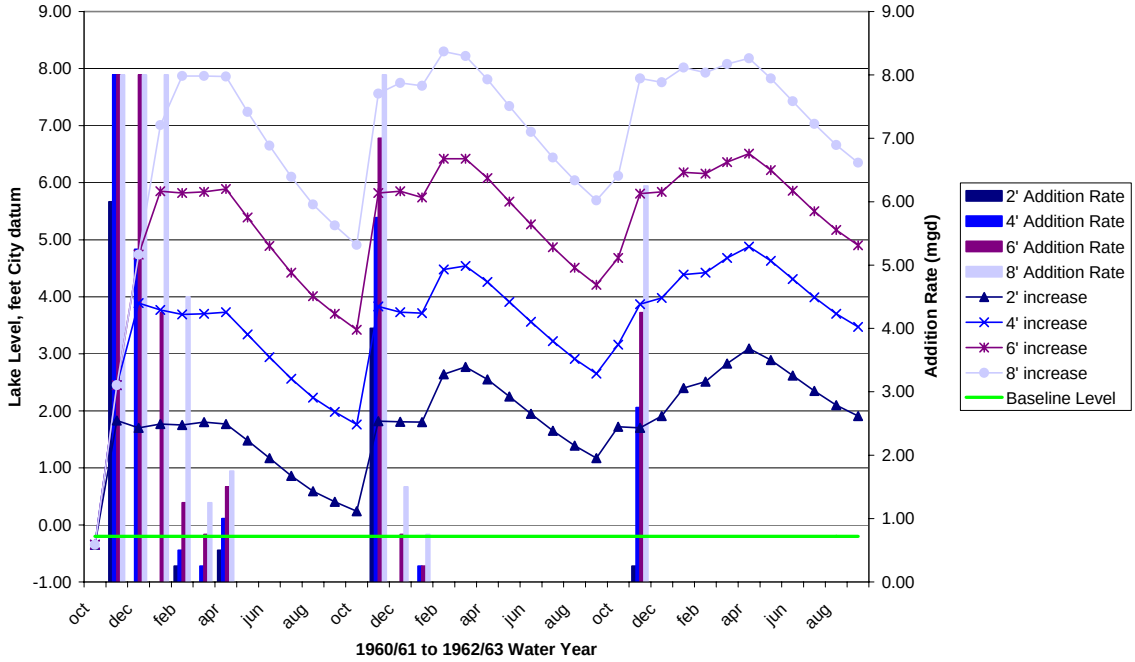
augmentation sources for Lake Merced – SFPUC System Supply Water, Vista Grande Stormwater, Recycled Water from SFPUC or Daly City, and Westside Basin Groundwater - were evaluated for impacts to existing beneficial uses, water quality, infrastructure, vegetation, and fisheries and wildlife. Task 4 TM focused on the water quality of these different sources; and found that the water quality of Vista Grande stormwater flows shows levels of nutrients and coliform that would require treatment before supplied to Lake Merced. A pilot study to investigate the treatment of stormwater flows through CDS units and riparian buffers was recently conducted by SFPUC and Daly City to evaluate the effectiveness of nutrient and coliform removal by vegetation and wetlands before supplied to Lake Merced (NSMCSD, 2005).

The volume of water needed to raise and maintain lake levels is discussed in detail in recent years. Two water augmentation alternatives were developed – a seasonal input with fluctuating lake levels, and a year-round supply maintaining a constant lake level. Assuming seasonal water supply additions, it is estimated that in a year of average hydrologic conditions, about 500 AF will be needed to maintain the lake in a range between 3 and 5 feet (SF city datum) after the initial water requirement to bring the lake level to this level is met. Under average hydrologic conditions, a multiple year hydrograph of managed lake levels could be expected to be as illustrated in Figure 3-1. This figure is based on 1960/1961 through 1962/1963 hydrologic condition (average precipitation of 20.13 inch), in which the initial supplemental water to raise the lake level would vary depending on the desired level increase. For example, assuming an existing lake level of 0 feet (SF city datum), the initial supplemental water requirement to raise the lake level by +4 feet would be about 1,400 AF. After reaching the +4 feet increase, the lake would decline about 2 feet through the spring, summer and early fall as a result of seepage and evaporation. Seasonal additions of precipitation and supplemental water would then restore the desired lake level through the winter followed by repeat cycle of decline and subsequent seasonal addition.

As illustrated in Figure 3-2, after the initial water requirement to raise Lake Merced is met, the volume of water required to maintain the lake level in the following water year (1961/1962) is only about 600 AF. In water year 1962/1963, which was only slightly wetter than average, the volume of water to maintain lake level is close to 250 AF. Therefore, between 250 AFY and about 600 AFY of additional supply is required to maintain the lake at the desired interim lake level range average between 3 to 5 feet (SF city datum), during average hydrologic conditions. It is important to note that water requirements to sustain a target lake level will be impacted by hydrologic conditions, and will be more significant during dry year conditions.

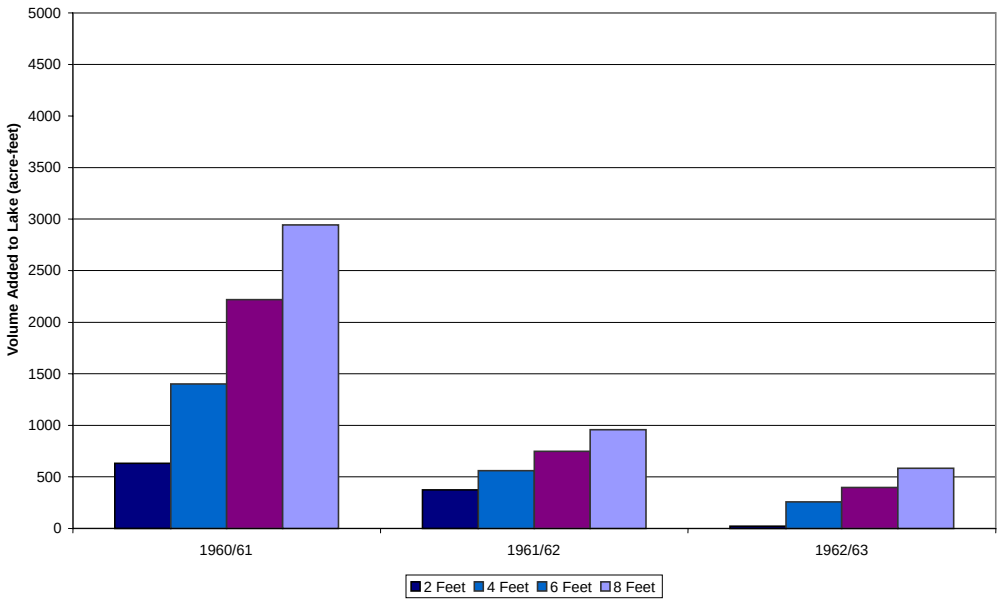
The TMs stated that existing lake water quality was determined to be eutrophic for a majority of the year with high nutrient levels and that these conditions may or may not be attributed to natural physical parameters of the lake, and can also be hastened by nutrients in other inputs, such as stormwater.

**Figure 3-1: Simulated Lake Level and Water Addition Rates: Seasonal Additions, Multiple-Year Average Hydrologic Conditions [a]**




a. Figure 4-5 from Task 3 Technical Memorandum-(EDAW, September 2004a).

**Figure 3-2: Supplemental Water Requirements for Alternative Lake Levels: Seasonal Additions, Multiple-Year Average Hydrologic Conditions [a]**




a. Figure 4-6 from Task 3 Technical Memorandum (EDAW, September 2004a).

# Chapter 4

# Alternatives Considered

# Chapter 4 Alternatives Considered

This chapter presents a series of alternatives that were considered to meet the study goal of resolving flooding issues along Vista Grande canal, as well as solving flooding within the Vista Grande watershed. Many of the alternatives evaluated for the Vista Grande Watershed Study were identified in previous studies including the Vista Grande Storm Sewer Draft Report (Kennedy/Jenks, 1983), Vista Grande Diversion Feasibility Evaluation (CH2M Hill, 2001) and Vista Grande Stormwater Drainage Basin Hydraulic Capacity Evaluation (CH2M Hill, 2001). Each of these studies is discussed in more detail in Chapter 3, Previous Studies. This watershed study reviewed the alternatives previously analyzed from a watershed perspective by looking at how potential upstream improvements might impact downstream improvements, and evaluating land availability and site constraints of the alternatives. Through this approach, the benefits and limitations of each alternative are identified. This Vista Grande Watershed Study also develops planning level cost estimates (in December 2005 dollars) for each of the alternatives. Note that the cost estimates presented in Chapter 4 may differ slightly to those presented in Chapter 5, Preliminary Program Recommendations. Planning level costs were developed in Chapter 4 to serve as a basis for comparison between the Alternatives Considered and to determine the most desirable alternatives. The preliminary program components presented in Chapter 5 were developed further and include more detailed planning level cost estimates.

This chapter summarizes the long-term upstream and downstream alternatives evaluated for the watershed study. These summaries are followed by a discussion of the comparison of alternatives and the preliminary long-term components recommended for further assessment in the Vista Grande Watershed Study. Finally, this section includes a discussion of potential interim solutions evaluated for the watershed study.

## 4.1 Upstream Alternatives

Upstream alternatives are those that are considered in the upstream portion of the Vista Grande watershed in Daly City. Upstream alternatives are intended to provide benefit to localized flooding issues, and in some cases, hydraulic benefit to flooding conditions at Vista Grande canal as well. Upstream alternatives considered include:

- Storm Drain Improvements
- Regional Detention Storage
- Local Detention Storage
- Best Management Practices

### 4.1.1 Storm Drain Improvements

This alternative would include a series of collection system improvements to replace or enlarge storm drain pipes that do not have sufficient capacity to convey the 10-year design storm flows. Studies done by both Kennedy/Jenks (1983) and CH2M Hill (2002) identified that some improvements of the storm drain improvements were necessary. As analyzed for the Vista Grande Watershed Study, it is assumed that storm drain improvements would be implemented to provide conveyance for the 10-year storm event. The 10-year recurrence interval has become a standard for storm drain design for most cities in California because it provides a balance between level of service and affordability. In order to fully define the extent and location of the required storm drain improvements in the Vista Grande drainage area a storm drain master planning process would be required.

***Planning Level Capital Cost Estimate***

The planning level cost estimate for storm drain improvements to provide 10-year level of protection for the Vista Grande drainage basin is between $25,000,000 and $35,000,000. Because storm drain master

planning has not yet been completed, this estimate is based on preliminary modeling conducted by CH2M Hill (2002) and comparison of proportional costs for storm drain improvements planned in several other Bay Area cities, including the City of Palo Alto, City of Gilroy, City of Milpitas, and the City of Livermore.

***Benefits***

Implementation of storm drain improvements for the 10-year design storm will increase the capacity of the existing storm drain system to eliminate flooding for the design storm event. Reducing flooding in upstream locations will benefit public safety and reduce the potential for flood damage to public and private property.

***Limitations***

Implementing storm drain improvements will allow more water to be conveyed downstream. As such, storm drain improvements must be implemented after downstream improvements are in place so that problems at Vista Grande canal are not exacerbated.

### 4.1.2 Regional Detention Storage

The concept of upstream detention storage was analyzed in the Vista Grande Stormwater Drainage Basin Hydraulic Capacity Evaluation (CH2M Hill, 2002). The study looked at the potential to implement a series of upstream detention basins in Daly City to alleviate regional flooding issues along interceptors throughout the watershed and at the Vista Grande canal and tunnel. The four upstream basin locations examined as part of the study are shown in Figure 4-1. Basins would essentially be underground, reinforced concrete reservoirs, as shown in Figure 4-2. As part of the CH2M Hill study, each of the basin locations was modeled to assess the benefit on flooding on interceptors throughout the system and at the Vista Grande canal and tunnel. It is important to note that the modeling conducted as part of the study assumed that 330 cfs would be diverted from the canal to Lake Merced (CH2M Hill, 2002.) The locations, volume and cost of the four detention basin locations are summarized in Table 4-1 and each is further discussed below.

**Figure 4-1 Location of detention basins modeled in the Vista Grande Hydraulic Capacity Evaluation (CH2M Hill, 2002)**

**Figure 4-2 Example of underground reservoir construction**

**Table 4-1 Summary of Detention Basins Studied in the Vista Grande Hydraulic Capacity Evaluation (CH2M Hill, 2002)**

| Detention Basin Location | Storage Volume | Planning Level Capital Cost Estimate |
|---|---|---|
| Interstate-280 (I-280) Cloverleaf | 1.6 MG | $6,200,000 |
| Lake Merced Golf Club (LMGC) | 4.3 MG | $16,800,000 |
| Westlake Shopping Center | 35.7 MG | $139,200,000 |
| Park Plaza Drive | 13.8 MG | $53,800,000 |

## Detention Basin at I-280 Cloverleaf

A detention basin at the I-280 Cloverleaf, as shown in Figure 4-3, would have a volume of 1.6 million gallons, with a depth of 12 feet and diameter of 150 feet. Flows from 1-280 and an area east of I-280 would enter the basin through a 48 inch pipeline and would exit the basin through a 24 inch pipeline. The objective of the basin would be to minimize surcharging and flooding along downstream interceptors.

**Figure 4-3 I-280 Detention Basin Location**

### *Planning Level Capital Cost Estimate*

The planning level cost estimate for the I-280 Cloverleaf detention basin is $6,200,000, as shown in Table 4-2. This estimate assumes an underground detention basin with a unit cost of $3.00/gallon.

**Table 4-2 Planning Level Cost Estimate for I-280 Cloverleaf Detention Basin**

| Item Description | Unit Cost [a] | Storage Volume | Total Cost |
|---|---|---|---|
| I-280 Cloverleaf Detention Basin | $3.00/gallon | 1.6 MG | $4,800,000 |
| Construction Cost Estimate | | | $4,800,000 |
| Implementation (30% Allowance) | | | $1,400,000 |
| Capital Cost Estimate | | | $6,200,000 |

a. Unit cost data for detention basins developed based on review of several capital cost estimates for similar basins around and Bay Area (as described in Appendix C) and estimated from SFPUC RW Master Plan (RMC, 2005.)

### *Benefits*

Based on the SWMM modeling conducted by CH2M Hill (2002), the I-280 Cloverleaf detention basin would provide flow attenuation to minimize surcharging along John Daly Boulevard. There is a potential to construct the I-280 Basin such that stormwater may percolate through the bottom of the basins to groundwater recharge and, resulting in a water supply benefit. A preliminary analysis has shown that the I-280 Cloverleaf basin could provide an approximate average annual recharge benefit of 26 acre-feet per year (ac-ft/yr) (Yates, 2005) at a cost of approximately $22,000 per acre foot.

### *Limitations*

The main limitation of the I-280 Cloverleaf detention basin is that it does not mitigate flooding at the Vista Grande canal and tunnel unless 330 cfs can be diverted from the canal to Lake Merced (CH2M Hill,

2002.) This alternative has a relatively high cost, which limits the feasibility of water supply benefits of the basin. This alternative would require extensive coordination with Caltrans for construction and maintenance activities. Additionally, there is risk associated with using storage for flood protection. To mitigate this risk, the basin would have to be operated so that water could be evacuated from the basin in preparation for upcoming storm events. Water would likely have to be pumped out of the basin, which would further limit water supply benefits.

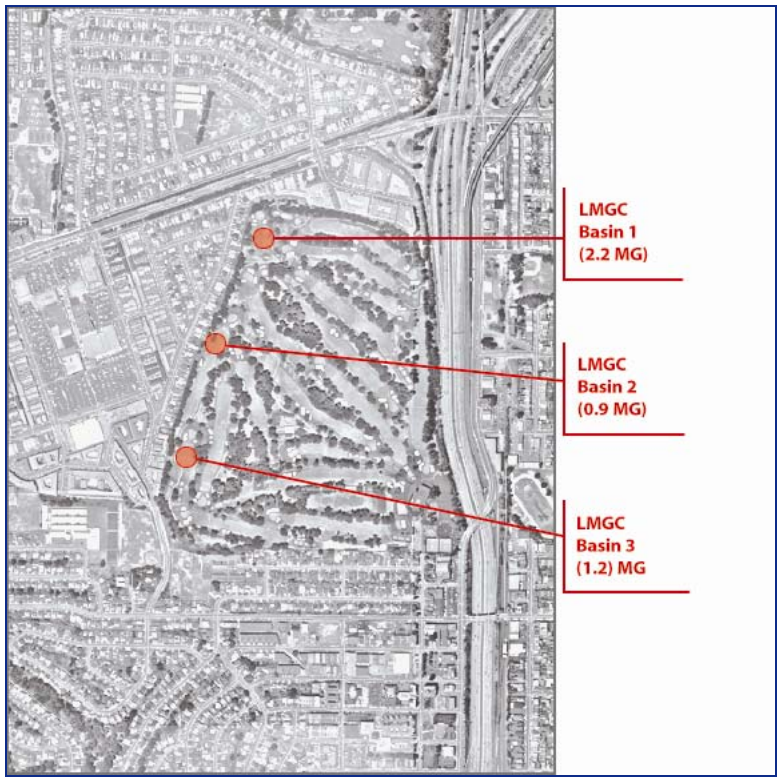
## Detention Basin at Lake Merced Golf Club (LMGC)

As described in the Vista Grande Stormwater Drainage Basin Hydraulic Capacity Evaluation (CH2M Hill, 2002), this alternative would include implementation of three detention basins at the LMGC, as shown in Figure 4-4:

- Basin 1, which would be located at the par three on the northern edge of the golf course, would be 10 feet deep and 95 feet in diameter and store approximately 2.2 MG
- Basin 2, located on the western edge of the golf course, would store approximately 0.9 MG
- Basin 3, located in the south west area of the course, would store approximately 11.2 MG.

The purpose of the basins would be to provide flow attenuation during storm events and mitigate flooding caused by downstream restrictions.

**Figure 4-4 Location of LMGC Detention Basins**




### *Planning Level Capital Cost Estimate*

As shown in Table 4-3, the planning level cost estimate for the LMGC detention basins is $16,800,000. This estimate assumes underground covered detention basins with a unit cost of $3.00/gallon.

**Table 4-3 Planning Level Cost Estimate for LMGC Detention Basins**

| Item Description | Unit Cost [a] | Storage Volume | Total Cost |
|---|---|---|---|
| Basin 1 – Northwestern edge of course | $3.00/gallon | 2.2 MG | $6,600,000 |
| Basin 2 – Western edge of course | $3.00/gallon | 0.9 MG | $2,700,000 |
| Basin 3 – Southwestern corner of course | $3.00/gallon | 1.2 MG | $12,900,000 |
| Construction Cost Estimate | | | $12,900,000 |
| Implementation (30% Allowance) | | | $3,900,000 |
| Capital Cost Estimate | | | $16,800,000 |

a. Unit cost data for detention basins developed based on review of several capital cost estimates for similar basins around and Bay Area (as described in Appendix C) and estimated from SFPUC RW Master Plan (RMC, 2005.)

### *Benefits*

There is a potential to construct the LMGC basins such that stormwater may percolate through the bottom of the basins to provide a groundwater recharge benefit. A preliminary analysis shows that combined, the three LMGC basins could provide up to 36 ac-ft/yr of recharge benefit (Yates, 2005) at a cost of $42,000 per acre foot. SWMM modeling found that these basins provided a drastic reduction in surcharging along the upstream interceptors (CH2M Hill, 2002.)

### *Limitations*

Modeling showed that, even with 330 cfs being diverted from the canal to Lake Merced, there would be no benefit to the hydraulic conditions at the Vista Grande canal after implementation of the LMGC detention basins (CH2M Hill, 2002.) The high unit cost of these detention basins is another major limitation and limits the feasibility of water supply benefits that could be achieved through groundwater recharge. Additionally, there is risk associated with using storage for flood protection. To mitigate this risk, the basin would have to be operated so that water could be evacuated from the basin in preparation for upcoming storms. Water would likely have to be pumped out of the basin at a significant energy cost. Pumping water out of the basin would also decrease potential groundwater recharge potential. Construction of these basins would need to be coordinated with the LMGC and would need to be constructed without modifying the existing golf course layout.

## Detention Basin at Westlake Shopping Center

This large detention basin would be located under the western half of Westlake Shopping Center's south parking lot, as shown in Figure 4-5. The basin would be designed to have a capacity of 35.7 MG (CH2M Hill, 2002.) At a depth of 25 feet, this would require an area approximately 275 feet x 700 feet (equivalent to 16 Olympic size swimming pools.)

**Figure 4-5 Location of Westlake Shopping Center Detention Basin**

### *Planning Level Capital Cost Estimate*

This planning level cost estimate of this basin is $139,200,000, as shown in Table 4-4. This estimate assumes construction of an underground covered detention basin with a unit cost of $3.00 per gallon.

**Table 4-4 Planning Level Capital Cost Estimate for Westlake Shopping Center Detention Basin**

| Item Description | Unit Cost [a] | Storage Volume | Total Cost |
|---|---|---|---|
| Westlake Shopping Center Detention Basin | $3.00/gallon | 35.7 | $107,100,000 |
| Construction Cost Estimate | | | $107,100,000 |
| Implementation (30% Allowance) | | | $32,100,000 |
| Capital Cost Estimate | | | $139,200,000 |

a. Unit cost data for detention basins developed based on review of several capital cost estimates for similar basins around and Bay Area (as described in Appendix C) and estimated from SFPUC RW Master Plan (RMC, 2005.)

### *Benefits*

SWMM modeling found that the Westlake Shopping Center detention basin would alleviate surcharging in the Central Interceptor along Southgate Avenue (CH2M Hill, 2002.) The basin could also be constructed with a permeable bottom to enable groundwater recharge. A preliminary analysis of the groundwater recharge potential indicated that up to 316 acre feet could be recharged annually (Yates, 2005) at a cost of $40,000 per acre foot.

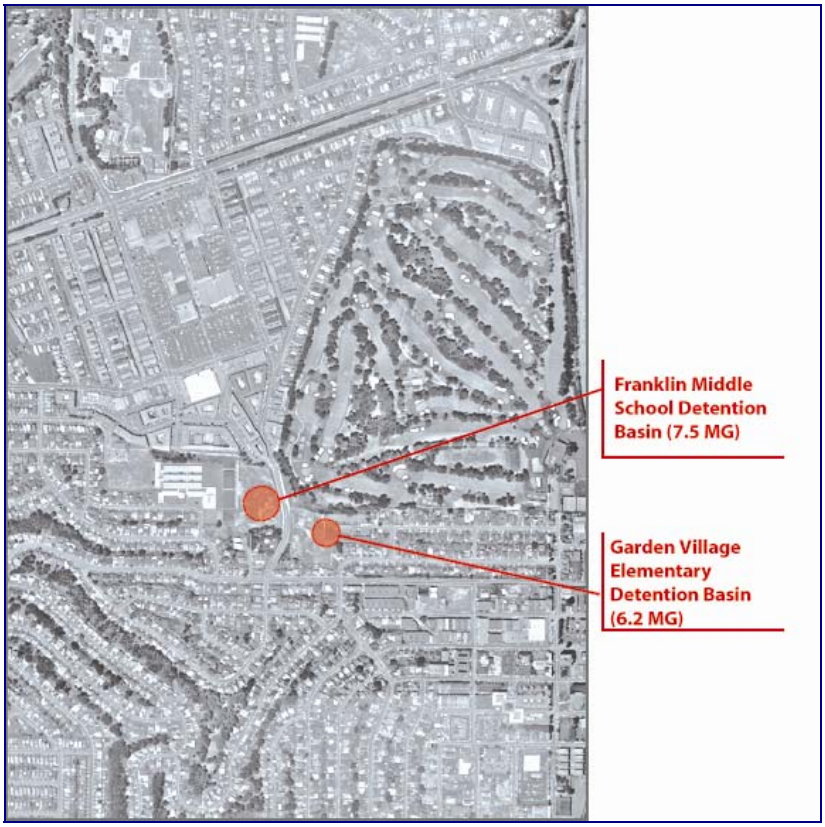
***Limitations***

The main limitation of the Westlake Shopping Center detention basin is that it would only mitigate flooding at the Vista Grande canal and tunnel for the 10-year, 4-hour storm event if 330 cfs is diverted from the canal to Lake Merced (CH2M Hill, 2002.) Additionally, the alternative has an extremely high capital cost. This high capital cost, which results in a high dollar per acre foot value for groundwater recharge, limits potential water supply benefit of this alternative. This detention basin would also require extensive coordination with the owner of the Westlake Shopping Center, which has recently undergone major renovations. Because of its size, there are extensive site constraints and land purchase could be required for implementation. Additionally, there is risk associated with using storage for flood protection. To mitigate this risk, the basin would have to be operated so that water could be evacuated from the basin in preparation for upcoming storms. Water would likely have to be pumped out of the basin at a significant energy cost. Pumping water out of the basin would also further decrease recharge potential and any resulting water supply benefits.

## Park Plaza Drive Detention Basins

This alternative includes two detention basins on Park Plaza Drive, one at Garden Village Elementary School and one at Franklin Middle School, as shown in Figure 4-6. As modeled by CH2M Hill (2002) these basins would be below-grade basins with playing fields reinstalled on top. The basin on the east side of Park Plaza Drive at Garden Village Elementary would have a capacity of 6.3 million gallons and the basin on the west side of Park Plaza Drive at Franklin Middle School would have a capacity of 7.5 million gallons.

**Figure 4-6 Park Plaza Drive Detention Basins**



***Planning Level Capital Cost Estimate***

As shown in Table 4-5, the planning level cost estimate for the Park Plaza Drive basins is $53,800,000. This estimate is a based on a unit cost of $3.00 per gallon for underground, covered storage basins.

**Table 4-5 Planning Level Cost Estimate for Park Plaza Drive Detention Basins**

| Item Description | Unit Cost [a] | Storage Volume | Total Cost |
|---|---|---|---|
| Garden Village Elementary Detention Basin | $3.00/gallon | 6.3 MG | $18,900,000 |
| Franklin Middle School Detention Basin | $3.00/gallon | 7.5 MG | $22,500,000 |
| Construction Cost Estimate | | | $41,400,000 |
| Implementation (30% Allowance) | | | $12,400,000 |
| Capital Cost Estimate | | | $53,800,000 |

a. Unit cost data for detention basins developed based on review of several capital cost estimates for similar basins around and Bay Area (as described in Appendix C) and estimated from SFPUC RW Master Plan (RMC, 2005.)

***Benefits***

The Park Plaza Drive detention basins could provide a water supply benefit if the bottoms of the detention basins were designed to allow for percolation to the groundwater basin. A preliminary analysis of the Franklin Middle School basin showed that the basin could provide an approximate annual recharge benefit of 316 ac-ft/yr (Yates, 2005) at a cost of $30,000 per acre foot.

***Limitations***

Due to hydraulic limitations and constructability issues, CH2M Hill (2002) recommended that the Garden Village Elementary basin be dropped from further consideration. SWMM modeling showed that the Franklin Middle School detention basin would mitigate flooding at the Vista Grande canal and tunnel for the 10-year, 4-hour storm event only if 330 cfs is diverted from the canal to Lake Merced (CH2M Hill, 2002.) This alternative also has a relatively high capital cost. This high capital costs, which results in a high dollar per acre foot value for groundwater recharge, limits the feasibility of the water supply benefit of this alternative. Implementation of these basins would require extensive coordination and long-term cooperation with the school district. Additionally, there is risk associated with using storage for flood protection. To mitigate this risk, the basin would have to be operated so that water could be evacuated from the basin in preparation for upcoming storms. Water would likely have to be pumped out of the basin at a significant energy cost. Pumping water out of the basin would also limit groundwater recharge potential.

### 4.1.3 Local Detention Storage

Local detention storage differs from the regional detention storage basins evaluated above in that it is designed to capture runoff from a smaller, localized drainage area such as a parking lot or within a neighborhood. Local detention storage is designed to alleviate localized flooding problems, as opposed to regional flooding issues, and can be implemented as part of, or in addition to, storm drain improvements. Local detention storage is often designed to store increased runoff from new developments in order to meet “no net increase” requirements in Phase II National Pollutant Discharge Elimination System (NPDES) stormwater permits. Some applications of local detention storage include:

- *Underground storage chambers such as those developed by CULTEC, Inc.* These chambers are generally intended to be used as replacements for large diameter pipe through subsurface detention of stormwater (CULTEC Inc., 2005.) A picture of CULTEC system is shown in Figure 4-7 Example of CULTEC Chambers (source: CULTEC, Inc., 2005).

- *Above ground storage to capture runoff from local neighborhoods.* Such storage often utilizes playing fields or parks that are specifically designed to retain runoff from newly developed neighborhoods, as shown in Figure 4-8 (personal communication, Spring Dineen, July 2005.)

**Figure 4-7 Example of CULTEC Chambers (source: CULTEC, Inc., 2005)**

**Figure 4-8 Use of park for detention of storm flows (Source: Clark County Regional Flood Control District, Las Vegas, NV.)**

***Benefits***

Local storage approaches are most applicable to comply with "no net increase" requirements found in Phase II NPDES permits and can be utilized to reduce localized flooding in small areas or neighborhoods. The use of local storage can reduce the need for storm drain upgrades in the area where it is cost effective to implement. Local storage can also provide water quality improvements through settlement, and can potentially provide groundwater recharge benefits if designed to allow stormwater to infiltrate into the groundwater basin.

***Limitations***

The primary limitation of local storage is that these smaller scale storage alternatives are not designed to solve watershed-wide flooding problems. Additionally, it is difficult and expensive to site local storage facilities in already developed areas such as Daly City, and is therefore, often most compatible with new developments or redevelopment.

### 4.1.4 Best Management Practices (BMPs)

A BMP is a program or device used to reduce stormwater runoff to storm drains and /or improve the quality of stormwater runoff. Non structural BMPs include activities such as development of stormwater pollution prevention plans, street sweeping, public outreach programs, and workshops. Structural BMPs may include devices such as swales, curbless gutters, or porous pavement. The implementation of different types BMPs is required for municipalities to meet their stormwater NPDES permits. Daly City's stormwater and BMP requirements are regulated under a countywide permit for San Mateo County. A countywide stormwater management program, called the San Mateo Countywide Stormwater Pollution Prevention Program (STOPPP) was as created to coordinate implementation and compliance with NPDES permits, and partnerships between STOPPP members to implement stormwater-related activities and BMPs. Daly City is a member of STOPPP, and as such, currently implements BMPs in compliance with the San Mateo Countywide NPDES permit, and in coordination with STOPPP.

***Benefits***

BMPs help reduce the quantity of stormwater entering the storm drain system, and help improve stormwater quality. Under the countywide NPDES permit, BMPs are also required for some new development and redevelopment projects. As such, BMPs are generally designed to help municipalities meet "no net increase" requirements of new developments and re-developments in NPDES permits.

***Limitations***

The primary limitation of BMPs is that they are designed to address incremental increases in stormwater, but are not designed to solve regional flooding problems. BMPs can be more difficult to implement in already developed areas such as Daly City, and would likely be implemented over a long period of time as redevelopment occurs.

## 4.2 Downstream Alternatives

Downstream alternatives are those alternatives designed to address flooding and stormwater flows at the Vista Grande canal through storage, conveyance, or diversion to Lake Merced. Downstream alternatives analyzed in the Vista Grande Watershed Study include:

- Direct discharge to Lake Merced
- Detention Basin at Vista Grande Canal
- Detention Basin at Impound Lake
- Constructed Wetlands at Impound Lake
- Structural Control Followed by Treatment Wetlands
- Constructed Wetlands at Vista Grande Canal
- New Parallel Tunnel
- New Tunnel South of County Line

### 4.2.1 Direct Discharge to Lake Merced

Direct discharge of excess stormwater from Vista Grande canal to Lake Merced was investigated by Kennedy/Jenks (1983) and was further reviewed by CH2M Hill (2001). As developed by Kennedy/Jenks,

excess stormwater from the canal would be discharged to Lake Merced through a series of 5 to 11 overflow structures across John Muir Drive to Impound and South Lake. This alternative would include no treatment with the exception trash racks. Since the Kennedy/Jenks report was developed, the City of San Francisco combined sewer structure has been constructed under John Muir Drive between South Lake and Vista Grande canal. Therefore, if implemented today, the direct diversion alternative would have a design similar to one of the Interim Solution alternatives analyzed as part of this watershed study:

- Diversion to Impound Lake, which could include four-48 inch pipes from the canal to Impound Lake
- Diversion to South Lake would include 440 feet of 2'x5' box culverts under John Muir Drive and over the combined sewer structure.

Further description and schematics of these Interim Solutions can be found in Section 4.4 and Appendix D.

Direct discharge was the alternative recommended by Kennedy/Jenks in 1983 because it was the least cost alternative, but with the caveat that CCSF and environmental approvals would be required. Since 1983, there have been changes in the way stormwater is regulated. Specifically, the 1987 amendments to the Clean Water Act established phased NPDES permit requirements for municipal stormwater discharges. Such changes make implementation of this alternative much more difficult. For this reason, and other limitations as described below, CH2M Hill recommended that direct discharge no be pursed as an alternative (CH2M Hill, 2002.)

***Planning Level Cost Estimate***

The planning level cost estimates for the direct diversion alternative range from $2,100,000 to $10,700,000 and are based on cost estimates developed for Interim Solutions diversion alternatives analyzed as part of the Vista Grande Watershed Study. Additional information on these cost estimates is provided in Appendix D.

***Benefits***

The direct diversion alternatives alternative would be the least cost alternative.

***Limitations***

Vista Grande stormwater introduced to Lake Merced would be untreated and would present challenging water quality permitting requirements. Discharge of stormwater to Lake Merced, which is typically high in nutrients, coliform, and other contaminants could negatively impact the quality of Lake Merced if not treated before diversion. Due to these water quality constraints and regulatory requirements, direct diversion is not considered a feasible long-term solution. Additionally, implementation of this alternative would require armoring of the banks near the outlet of discharge structures, disturbing Lake Merced wetland habitat, which could present significant permitting and require extensive mitigation for disturbed habitat.

### 4.2.2 Detention Basin at Vista Grande Canal

A storage basin along Vista Grande canal was originally suggested by Kennedy/Jenks (1983) and further evaluated in the Vista Grande Diversion Feasibility Study (CH2M Hill, 2001). As shown in Figure 4-9 and Figure 4-10, this basin would be implemented by expanding Vista Grande canal along John Muir Drive for approximately 3,600 feet from the upstream end of the canal to the tunnel entrance. The basin would vary in width from 140 to 230 feet for the first 200 feet of the basin, and then narrow to approximately 30 feet wide for the remaining portion of the basin to the tunnel (resulting in an average width of 25 feet.) With a 10 foot depth, the basin could store up to 38 MG. Additionally, the basin could be designed with a pervious bottom to encourage infiltration to the groundwater basin. As designed, the

basin would store flows until they can be discharged by gravity through the Vista Grande tunnel or diverted to treatment and Lake Merced.

**Figure 4-9 Location of Vista Grande Detention Basin**

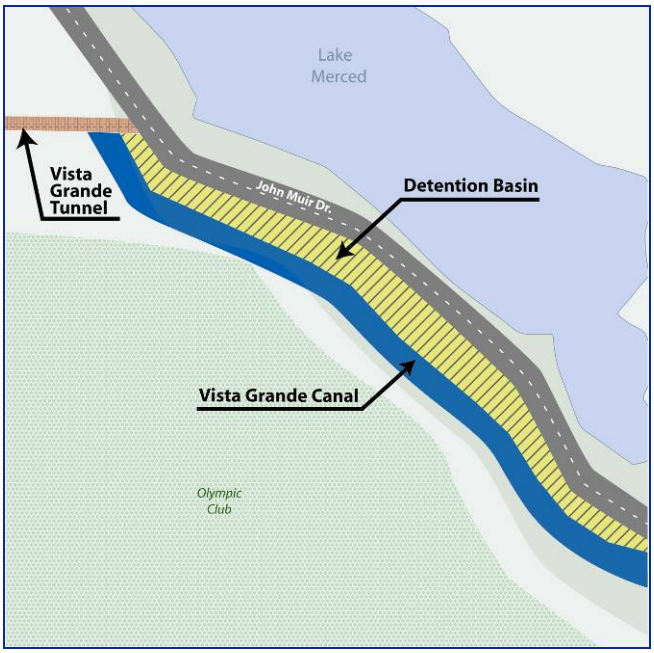
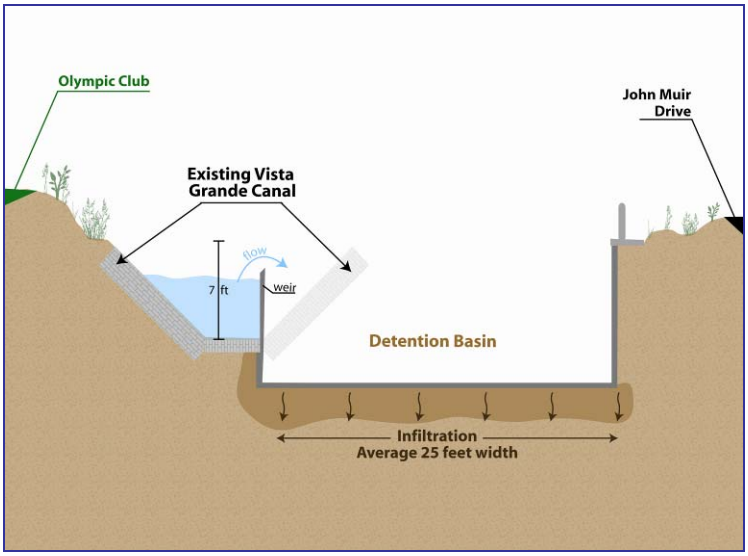



**Figure 4-10 Conceptual Cross Sectional View of Vista Grande Detention Basin**




### *Planning Level Capital Cost Estimate*

The planning level cost estimate for the Vista Grande Detention Basin is estimated at $148,200,000 as presented in Table 4-6. The cost estimate assumes that the basin is an uncovered, reinforced concrete detention basin with a cost of $2.50 per gallon to construct.

**Table 4-6 Planning Level Cost Estimate for Vista Grande Detention Basin**

| Item Description | Unit Cost[a] | Quantity | Total Cost |
|---|---|---|---|
| Vista Grande Detention Basin | $2.50/gal[a] | 38 MG | $95,000,000 |
| Construction Cost Estimate | | | $95,000,000 |
| Implementation (30% Allowance) | | | $28,500,000 |
| Capital Cost Estimate | | | $123,500,000 |

a. Unit cost data for detention basins developed based on review of several capital cost estimates for similar basins around and Bay Area (as described in Appendix C) and estimated from SFPUC RW Master Plan (RMC, 2005.); lower unit cost accounts for uncovered detention basin construction.

***Benefits***

The Vista Grande Detention Basin would provide flow equalization for discharge through the tunnel, reducing tunnel and outfall capacity improvement needs. A basin at Vista Grande canal could also provide equalization for stormwater flows that are diverted to Lake Merced through treatment, reducing the required size of treatment facilities. If constructed with a permeable bottom, the basin could also allow for recharge to the groundwater basin, potentially providing some water supply benefits. Detention basins also provide limited water quality treatment through settling and coliform die off.

***Limitations***

The primary limitation of the Vista Grande Detention Basin is that it would need to be implemented in combination with upstream storage or tunnel and outfall capacity improvements. This is because site constraints limit the volume of the basin to 38 MG, which is not sufficient to store flood projected flows from the 10-year design storm event. Additionally, potential reliability issues associated with the existing tunnel would need to be evaluated. Another major limitation of the Vista Grande Detention Basin is constructability. The existing site is approximately 10 to 12 acres and lies between on Olympic Club and John Muir Drive. The storage basin would lie within feet of John Muir Drive, presenting potential safety issues for traffic, and its construction and resulting impact to the golf course, including aesthetics, would need to be coordinated with the Olympic Club. Additionally, there would be conflicts with existing utilities including Daly City 30 inch sewer line, a sewer line running across Vista Grande canal from the Olympic Club, and other above ground utilities. Relocation of these utilities would need to be addressed as part of the project. Finally, the risk associated with using storage for flood protection would need to be considered in the operation of the basin so that the basin is ready to capture flood flows, especially for multiple storm events.

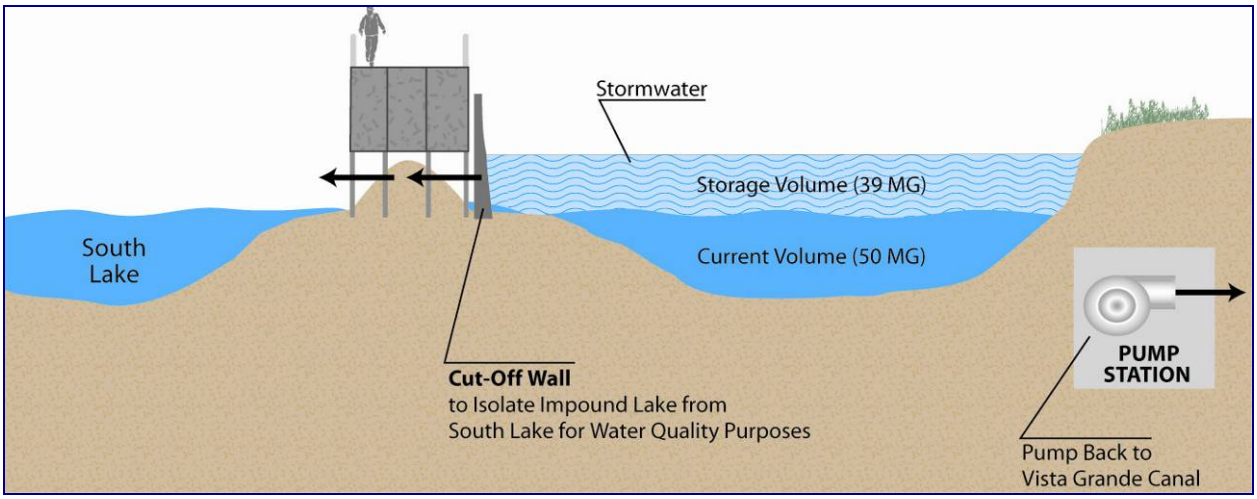
### 4.2.3 Detention Basin at Impound Lake

Impound Lake is a relatively small lake at the southernmost part of Lake Merced. At its current level (+4 SF city datum), Impound Lake is hydraulically isolated from South Lake by a sandy berm located beneath the viaduct that carries the CCSF combined sewer lines. If the level of Impound Lake is raised about 1 foot, the two lakes become hydraulically connected.

The concept of a detention basin at Impound Lake was initially evaluated by CH2M Hill (2001) and was further refined as part of this watershed study. A detention basin at Impound Lake would be implemented by diverting stormwater flows from Vista Grande canal to Impound Lake. Because direct diversion of stormwater to Lake Merced is not considered a long-term option, and the diversion of stormwater to Impound Lake would increase lake levels to a point where Impound Lake becomes hydraulically connected to the South Lake, the conceptual design of a detention basin at Impound Lake would require a cut off wall at the viaduct to isolate Impound Lake from South Lake for water quality purposes. Once there is adequate capacity in the tunnel, stormwater stored in Impound Lake would be pumped back to Vista Grande canal for discharged through the existing tunnel.

The current volume available for storage of stormwater in of Impound Lake is estimated at approximately 50 million gallons at water surface elevation (at +4 SF city datum) (EDAW, September 2004a). To maximize the volume available for storage of flood protection, this alternative would require that Impound Lake be drained prior to storm events, which would provide approximately 89 million gallons of storage (EDAW, September 2004a). A schematic of this alternative is shown in Figure 4-11. Implementing this alternative would require that Impound Lake be operated as a flood protection facility, as opposed to a natural lake.

**Figure 4-11 Schematic of Detention Basin at Impound Lake**




### *Planning Level Capital Cost Estimate*

As shown in Table 4-7, the planning level capital cost estimate for the Impound Lake detention basin is $24,700,000. This cost estimate does not include mitigation costs for the loss of habitat that would be encountered by operating Impound Lake as a detention basin, which would likely be significant.

**Table 4-7 Planning Level Cost Estimate for Detention Basin at Impound Lake**

| Item Description | Total Cost |
|---|---|
| Pump Station (300 cfs) | $3,000,000 |
| Pipelines | $4,000,000 |
| Cut Off Wall | $12,000,000 |
| Construction Cost Estimate | $19,000,000 |
| Implementation (30% Allowance) | $5,700,000 |
| Capital Cost Estimate | $24,700,000 |

### *Benefits*

The benefits of this alternative relate strictly to its potential for solving or reducing flooding problems at Vista Grande canal.

### *Limitations*

There are several limitations of the Impound Lake detention basin alternative. The most significant limitation is the environmental impact, and associated permitting challenges, of draining Impound Lake prior to storm events to provide the required volume to retain storm flows. Draining Impound Lake and

operating it as a stormwater facility would have significant impacts to aquatic and wetland habitat of the lake. Impound Lake and its associated wetlands have been designated as a high priority for resource conservation by the San Francisco Natural Areas Program because the area supports significant habitat and species (SFRPD, 2005). Operating the lake as a detention basin would likely face significant stakeholder opposition.

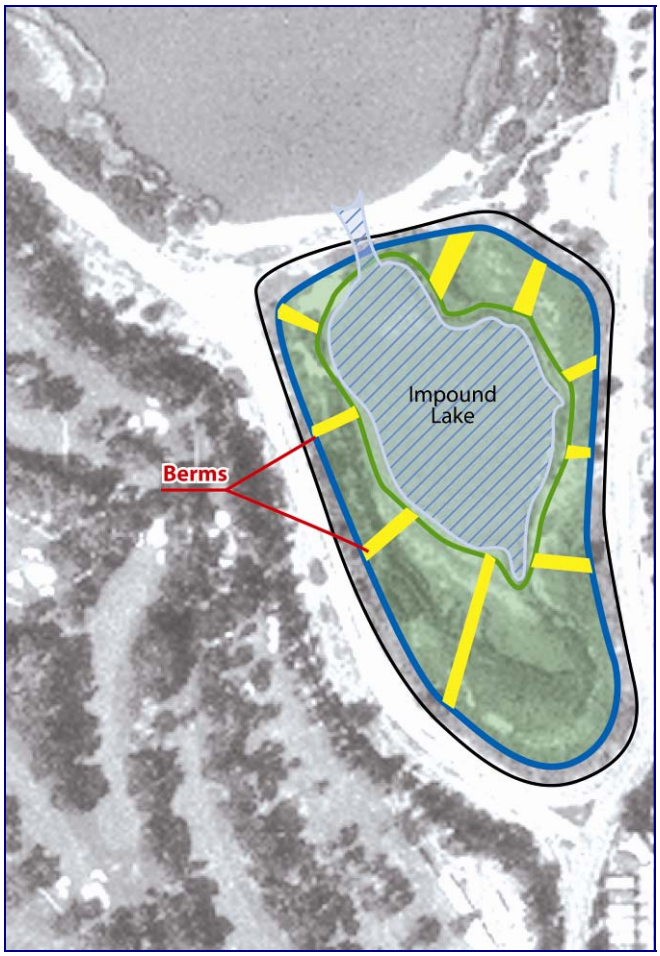
Another limitation of this alternative is that it would likely need to be done in combination with other flood protection improvements in order to provide adequate protection for the design storm event. Conservative estimates show that approximately 100 MG of storage would be required in Impound Lake to handle the 10-year storm if upstream storm drain improvements are implemented. However, as described above, Impound Lake could provide approximately 89 MG for storage of flood flows. Further modeling would need to be conducted to refine the required flows and storage volumes.

Additional limitations of this alternative include water quality impacts to Impound Lake, potential reliability issues with the existing tunnel, and addressing risk issues associated with operating detention basins for flood protection.

### 4.2.4 Constructed Wetlands at Impound Lake

The potential use of constructed wetlands to treat stormwater diversions to Impound Lake was investigated by CH2M Hill (2002) and was further refined for the Vista Grande Watershed Study, as shown in Figure 4-12. Implementation of constructed wetlands at Impound Lake would include conversion of existing wetlands areas at Impound Lake to several constructed wetlands treatment cells through grading, construction of berms, and replanting with wetland vegetation commonly used in treatment systems such as cattail (*Typha* sp.) and bulrush (*Scirpus* sp.). Approximately 13 to 20 acres of area would be available for treatment which would allow for between 2.5 to 4 cfs (approximately 1.7 to 2.6 mgd) to be treated assuming the wetlands were operated at 2 foot depth with a 5 day hydraulic residence time. Once treated, stormwater would be pumped into South Lake for lake level augmentation.

**Figure 4-12 Schematic of Impound Lake Wetlands**




### *Planning Level Capital Cost Estimate*

The planning level cost estimate for the Impound Lake wetlands is approximately $14,200,000 to $21,800,000, depending on the number of acres of wetland constructed. This is based on a planning level cost of $840,000 per acre as shown in Table 4-8. It is important to note that this cost does not account for mitigation costs that would likely be required based on the acreage of existing wetland habitat at Impound Lake that would be lost or altered from implementation of this alternative.

**Table 4-8 Impound Lake Planning Level Cost Estimate**

| Item Description | Unit Cost [a] | Quantity | Total Cost [b] |
|---|---|---|---|
| Constructed Wetlands at Impound Lake | $840,000/acre | 13 to 20 acres | $10,900,000 to $16,800,000 |
| Construction Cost Estimate | | | 10,900,000 to $16,800,000 |
| Implementation (30% Allowance) | | | $3,300,000 to $5,000,000 |
| Capital Cost Estimate | | | $14,200,000 to $21,800,000 |

a. Unit cost data estimated from the Vista Grande Wetland cost estimate for the Vista Grande Watershed Study.
b. Costs are rounded to the closest $100,000.

***Benefits***

The Impound Lake wetlands concept would provide water of appropriate quality and quantity for augmentation of Lake Merced levels. In addition it could provide a water supply benefit by contributing to groundwater recharge.

***Limitations***

The primary limitation of the implementation of constructed wetlands at Impound Lake is that there is not enough land area available to provide treatment for the entire surcharge flow at the canal (assumed to be 510 cfs for a 10-year event if upstream storm drain improvements are not implemented.) In order to treat the entire 10-year flood flows with a hydraulic residence time of 5 days, approximately 2,500 acres of treatment wetlands would be required. Therefore, while the implementation of Impound Lake wetlands would provide for lake level augmentation and water quality benefits, it would not meet the flood protection objective of the Vista Grande Watershed Study. An additional limitation of treatment wetlands at Impound Lake is that it would require the replacement of existing natural wetlands with constructed and managed wetlands, which would present significant permitting challenges. Impound Lake is and its associated wetlands are have been designated as a high priority for resource conservation by the San Francisco Natural Areas Program because the area supports significant habitat and species (SFRPD, 2005). As such, there would likely be extensive stakeholder concerns and significant mitigation requirements with alternatives that alter the existing wetlands at Impound Lake.

### 4.2.5 Structural Control Followed by Treatment Wetlands

An alternative which combines structural control with treatment wetlands was identified as the preferred alternative in Vista Grande Stormwater Diversion Feasibility Evaluation (CH2M Hill, 2001). This alternative would first divert Vista Grande stormwater through four structural control units for initial water quality treatment that use screens in combination with vortex hydraulics to separate pollutants such as floatables, particles, suspended solids and oil and grease from the stormwater. Water would then flow from the structural control units to a total of 23 acres of treatment wetlands along the existing shoreline of Lake Merced, constructed along the majority of the south shoreline of South Lake and the entire shoreline of Impound Lake. The CH2M Hill study (2001) found that the combination of structural control and wetland treatment could meet water quality parameters for a flow of up to approximately 6 cfs.

***Planning Level Capital Cost Estimate***

As shown in Table 4-9, the planning level cost estimate for this alternative is approximately $30,800,000. It is important to note that this cost does not account for mitigation costs that would likely be required based on the acreage of existing wetland habitat at South Lake or Impound that would be lost or altered from implementation of this alternative.

**Table 4-9 Structural Control Followed By Treatment Wetlands Planning Level Cost Estimate**

| Item Description | Unit Cost [a] | Quantity | Total Cost [b] |
|---|---|---|---|
| Structural Control Units | $4,400,000 | 1 | $4,400,000 |
| Installation of Constructed Wetlands | $840,000/acre | 23 acres | $19,300,000 |
| Construction Cost Estimate | | | $23,700,000 |
| Implementation (30% Allowance) | | | $7,100,000 |
| Capital Cost Estimate | | | $30,800,000 |

a. CDS unit cost data from CH2M Hill (2001) and adjusted to 2005 dollars; wetlands unit cost data estimated from the Vista Grande Wetland cost estimate for the Vista Grande Watershed Study.
b. Costs are rounded to the closest $100,000.

***Benefits***

This alternative would provide lake level augmentation benefits by providing water of appropriate quality and quantity to Lake Merced Lake. In addition it could contribute to additional groundwater recharge.

***Limitations***

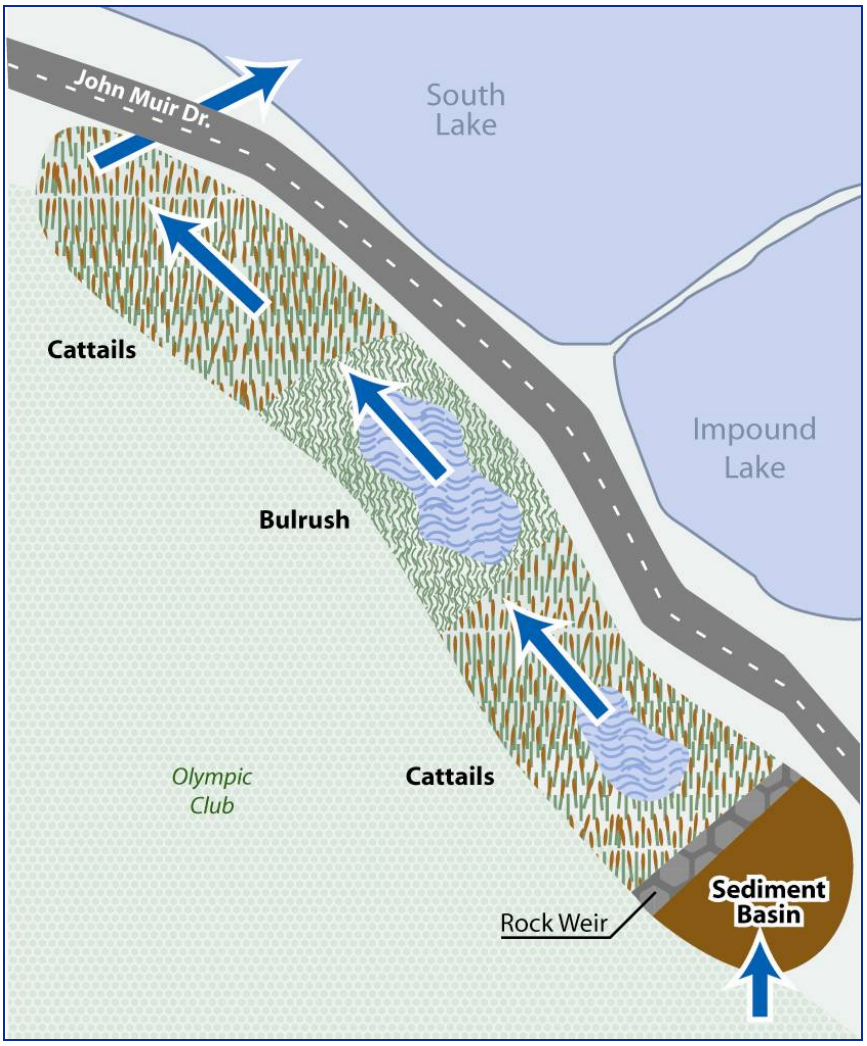
The primary limitation of this alternative is that there is not enough land area available to provide wetlands treatment for the entire flow expected for the 10-year design storm. As developed in the study (CH2M Hill, 2002), the alternative would only handle 6 cfs. Therefore, as developed, this alternative could not be considered a flood protection alternative.

Additionally, the stormwater treatment wetlands for the alternative would be created in existing wetland areas along both South Lake and Impound Lake, resulting in modifications of existing habitat areas which would present a number of significant permitting challenges. As described above, Impound Lake is and its associated wetlands have been designated as a high priority for resource conservation and there would likely be extensive stakeholder concerns and significant mitigation requirements with alternatives that alter the existing wetlands at Impound Lake.

### 4.2.6 Constructed Wetlands at Vista Grande Canal

Constructed wetlands at Vista Grande canal would be located at the site of the existing Vista Grande canal between the Olympic Club Golf Course and John Muir Drive, as shown in Figure 4-13. The wetlands would encompass approximately 8 acres of land with an effective treatment area of approximately 6.4 acres. One to two mgd of stormwater would be pumped into a settling basin prior to entering the wetland. Downstream of the settling basin, stormwater would flow by gravity into three consecutive cells, each of which would be approximately 1,100 feet long. Consecutive cells would be separated by a fifteen feet wide berm (top width), and connected by 8-inch pipelines. Water from one cell would overflow into the next cell when the water rises above two feet. Water from the third cell would then drain by gravity into South Lake via the Lake Merced overflow structure. An access road located on the north edge of the wetland, south of John Muir Drive, would provide maintenance access along the wetland cells and berms. A traffic barrier would be installed along the wetland, between the wetland and John Muir Drive.

**Figure 4-13 Schematic of Constructed Wetlands at Vista Grande Canal**




### *Planning Level Cost Estimate*

The planning level cost estimate for the Vista Grande Wetland is $8,700,000, based on a unit cost of $840,000 per acre for treatment wetlands developed, as shown in Table 4-10.

**Table 4-10 Vista Grande Wetland Cost Estimate**

| Item Description | Unit Cost[a] | Quantity | Total Cost [b] |
|---|---|---|---|
| Vista Grande Wetland | $840,000/acre | 8 acres | $6,700,000 |
| Construction Cost Estimate | | | $6,700,000 |
| Implementation (30% Allowance) | | | $2,000,000 |
| Capital Cost Estimate [c] | | | $8,700,000 |

a. Unit cost data based on detailed Vista Grande Wetland cost estimate.
b. Costs are rounded to the closest $100,000.
c. Note that the cost estimates presented in Chapter 4 may differ slightly to those presented in Chapter 5, Preliminary Program Recommendations. Planning level costs were developed in Chapter 4 to serve as a basis for comparison between the Alternatives Considered and to determine the most desirable alternatives. The preliminary program recommendations presented in Chapter 5 were developed further and include more detailed planning level cost estimates.

***Benefits***

The primary objective of the wetland is to supply water of an acceptable quantity to augment the water levels of Lake Merced. Providing approximately one to two mgd to Lake Merced could provide a maximum lake level increase of 8 feet (Geo/Resource Consultants, 1993). Providing water of appropriate quantity and quality for lake level enhancement meets one of the secondary objectives of the Vista Grande Watershed Study.

In addition, the wetland provides additional habitat for birds and wildlife adjacent to existing habitat along Lake Merced. It protects existing recreational activities and provides additional educational opportunities for school groups and the general public.

***Limitations***

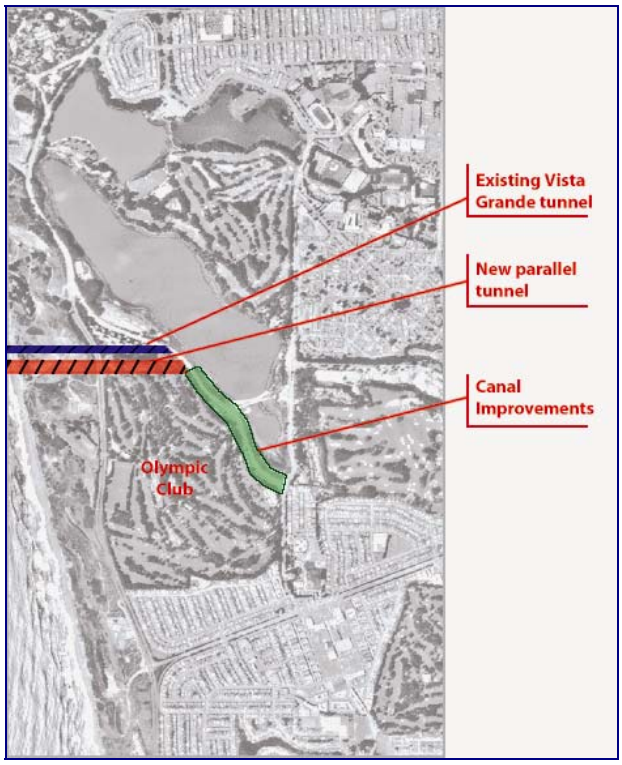
The primary limitation of the Vista Grande Wetland is that there is not enough land area available at the site to provide treatment for flood flows, and therefore, it does not provide flood protection benefits. Instead, it would treat a fraction of the stormwater runoff (1.0 to 2.0 mgd) to provide water supply to Lake Merced for lake level enhancement.

Conflicts with existing utilizes would need to be addressed including the Daly City 30” sewer line, a sewer line running across Vista Grande canal from the Olympic Club, and above ground utilities. Relocation of these utilities would need to be addressed as part of the project. The site for the Vista Grande Wetland is on property owned by the Olympic Club and its construction would require close coordination with, and possible land acquisition from, the Olympic Club. Additionally, because this alternative would require abandonment of the existing Vista Grande canal to maximize the land area available for treatment wetland development, this alternative would need to be constructed with a flood protection alternative that does not require the existing canal for stormwater conveyance.

### 4.2.7 New Parallel Tunnel

This alternative, which was examined in the Kennedy/Jenks study (1983), consists of a 3,500 foot long tunnel that is south of, and parallel to, the existing Vista Grande tunnel. The new parallel tunnel would extend westward from the Vista Grande canal about 500 feet upstream from the existing tunnel entrance (Kennedy/Jenks, 1983). The parallel tunnel would pass under the Olympic Club and would exit on the beach south of Fort Funston. This parallel tunnel also would require that the Vista Grande canal be enlarged to handle 1,300 cfs. A schematic of the new parallel tunnel location is shown in Figure 4-14

**Figure 4-14 New Parallel Tunnel**




### *Planning Level Cost Estimate*

The planning level cost estimate for the new parallel tunnel is $52,260,000, as shown in Table 4-11.

**Table 4-11 New Parallel Tunnel Cost Estimate**

| Item Description | Unit Cost [a] | Quantity | Total Cost |
|---|---|---|---|
| Enlargement of Vista Grande Canal | $3,000/foot | 3,600 feet | $10,800,000 |
| New Parallel Tunnel | $8,400/foot | 3,500 feet | $29,400,000 |
| Construction Cost Estimate | | | $40,200,000 |
| Implementation (30% Allowance) | | | $12,100,000 |
| Capital Cost Estimate | | | $52,260,000 |

a. Tunnel unit cost based on cost estimate developed for John Muir Drive alignment of the Tunnel South of County Line; canal enlargement unit cost estimated from Zone 7 Stream Management Master Plan cost estimating (RMC, 2005)

### *Benefits*

This alternative would provide a reliable method to solve the flooding issues at Vista Grande canal. Additionally, the installation of a parallel tunnel would eliminate erosion and water quality impacts to Lake Merced that result from uncontrolled overflows at the canal. This tunnel would also alleviate public safety issues associated with overflows along John Muir Drive.

### *Limitations*

Constructability of a new parallel tunnel would need to be evaluated, as the tunnel would require a staging area of approximately 200 feet by 200 feet. This could require significant land acquisition and could impact activities on the Olympic Club golf course. Additionally, the required widening of the Vista

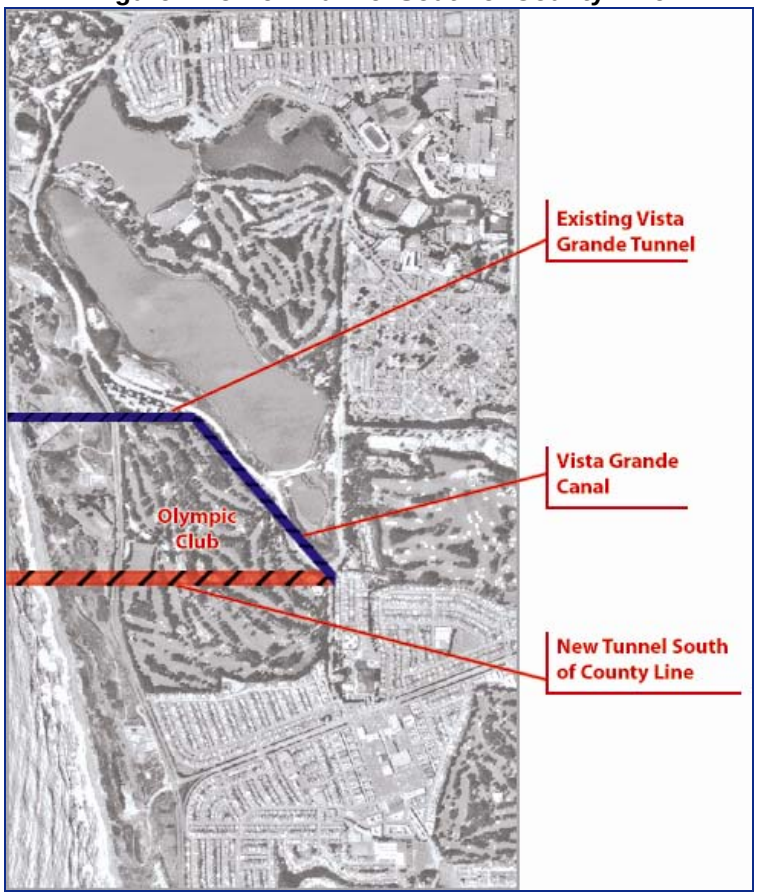
Grande canal for this alternative would also potentially require land acquisition of a portion of the Olympic Club golf course and would require significant coordination with the Olympic Club.

The installation of a parallel tunnel limits the opportunities for multiple benefits, unless it is implemented with wetlands treatment projects. Due to the canal improvements necessary as part of the parallel tunnel, this option would not be compatible with the Vista Grande Wetland alternative. A new parallel tunnel would require extensive environmental and permitting coordination.

### 4.2.8 New Tunnel South of County Line

This alternative, which was examined in the Kennedy/Jenks study (1983) and refined for the Vista Grande Watershed Study, consists of a tunnel that starts at the upstream end of the Vista Grande canal and runs under the Olympic Club to the beach below Fort Funston, as shown in Figure 4-15. Depending the on the alignment selected, the tunnel would range between 4,700 and 4,900 feet in length and would have an approximately 15 foot diameter, which could carry 25-year flows. Construction of a tunnel south of the County line would allow the existing Vista Grande canal to be abandoned. Such a tunnel could be constructed using a tunnel boring machine which operates primarily underground so there are minimal impacts on the surface to traffic and the surrounding community. Tunnel construction would be primarily visible only at the openings at each end of the tunnel.

**Figure 4-15 New Tunnel South of County Line**




***Planning Level Cost Estimate***

The planning level capital cost estimate for a 4,800 foot tunnel south of the County line is approximately $52,420,000, based on a tunnel unit cost of $8,400/foot, as shown in Table 4-12. The planning level cost estimate would vary depending on the exact alignment and length.

**Table 4-12 Tunnel South of County Line Cost Estimate**

| Item Description | Unit Cost [a] | Quantity | Total Cost |
|---|---|---|---|
| New Tunnel | $8,400/foot | 4,800 feet | $40,320,000 |
| Construction Cost Estimate | | | $40,320,000 |
| Implementation (30% Allowance) | | | $12,100,000 |
| Capital Cost Estimate [b] | | | $52,420,000 |

a. Tunnel unit cost based on cost estimate developed for John Muir Drive alignment of the Tunnel South of County Line.
b. Note that the cost estimates presented in Chapter 4 may differ slightly to those presented in Chapter 5, Preliminary Program Recommendations. Planning level costs were developed in Chapter 4 to serve as a basis for comparison between the Alternatives Considered and to determine the most desirable alternatives. The preliminary program components presented in Chapter 5 were developed further and include more detailed planning level cost estimates.

***Benefits***

The Tunnel South of County Line will provide a reliable approach to flood protection to eliminate flooding at Vista Grande canal along John Muir Drive, and the associated damages and risk of stormwater overflows. The tunnel will be completely within Daly City and requires only a limited construction area. The tunnel bypasses the existing Vista Grande canal and allows the NSMCSD Wastewater Treatment Plant to use the existing tunnel for gravity flow of effluent.

***Limitations***

There are a number of implementation issues will need to be considered with construction of this alternative. The alignment for the tunnel, as currently portrayed, would run under private property (the Olympic Club Golf Course.) This would require and easement for the length of the tunnel under the Olympic Club and at the construction site. Access to the beach outlet for construction may require temporary right-of-way agreements from the Golden Gate National Recreation Area (GGNRA), the National Park Service (NPS), and the Olympic Club Golf Course.

A tunnel of this size would require extensive environmental and permitting issues including coordination with the California Coastal Commission (CCC), NPS, US Army Corps of Engineers (Corps), and the Regional Water Quality Control Board (RWQCB).

Construction of a new tunnel would cause impacts at the beach below Fort Funston related to increased stormwater discharges at the beach, which could result in water quality and erosion impacts, aesthetic impacts with the construction of a new outfall structure, and possible habitat impacts. These issues would need to be further studied as part of the implementation analysis of the tunnel.

The construction schedule assumes that the tunnel excavation would operate 24-hours a day during peak construction periods. While the majority of construction would be done in the tunnel itself and away from residential areas, noise, traffic control, and light containment measures, such as sound walls, may be necessary.

## 4.3 Alternatives Recommended for Further Evaluation

The alternatives discussed above were evaluated for their ability to meet the primary flood protection objective, as well as other benefits and limitations to determine which alternatives were most feasible for further evaluation in the Vista Grande Watershed Study. A summary table of the alternatives considered, cost estimates, flood protection benefits, other benefits, and limitations is shown in Table 4-13. The table also provides a discussion of why alternatives were, or were not, recommended for further analysis in the watershed study.

As presented in Table 4-13, the alternatives identified for further evaluation in the Vista Grande Watershed Study include the Tunnel South of County Line, Vista Grande Wetland, Storm Drain

Improvements and ongoing implementation of BMPs in compliance with the San Mateo Countywide NPDES permit. Each of these four components is further evaluated in Chapter 5. These four alternatives make up the preliminary program recommendations of the Vista Grande Watershed Study and are shown in Figure 4-16.

**Table 4-13 Comparison of Long-Term Program Improvements [a]**

| Alternative | Description | Planning Level Capital Cost Estimate | Flood Protection Benefits and/or Limitations | Potential Benefits | Limitations | Recommended for Further Evaluation in Vista Grande Watershed Study |
|---|---|---|---|---|---|---|
| **UPSTREAM ALTERNATIVES** | | | | | | |
| Storm Drain Improvements | Collection system improvements to replace or enlarge storm drain pipes that do not have sufficient capacity to convey the 10-year design storm | $25,000,000 to $35,000,000 | Would eliminate upstream flooding for the 10-year design storm event.<br>Must be implemented after downstream improvements are completed. | Increases public safety<br>Reduces potential and frequency of property damage due to upstream flooding | Must be implemented after downstream improvements are in place | YES.<br>Master planning should be done to determine the extent of upstream improvements necessary. |
| Regional Detention Storage at I-280 Cloverleaf | 1.6MG detention basin to minimize surcharging and flooding along downstream interceptors<br>Basin would be underground reinforced concrete structures | $6,200,000 | Does not mitigate flooding at the Vista Grande canal and tunnel without 330 cfs diversion to Lake Merced<br>Would provide flow attenuation to minimize surcharging along John Daly Boulevard | Could be designed to allow for potential groundwater recharge | Construction impacts on newly reconstructed cloverleaf<br>High construction cost<br>Risk associated with the use of storage for flood protection<br>The need to pump water out of storage to provide capacity for flood water storage limits recharge potential. | NO.<br>This alternative is not recommended for further evaluation due to its limited flood protection benefit, and high capital cost. |
| Regional Detention Storage at LMGC | Total of 4.3MG of detention storage in 3 storage basins.<br>Basins would be underground, reinforced concrete structures | $16,800,000 | No benefit to hydraulic conditions at Vista Grande canal<br>Provides reduction in surcharging along upstream interceptors | Could be designed to allow for potential groundwater recharge | High construction cost<br>Risk associated with the use of storage for flood protection<br>The need to pump water out of storage to provide capacity for flood water storage limits recharge potential. | NO.<br>This alternative is not recommended for further evaluation due to limited flood protection benefit, and high capital cost. |
| Regional Detention Storage at Westlake Shopping Center | 35.7 MG of detention storage located under the southwest corner of the Westlake Shopping Center<br>Basin would be underground, reinforced concrete structure | $139,200,000 | Would not mitigate flooding at the Vista Grande canal unless 330 cfs of water was diverted to Lake Merced<br>Would alleviate surcharging in the Central Interceptor along Southgate Avenue | Could be designed to allow for potential groundwater recharge | Site constraints and constructability issues<br>Construction impacts on newly redeveloped shopping center<br>High construction cost<br>Risk associated with the use of storage for flood protection<br>The need to pump water out of storage to provide capacity for flood water storage limits recharge potential. | NO.<br>This alternative is not recommended for further evaluation due to limited flood protection benefit, high capital cost, and site constraints and constructability issues. |
| Regional Detention Storage at Park Plaza Drive | 13.8 MG of detention storage in two basins along Park Plaza Drive (7.5MG at Franklin Middle School, 6.3 gallons at Garden View Elementary)<br>Basins would be underground, reinforced concrete structures | $53,800,000 | Garden View detention basin would not provide hydraulic benefit<br>Franklin middle school basin would not mitigate flooding at the Vista Grande canal unless 330 cfs was diverted to Lake Merced | Basins could be designed to provide groundwater recharge | Extensive coordination with school district<br>Construction and site constraints<br>High construction cost<br>Risk associated with the use of storage for flood protection<br>The need to pump water out of storage to provide capacity for flood water storage limits recharge potential | NO.<br>This alternative is not recommended for further evaluation due to limited flood protection benefit, high capital cost, and constructability issues. |

a. Note that the cost estimates presented in Chapter 4 may differ slightly to those presented in Chapter 5, Preliminary Program Recommendations. Planning level costs were developed in Chapter 4 to serve as a basis for comparison between the Alternatives Considered and to determine the most desirable alternatives. The preliminary program components presented in Chapter 5 were developed further and include more detailed planning level cost estimates.

| Alternative | Description | Planning Level Capital Cost Estimate | Flood Protection Benefits and/or Limitations | Potential Benefits | Limitations | Recommended for Further Evaluation in Vista Grande Watershed Study |
|---|---|---|---|---|---|---|
| Local Detention Storage | Storage of local overflows from small drainage areas through detention storage in parks or through technologies such as CULTEC. | n/a<br>(Depends on location of size of facility; would be determined through modeling.) | Not designed to solve watershed wide flooding; most applicable to local flooding from new/re-developments | Applicable to "no net increase" requirements in Phase 2 NPDES permits for new or re-development projects<br>Can reduce local storm drain size upgrades if cost effective<br>Can provide for groundwater recharge<br>Can provide water quality improvements | Difficult to site storage facilities in developed areas<br>Large volumes of stormwater are very costly to store in an urbanized setting. | *NO.*<br>This alternative should be evaluated for hydraulic benefit and cost effectiveness as part of a storm drain master plan; but is not recommended for further evaluation as a flood protection alternative in the watershed study. |
| Best Management Practices | BMPs are programs or devices that reduce stormwater runoff to storm drains<br>BMPs are required as part of the Daly City Countywide NPDES permit. | n/a | Do not provide flood protection; more appropriate for smaller volumes of runoff | Can reduce quantity of stormwater from new developments and redeveloped areas<br>Can provide water quality improvements<br>Especially appropriate for small drainage areas and individual developments | Difficult to implement in an already developed area<br>Implemented over a long period of time as redevelopment occurs | YES.<br>Daly City is in compliance with BMPs as part of the San Mateo Countywide NPDES permit; ongoing compliance and implementation is component of the watershed study. |
| **DOWNSTREAM ALTERNATIVES** | | | | | | |
| Direct Diversion | Direct diversion of stormwater from Vista Grande canal to Lake Merced without treatment<br>Stormwater would be conveyed to Impound Lake or South Lake through diversion structures under John Muir Drive | $2,100,000 to $10,700,000 | Would provide flood protection at Vista Grande canal | Lowest cost alternative | Considered infeasible as a permanent solution do to regulatory requirements<br>Water quality impacts to Lake Merced | NO.<br>Alternative dropped from further consideration due to incompatibility with regulatory requirements and water quality impacts to Lake Merced |
| Vista Grande Detention Basin | 38 MG storage basin along Vista Grande canal adjacent to John Muir Drive<br>Basin would be below grade, uncovered reinforced concrete structure | $123,500,000 | Basin would not have capacity to store flood flows from the 10-year design storm event and would need to be done in combination with other alternatives<br>Would provide flow attenuation for stormwater flows before discharge through Vista Grande tunnel or diversion to treatment/Lake Merced | Could be designed to provide groundwater recharge benefits<br>Would provide limited water quality treatment through settling and coliform die off | Reliability issues associated with the existing canal and tunnel<br>Site constraints<br>Utility conflicts<br>Risk associated with the use of storage for flood protection | NO.<br>Alternative dropped from further consideration due to site constraints and volume limitations required for flood protection, and high capital cost |

| Alternative | Description | Planning Level Capital Cost Estimate | Flood Protection Benefits and/or Limitations | Potential Benefits | Limitations | Recommended for Further Evaluation in Vista Grande Watershed Study |
|---|---|---|---|---|---|---|
| Impound Lake Detention | Operate Impound Lake as a detention basin by draining lake before storm events and storing flows greater than 170 cfs in the lake<br>After storm even, water would be pumped back to Vista Grande for drainage through the tunnel<br>Approximately 89 MG available for storage | $24,700,000 (Cost does not include mitigation which would be significant for this alternative.) | Modeling would need to be done to determine if capacity available would store the flows for the design storm if upstream storm drain improvements were implemented | Provides limited water quality treatment through settling and coliform die-off | Requires draining of Impound Lake prior to storm events to provide required volume for flood flows, presenting significant environmental impact<br>Would require isolation of Impound Lake from South Lake to protect Lake Merced water quality<br>Potential reliability issues associated with the existing tunnel<br>Significant impacts to Impound Lake aquatic and wetland habitat<br>Water quality impacts to Impound Lake<br>Alterations to existing wetlands will present significant permitting challenges<br>Risk associated with the use of storage for flood protection<br>Stakeholder concern | NO.<br>Environmental impacts to Impound Lake aquatic and wetland habitat make this alternative infeasible. |
| Constructed Wetlands at Impound Lake | Divert up to 3 cfs (2 mgd) of stormwater from Vista Grande canal for treatment in constructed wetlands around Impound Lake<br>Treated stormwater could be discharged to Lake Merced | $14,200,000 to $21,800,000<br>(Cost does not include mitigation which would be significant for this alternative.) | Would not provide flood protection benefit; not enough land area available to construct enough wetlands to treat flood flows | Provides water of appropriate quality and quantity for augmentation of Lake Merced lake levels<br>Potential groundwater recharge | Would require removal of existing wetland habitat around Impound Lake and regarding of Impound Lake shoreline<br>Significant permitting challenges associated with altering existing wetland habitat | NO.<br>Impacts to Impound Lake aquatic and wetland habitat make this alternative infeasible. |
| Structural Control and Constructed Wetlands | Divert stormwater through structural control units to provide limited water quality treatment<br>Stormwater would then flow through 23 acres of wetlands constructed along the south shoreline of South Lake and entire shoreline of Impound Lake<br>After wetlands treatment water would be diverted to Lake Merced | $30,800,000<br>(Cost does not include mitigation which would be significant for this alternative.) | Would not provide flood protection benefit; not enough land area available to construct enough wetlands to treat flood flows | Provides water of appropriate quality for lake level enhancement of Lake Merced | Would require extensive alteration of existing wetlands along Impound Lake that are considered a high priority for conservation<br>Would likely require significant permitting and mitigation | NO.<br>Impacts to South Lake and Impound Lake habitat, combined with the lack of flood protection benefit, make this alternative infeasible. |
| Vista Grande Constructed Wetlands | Construction of 8 acres of wetlands at site of existing Vista Grande canal<br>Divert approximately 2 to 3 cfs (1 mgd) of stormwater to wetlands<br>After wetlands treatment, water would be diverted to Lake Merced | $8,700,000 | Would not provide flood protection benefit | Provides water of appropriate quality and quantity for enhancement of Lake Merced lake levels<br>Wetlands are constructed outside of existing wetland areas; increase wetland acreage at Lake Merced | Would need to be done in combination with Tunnel South of County Line alternative in order for existing canal to be abandoned for wetlands construction<br>Utility conflicts will need to be addressed<br>Land acquisition issues.<br>Removal of approximately 50 trees. | YES.<br>Compatible with Tunnel South of County Line alternative to provide multiple benefits; provides option for treatment of stormwater flows before diversion to Lake Merced for lake level enhancement; does not disturb existing wetland habitat. |

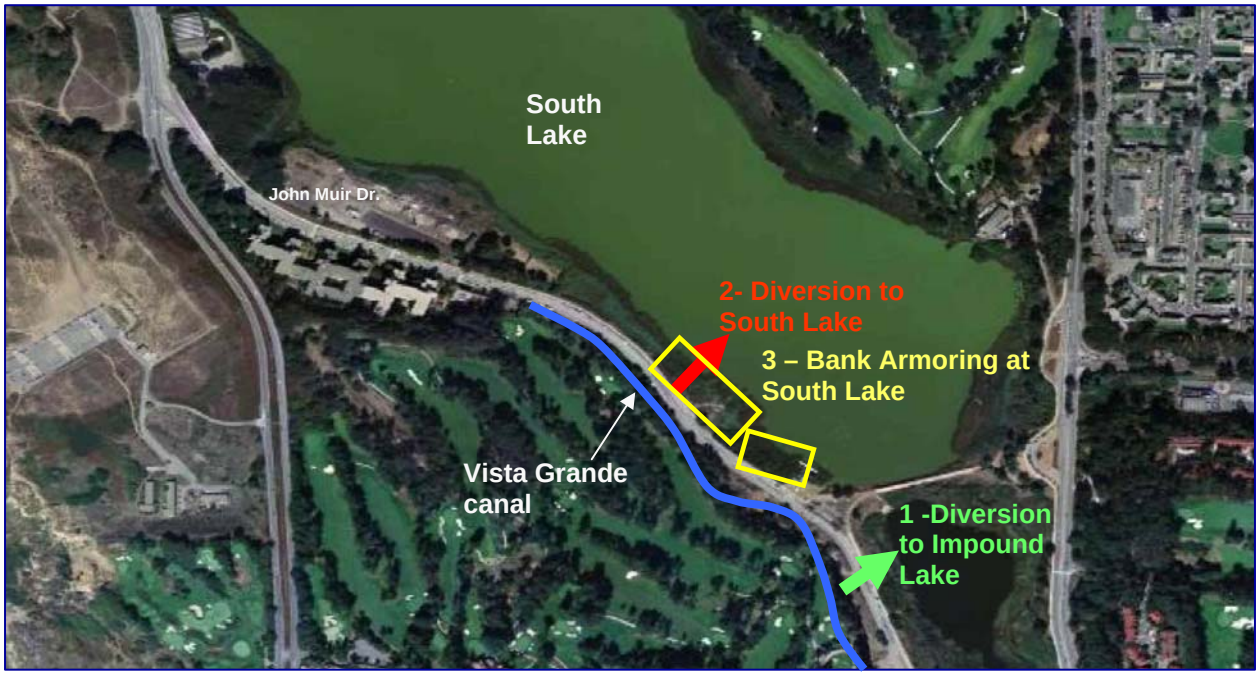
| Alternative | Description | Planning Level Capital Cost Estimate | Flood Protection Benefits and/or Limitations | Potential Benefits | Limitations | Recommended for Further Evaluation in Vista Grande Watershed Study |
|---|---|---|---|---|---|---|
| New Parallel Tunnel | Construction of a 3,500 foot long tunnel parallel to the existing Vista Grande tunnel<br>Would also require improvements along Vista Grande canal to convey the design storm to the new tunnel | $52,260,000 | Would provide reliable flood protection at Vista Grande canal for the design storm | Eliminates erosion along Lake Merced resulting from overflows<br>Protects Lake Merced water quality<br>Eliminates public safety issues along John Muir Drive | Would require extensive permitting<br>Would increase stormwater discharges to the beach below Fort Funston | NO.<br>Alternative dropped for Tunnel South of County Line alternative which is less costly tunnel alternative, and does not require improvements to Vista Grande |
| Tunnel South of County Line | Construction of a 4,700 to 4,900 foot tunnel at the upstream end of Vista Grande canal<br>Tunnel would be entirely within San Mateo County | $52,420,000<br>(Based on a 4,800 foot tunnel.) | Would provide reliable flood protection at Vista Grande canal for the design storm | Eliminates erosion along Lake Merced resulting from overflows<br>Protects Lake Merced water quality<br>Eliminates public safety issues along John Muir Drive<br>Compatible with Vista Grande Wetland alternative | Would require extensive permitting<br>Would increase stormwater discharges to the beach below Fort Funston | YES.<br>This alternative provides reliable flood protection, is cost competitive, and is compatible with Vista Grande Wetland alternative for Lake Merced Lake Level enhancement. |

**Figure 4-16 Long-Term Program Components Recommended for Further Evaluation in the Vista Grande Watershed Study**

## 4.4 Interim Solutions

Because the long-term program components would likely take 5 to 8 years to implement, several interim solutions for addressing overflows at Vista Grande canal were also investigated as part of this watershed study. The primary purpose of interim solutions would be to reduce the number of years of flooding impacts at Vista Grande canal, to address the immediate public safety issues along John Muir Drive, and reduce Lake Merced bank erosion and water quality impacts that result from overflows at the canal. To address overflows at the canal, interim solutions were designed to allow 170 cfs to flow through Vista Grande canal and tunnel, and divert 510 cfs of flow to Lake Merced in a controlled manner. A successful interim solution would solve flooding problems cost effectively, be compatible with the long-term program components, and would be capable of implementation in a relatively short period of time. As shown in Figure 4-17, three interim solutions were investigated: Diversion to Impound Lake, Diversion to South Lake, and Bank Armoring at South Lake. A detailed analysis of the interim solutions evaluated is provided in Appendix D and a summary of each solution and recommendations related to interim solutions is provided below.

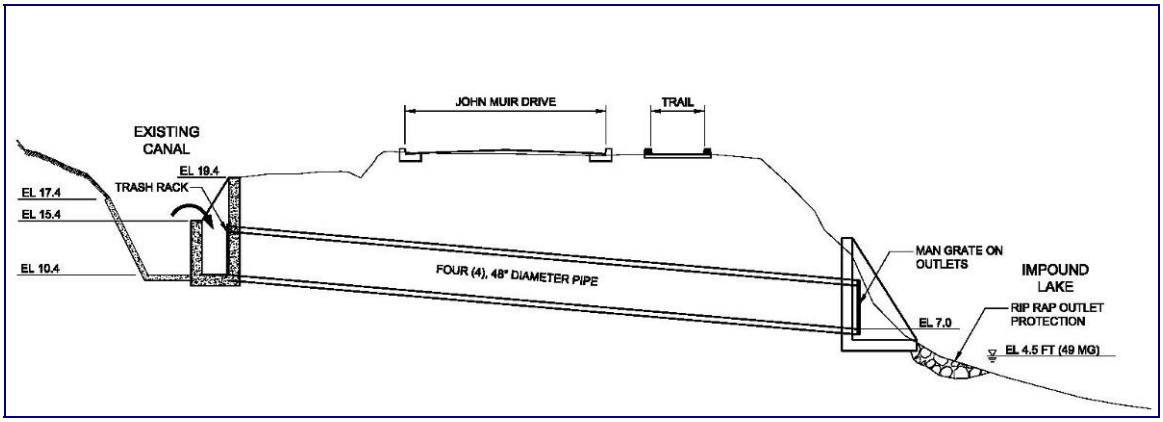
**Figure 4-17 Location of Interim Solutions Examined for the Vista Grande Watershed Study**




### 4.4.1 Diversion to Impound Lake

This interim solution would divert flow in excess of the tunnel capacity to Impound Lake via a concrete weir structure installed in Vista Grande canal, which includes four 48-inch diameter pipes under John Muir Drive and a concrete outfall at Impound Lake. The banks of Impound Lake would be lined with rip rap below the outlet structure to the normal lake level to prevent erosion. After implementation of a long-term solution, the rip rap would be removed and the banks would be restored. Figure 4-18 provides a schematic diagram of the facilities for this alternative.

**Figure 4-18 Schematic of Impound Lake Diversion Interim Solution**




***Planning Level Capital Cost Estimate and Implementation Schedule***

The planning level cost estimate for Diversion to Impound Lake is approximately $2,140,000. Details of the cost estimating analysis and implementation schedule are provided in Appendix D.

Implementation of this interim solution is expected to take approximately 3 years which includes time necessary for preparing permit applications, obtaining permit approval, design, bidding and construction. The permitting process is expected to take up to 2 years. If the permitting process began in early 2006, there would be four years of potential flooding along Vista Grande canal (winters of 2005/2006, 2006/2007, 2007/2008, and 2008/2009) before the project would be implemented.

***Benefits***

The Impound Lake Diversion interim solution addresses safety concerns and bank erosion issues by preventing the flooding of John Muir Drive during a 10-year storm event. This alternative requires a relatively low capital cost and the loss of habitat of 0.04 acres is considerably lower than the other interim solutions analyzed, requiring only 0.15 acres of mitigation based on an assumed 3:1 mitigation ration.

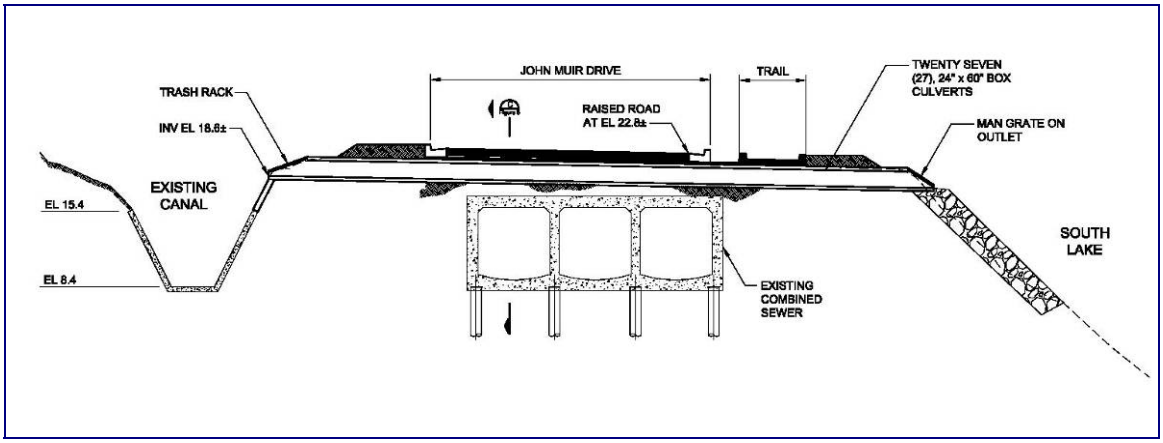
***Limitations***

This alternative would take approximately 3 to 3 ½ years to implement, which would mean up to four rainy seasons without flood protection if work began on the project in early 2006. There would be loss of a small amount of habitat at Impound Lake, but the wetland habitat at Impound Lake is high priority for conservation (SFRPD, 2005). The impacts of discharging stormwater with higher than ambient levels of coliforms, nutrients, and some metals and other pollutants will need to be addressed in the permitting and environmental compliance process. Additionally, this alternative is not compatible with the long-term solutions and therefore would be abandoned when a long-term solution is implemented.

### 4.4.2 Diversion to South Lake

The Diversion to South Lake interim solution would divert flow in excess of the tunnel capacity to South Lake via a concrete overflow structure installed in Vista Grande canal, 27 rows of 2 foot x 5 foot box culverts under John Muir Drive, and a concrete outlet structure at South Lake. To avoid conflict between the proposed box culverts and an existing 10 foot x 24 foot combined sewer box that runs under John Muir Drive, the road would have to be raised between 6 inches and 2.5 feet for a length of approximately 440 feet. The banks of South Lake below the outlet structure would be lined with rip rap to the normal lake level to prevent erosion. Figure 4-19 provides a schematic diagram of the required facilities for this alternative.

**Figure 4-19 Schematic of South Lake Interim Solution**




***Planning Level Capital Cost and Implementation Schedule***

The planning level capital cost estimate for the South Lake Diversion interim solution is $10,720,000. This alternative is more expensive to construct than the Impound Lake interim solution because of the

complications with conveying flows over the combined sewer structure that runs under John Muir Drive. Details of the cost estimating analysis and implementation schedule are provided in Appendix D.

Implementation of this interim solution is expected to take approximately 3 years, which includes time necessary for preparing permit applications, obtaining permit approval, design, bidding and construction. The permitting process is expected to take 18 months to two years. If the permitting process began in early 2006, there would be up to four years of potential flooding (winters of 2005/2006, 2006/2007, 2007/2008, and 2008/2009) before the project would be implemented.

***Benefits***

The South Lake Diversion interim solution would address safety concerns and bank erosion issues by preventing flooding of John Muir Drive during a 10-year storm event. This option would essentially allow water to go where it naturally goes today, but it would flow under the road in a controlled manner rather than over the road. This alternative avoids habitat disturbance to the wetlands around Impound Lake.

***Limitations***

The limitations of this alternative are significant. First, it would take approximately 3 years to implement this alternative, which means at least four rainy seasons without protecting the roadway or the banks, and without addressing public safety concerns. Second, the capital cost is very high and the facility would be abandoned when long-term solutions are in place. Finally, loss of habitat would be approximately 0.92 acres, which is a significant impact considering the quality of habitat surrounding Lake Merced. Mitigation would be required at a 3:1 ratio, or approximately 3 acres. As with all interim solutions, the impacts of discharging stormwater with higher than ambient levels of coliform, nutrients and some metals and other pollutants would need to be addressed in the environmental and compliance process.

### 4.4.3 Bank Armoring

Bank Armoring at South Lake would consist of installing vegetated rip-rap along the banks of South Lake where overflows presently occur. The width of rip rap would be approximately 300 feet along John Muir Drive and extend from the roadway to normal lake level. After implementation of a long-term solution, the rip rap would be removed and the banks would be restored.

***Planning Level Capital Cost and Implementation Schedule***

The planning level cost estimate for this interim solution is $3,570,000. This cost includes cost for bank restoration after the interim solution is removed and mitigation for wetland habitat destroyed through the installation of this interim solution. A detailed cost estimate and implantation schedule is provided in Appendix D.

Implementation of this alternative is expected to take approximately 2-1/2 years which accounts for the time necessary for preparing permit applications, obtaining permit approval, design, bidding and construction. The permitting process is expected to take 18 months to 2 years. If the permitting process began in early 2006, there would be up to three seasons of potential flooding (winters of 2005/2006, 2006/2007, and 2007/2008) before the project would be implemented

***Benefits***

Installing rip rap at South Lake addresses bank erosion issues related to flooding of John Muir Drive by protecting the soil from being washed away during an overflow. The cost of the project is in the same range as the Impound Lake Diversion, but significantly less than the South Lake Diversion. The implementation period for this alternative is one year shorter than other interim solution alternatives.

***Limitations***

A significant limitation with this alternative is that it does not address safety concerns associated with flooding of the roadway. The roadway will flood, as it does presently, during a 10-year storm event, posing a safety risk to motorists and pedestrians. This alternative would also require the largest loss of habitat of the three interim solutions examined. A total of 1.4 acres of habitat would be lost, which would require 4.2 acres of mitigation at a 3:1 ratio. As previously mentioned, the impacts of discharging stormwater with higher than ambient levels of coliform, nutrients and some metals and other pollutants would need to be addressed in the environmental and compliance process.

### 4.4.4 Recommendations Related to Interim Solutions

It is recommended that interim solutions are not further analyzed as part of the Vista Grande Watershed Study, and that the partner agencies do not proceed with implementation of an interim solution. There is a significant amount of time related to permitting activities associated with each of the interim solutions, resulting in a 2-1/2 to 3-1/2 year implementation schedule. With an assumed 5 to 8 year implementation schedule for the Tunnel South of County Line alternative recommended as part of the study, the interim solutions would provide only 2 to 4 years of flood protection before the long-term solution is implemented. Additionally, none of the interim solutions are compatible with the long-term program, so they would need to be removed once the long-term program is in place. Additionally, there is considerable expense associated with each interim solution with costs ranging between $2,100,000 and $10,700,000. Perhaps the most significant challenges associated with implementation of the interim solutions are the permitting and regulatory issues associated with the filling of 0.04 to 4.2 acres of wetlands along the shoreline of Lake Merced and the regulatory issues associated with creating a structure to discharge untreated stormwater into Lake Merced, as outlined under the Impound Lake and South Lake interim solution alternatives. As such, it is instead recommended that a traffic plan be developed to control traffic on John Muir Drive during storm events and that implementation activities associated with the long-term program be initiated as soon as possible.

Since interim solutions are not recommended as part of the watershed study, there may be potential for costs related to roadway and trail repairs associated with Vista Grande canal overflows until the long-term program components are implemented. Maintenance of the Vista Grande drainage system, especially the Vista Grande canal and the Vista Grande tunnel, will be essential in minimizing flooding damages until the long-term program is in place. This maintenance should include a pre-storm season walkthrough of the canal and adjacent areas to identify debris and other maintenance activities to be conducted prior to the storm season. Maintenance during storm events could be enhanced by installing a mechanical device to catch and remove debris to maintain flow through the canal and tunnel.

# Chapter 5

# Recommended Program

# Chapter 5 Preliminary Program Recommendations

## 5.1 Summary of the Preliminary Program Recommendations

As described in Chapter 4, the alternatives identified for further evaluation in the Vista Grande Watershed Study include the Tunnel South of County Line, Vista Grande Wetland, Strom Drain Improvements and ongoing implementation of BMPs in compliance with the San Mateo Countywide NPDES permit. These four preliminary program components, shown conceptually in Figure 5-1, will solve the flooding issues within Daly City and along the Vista Grande canal while providing additional watershed benefits in accordance with the goals and objectives of this watershed study.

These Preliminary Program Recommendations establish a general approach for further investigation to provide flood protection within the Vista Grande watershed based on the preliminary alternatives analysis presented in Chapter 4 Alternatives Considered. The preliminary program components have been evaluated at a planning level only and none of the alternatives presented in this document have been selected for implementation. Further investigation and detailed design would be necessary prior to implementing any of the concepts presented as part of this study. Chapter 6 Implementation Strategies presents information on the next steps for developing the findings of this study and implementing a comprehensive watershed program to solve flooding issues in the watershed.

**Figure 5-1 Long-Term Program Components Recommended for Further Evaluation in the Vista Grande Watershed Study**

As shown in Table 5-1, the overall planning level cost estimate for the preliminary program recommendations, escalated to the assumed midpoint of construction for each preliminary program component, is $118,000,000 - $165,000,000. The cost estimates summarized in Table 5-1 are based on the planning level cost estimates developed for each preliminary program component and described in this chapter.

**Table 5-1 Overall Planning Level Cost Estimate for the Vista Grande Watershed Preliminary Program**

| Preliminary Program Recommendations | Planning Level Cost Estimate Range |
|---|---|
| Tunnel South of County Line | $72,000,000 - $104,000,000 |
| Vista Grande Wetland | $11,000,000 |
| Storm Drain Improvements | $35,000,000 - $49,000,000 |
| Ongoing Best Management Practices | Not Applicable [a] |
| **Total Cost for the Vista Grande Watershed Study Preliminary Program** | **$118,000,000 - $165,000,000** |

a. BMP implementation will be ongoing in accordance with the San Mateo County NPDES permit.
b. Costs have been escalated to the midpoint of construction for each preliminary program component at a rate of 5% per year. See Appendix G for more information.
c. Cost estimates provided in Table 5-1 are based on planning level cost estimate work conducted for each preliminary program component and described in Section 5.2 (Tunnel South of County Line), 5.3 (Vista Grande Wetland), and 5.4 (Storm Drain Improvements).

This chapter presents a more detailed analysis and discussion of the preliminary program recommendations: Tunnel South of County Line, the Vista Grande Wetland, storm drain improvements, and ongoing BMP implementation.

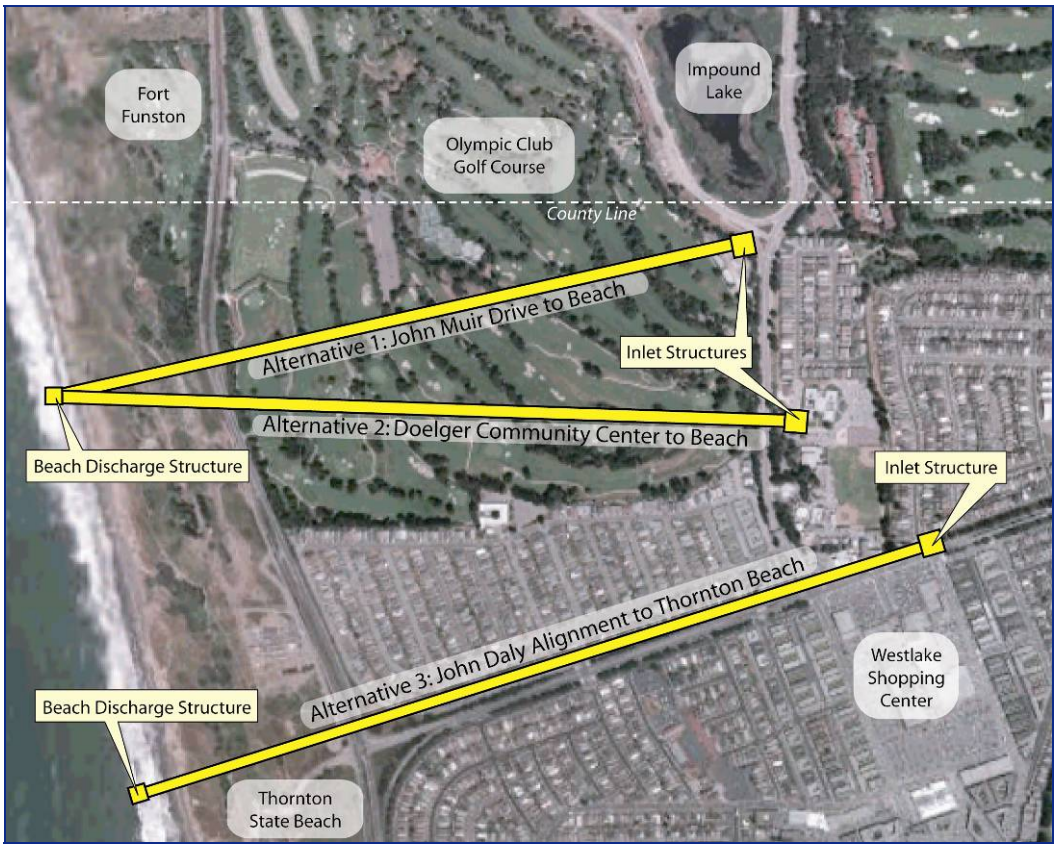
## 5.2 Tunnel South of County Line

### 5.2.1 Description & Location

The Tunnel South of County Line is the long-term, downstream flood protection component of the preliminary program recommendations of the Vista Grande Watershed Study. The tunnel would convey stormwater from Daly City to a beach discharge structure south of the San Mateo/San Francisco County line. The following section presents a preliminary analysis of potential options for the layout and design of the Tunnel South of County Line. It also presents an overview of the concepts that will need to be considered if the Tunnel South of County Line is selected for implementation. Further investigation and detailed design would be necessary prior to project implementation.

Three alternatives were developed for the tunnel alignment as part of this preliminary analysis. Figure 5-2 shows the locations of each alternative. These three alignments were included as examples to evaluate conceptual feasibility and general planning level cost ranges of the Tunnel South of County Line. A detailed alternatives analysis will need to be conducted in order to select the most cost effective, beneficial alignment. This alternatives analysis will evaluate a number of different alignments, including, but not limited to, the three alignments evaluated as part of this study. Since all options will require further investigation, a preferred alternative has not yet been selected.

**Figure 5-2 Tunnel South of County Line Alternative Map**




### 5.2.2 Objectives

The primary objective of the Tunnel South of County Line is to eliminate flooding in the lower Vista Grande watershed. As previously indicated, the existing Vista Grande canal and tunnel do not have

adequate capacity to convey stormwater flows for design storm conditions. This insufficient capacity is responsible for recent overflows and flooding across John Muir Drive into Lake Merced. The new tunnel would circumvent the existing Vista Grande canal and tunnel by taking flow from the existing storm drain system before it is released into the canal, thereby providing flood protection and ensuring public safety in the Lake Merced area. Additionally, the elimination of downstream flooding would reduce Lake Merced bank erosion and protect the water quality of lake.

The long-term, upstream component to the watershed study is to improve the Daly City storm drain system to provide conveyance for the 10-year design storm event. This would increase the amount of flow conveyed downstream. The hydrologic and hydraulic design assumptions for the tunnel are discussed below.

### 5.2.3 Design Assumptions

The following design assumptions served as the basis for the conceptual design of the Tunnel South of County Line.

#### Hydrologic Assumptions

The tunnel is intended to have the capacity to transport storm drain flows after upstream improvements have been made. The design criteria for upstream system improvements in this study were based on the 10-year, 4-hour storm event. The 10-year event has become a typical storm drain design level because it provides a balance between level of service and affordability. The 25-year storm event capacity was chosen for the preliminary evaluation of tunnel improvements in lieu of a 10-year storm event to ensure downstream flooding for larger events can also be conveyed. Additionally, from an economic perspective, the incremental cost of building a tunnel for 10-year peak flows vs. 25-year peak flows is minimal compared to the overall cost of implementing the tunneling project. These levels of protection (10-year and 25-year for upstream and downstream improvements, respectively) were used to establish a base line for the preliminary alternatives comparison and planning level cost estimates only. The final design storm for the Tunnel South of County Line would be determined as part of a detailed alternatives analysis to determine the optimal design.

#### Hydraulic Assumptions

The peak stormwater flow entering into the Vista Grande canal for a 4-hour, 25-year storm event is approximately 1,500 cfs (see Section 1.2 and Appendix A for more information). For preliminary sizing calculations, this peak flow represents the peak design flowrate for the stormwater tunnel. Preliminary site investigations and mapping exercises established approximate tunnel lengths and invert elevations. These initial assumptions were refined throughout the planning process and are reflected in the description of each alternative. Manning’s equation was used to determine an approximate tunnel diameter for the established hydraulic conditions. An interior diameter of 15 ft was calculated. Table 5-2 presents the hydraulic design criteria.

**Table 5-2 Hydraulic Design Criteria**

| Criteria | Value | Units | Description |
|---|---|---|---|
| Tunnel Design Capacity | 1,500 | cfs | 4-hour, 25-year storm event |
| Tunnel Interior Diameter | 15.0 | ft | Based on preliminary design calculations |
| Tunnel Length | 4750-5400 | ft | Based on preliminary tunnel layouts |
| Tunnel Material | Concrete | - | |
| Manning's n | 0.013 | - | Average value for concrete pipe[a] |
| Initial Invert Elevation | ~ 8 | ft | Based on SF city datum |
| Final Invert Elevation | 4 | ft | Based on SF city datum |
| Slope | 0.0008 | - | Based on invert elevations and tunnel lengths |
| Velocity | <10 | fps | To limit tunnel corrosion |

Footnotes:

a. From Civil Engineering Reference Manual, Appendix 19.A (Lindeburg, 2003). For the type of precast, concrete sections that may be used for construction of the tunnel, initial tunnel conditions may be more closely approximated by using a Manning's coefficient of 0.015. However, experience has shown that an operational tunnel will soon approximate standard concrete pipe conditions, so a Manning's coefficient of 0.013 was used.

## Groundwater Assumptions

The groundwater conditions in the project area have been investigated in recent years through monitoring well data and groundwater model simulations. A summary of pertinent findings as they relate to the Tunnel South of County Line is presented here. Refer to information developed by Yates (October, November 2005) in Appendix E for additional groundwater information.

- The groundwater in the project area is dominated by the Serra Fault, a buried thrust fault that runs southeast to northwest through the project area (as seen in Figure 5-3). The fault separates an area of relatively low and flat groundwater elevations on the east side of the fault from a ridge of elevated groundwater levels on the west side.
- The area to the west of the fault consists of a tilted and possibly folded block of primarily Merced Formation rock. This deformation results in low horizontal hydraulic conductivity, contributing to the high water level in the area to southwest. The water level drops steeply to a seepage face near the toe of the beach bluff cliffs.
- East of the fault, the regional water table slopes southward toward a major pumping depression in the Westlake area. Shallow clay layers that support the shallow aquifer become discontinuous between Impound Lake and John Daly Boulevard. As the clays become discontinuous, the downward slope steepens and the water table plunges to an elevation of approximately 100 feet below sea level (SF city datum) in the Westlake area. The exact shape of the water table as it slopes southward is poorly known.

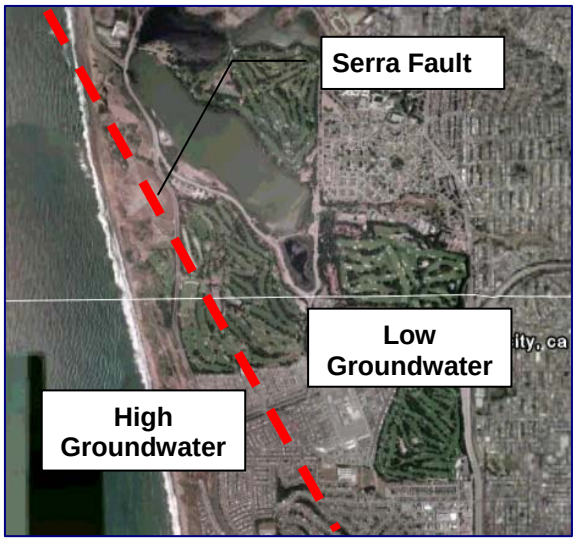



**Figure 5-3 Serra Fault Location**

General conclusions regarding the groundwater table are that tunnel construction would be above the water table at the eastern end of the project area but would encounter the water table about halfway to the

coast. Groundwater elevations as they relate to the alternative tunnel alignments are evaluated in Section 5.2.4.

## Construction Assumptions

Construction of the Tunnel South of County Line is expected to be below the water table for a significant reach of the tunnel. As such, construction assumes the use of an Earth Pressure Balance tunnel boring machine (EPBM), which can operate below the water table so that dewatering is not required. The EPBM, greatly refined over the last 30 years, has contributed to improved safety, faster construction completion, and fewer environmental impacts associated with tunnels, especially in soft ground conditions similar to those found in the Daly City/San Francisco area. The tunnel boring machine has been used successfully on many projects, such as the Richmond Transport Tunnel in San Francisco. The Richmond Transport Tunnel is a 2-mile long, 14-ft diameter tunnel built for combined stormwater/wastewater overflows into San Francisco Bay. The tunnel was constructed in extremely variable ground conditions, ranging from sandstones and siltstones, to mélange/fault gouge materials, to soft ground conditions consisting of dune sands. The project was successful in balancing a number of issues, such as construction staging within limited areas, city sound ordinances, and traffic control. The project also minimized damage as a result of tunneling-induced settlement as it passed under the Palace of the Legion of Honor and the Seacliff residential area (Woodward-Clyde, 1995).

**Figure 5-4 Typical tunnel boring machine**

**Figure 5-5 Typical construction layout**

**Figure 5-6 Typical tunnel portal**

A tunnel boring machine (TBM) typically consists of one or two shields (large metal cylinders) and trailing support mechanisms. A rotating cutting wheel is located at the front end of the shield and transfers dirt onto a conveyor belt and into a cart for removal at the tunnel portal. Forward pressure along with a system to balance internal and external pressure keeps water and mud from seeping into the tunnel and minimizes surface settlement (VTA, 2002). Behind the dirt conveyance chamber there is a set of hydraulic jacks supported by the finished part of the tunnel which are used to push the TBM forward. The action here is caterpillar-like. The rear section of the TBM is braced against the tunnel walls and used to push the TBM head forward. At maximum extension the TBM head is then braced against the tunnel walls and the TBM rear is dragged forward (Boyce, 2005; Wikipedia, 2005).

Behind the shield, inside the finished part of the tunnel, several support mechanisms can be found: dirt removal, slurry pipelines if applicable, control rooms, rails for transport of the precast segments, etc. (Boyce, 2005; Wikipedia, 2005).

The cutting wheel will typically rotate at 4 to 10 rpm (depending on size and geology), cutting the rock face into chips or excavating soil (muck). Depending on the type of TBM, the muck will fall onto a conveyor belt system and be carried out of the tunnel, or be mixed with slurry and pumped back to the tunnel entrance (Boyce, 2005; Wikipedia, 2005).

The TBM operates primarily underground so there are minimal impacts on the surface to traffic and the surrounding community. Tunnel construction would be primarily visible only at the openings at each end of the tunnel, known as portals (VTA, 2002). Construction staging would focus on minimizing impacts such as traffic interruption, dust and noise, and maintenance of auto and pedestrian access at key locations (Boyce, 2005).

The follow are a list of construction considerations common to all tunnel alternatives:

- The tunnel was estimated to be supported using bolted, gasketed precast concrete segments, thereby eliminating the need for a final cast-in-place concrete lining.
- Tunnel muck (i.e., spoils) was estimated to be disposed of on local beaches or other sites (within 10 miles) as remediation material. Discussions with GGNRA and California State Parks staff have indicated that this remediation material could be applied to beneficial uses.
- The downstream end of the tunnel is assumed to terminate at a concrete outlet structure located on the beach. The structure is assumed to be founded on mini-piles, socketed into the cliff face, and equipped with a steel grate and sand pocket. Construction of an ocean outfall would increase the project expense significantly. An ocean outfall was not assumed for the tunnel alternatives due to the fact that there are no regulatory or permitting requirements dictating the use of ocean outfalls for the discharge of stormwater. The primary reason for using an ocean outfall would be to take advantage of the dispersion capability it provides. However, the Clean Water Act does not stipulate numerical limits regarding water quality of stormwater. Stormwater discharges are regulated by NPDES permits which require BMPs for operation. For these reasons at a conceptual level, an ocean outfall is not

**Figure 5-7 Typical construction shaft**

assumed necessary and construction of a beach discharge structure is assumed for all tunnel alternatives.

### 5.2.4 Preliminary Layout and Facilities

#### Alternative 1 – John Muir Drive Site

The tunnel inlet structure of Alternative 1 would be located at the upstream end of the existing Vista Grande canal, at the intersection of John Muir Drive and Lake Merced Boulevard. The three Daly City storm drain trunk lines converge at this location. The inlet of the tunnel would be located at the storm drain convergence point and extend west-southwest under the hill at the edge of the Olympic Club. The tunnel would be approximately 4,750 ft long and terminate at a beach outlet structure south of Fort Funston. Figure 5-8 shows the profile view of the tunnel alignment with approximate groundwater levels. Figure 5-9 presents the inlet area of Alternative 1. As shown, an inlet structure would collect the flow from the storm drains and feed it into the tunnel.

***Construction Considerations***

The following are a list of construction considerations specific to the John Muir Drive site:

- A 32-foot diameter access shaft sized to permit subsequent tunneling and construction of a permanent, cast-in-place inlet structure. The access shaft would be located at the intersection of John Muir Drive and Lake Merced Boulevard.
- A temporary diversion structure to handle up to 680 cfs of flows into the canal along John Muir Drive for the entire construction period. The temporary diversion would be filled in after construction is complete and the tunnel is operational.
- Construction of a 4,200 gpm pump station and approximately 400-ft 12-inch force main to convey flows from the Daly City storm drain system to the tunnel. The pump station would be installed underground.

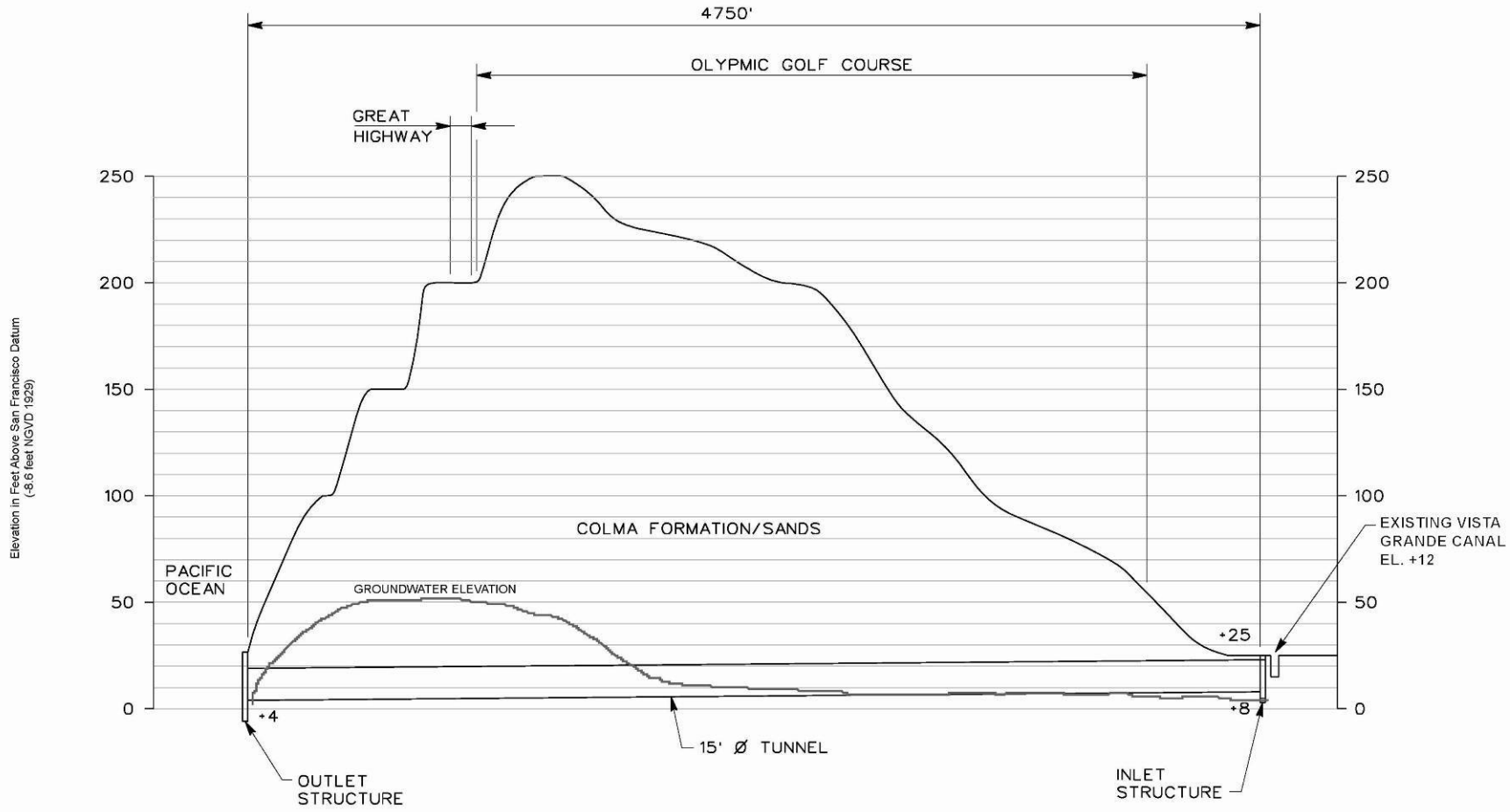



**Figure 5-8 Alternative 1 Tunnel Profile**

| | | | |
|---|---|---|---|
| DRAWN BY D.H. | JACOBS ASSOCIATES | CITY OF DALY CITY AND SFPUC<br>RMC WATER & ENVIRONMENT, INC | SCALE AS NOTED<br>JOB NUMBER 3957 |
| DATE 10/05 | Engineers/Consultants<br>465 California Street, Suite 1000 San Francisco, CA 94104 | VISTA GRANDE PROJECT<br>PROFILE FROM JOHN MUIR | DRAWING NUMBER PROFILE 1 |
| | | | REV. 0 |

**Figure 5-9 John Muir Drive Site**

### *Outlet Structure*

The beach outlet structure for Alternative 1 is assumed to be south of Fort Funston. The outlet location was chosen due to the nearby cliff-line configuration which reduces the visual impacts of the outlet. Also, this location is expected to minimize impacts to animal habitat and not obstruct public access. The structure would be similar in design to the existing San Francisco combined sewer overflow (CSO) beach outlet. The concrete outlet structure is assumed to be socketed into the cliff face and equipped with a steel grate and sand pocket. Construction is estimated to be staged entirely from within the tunnel. Figure 5-10 and Figure 5-11 shows the location of the outlet structure and the CSO structure, respectively.

**Figure 5-10 Fort Funston Beach Outlet Location**

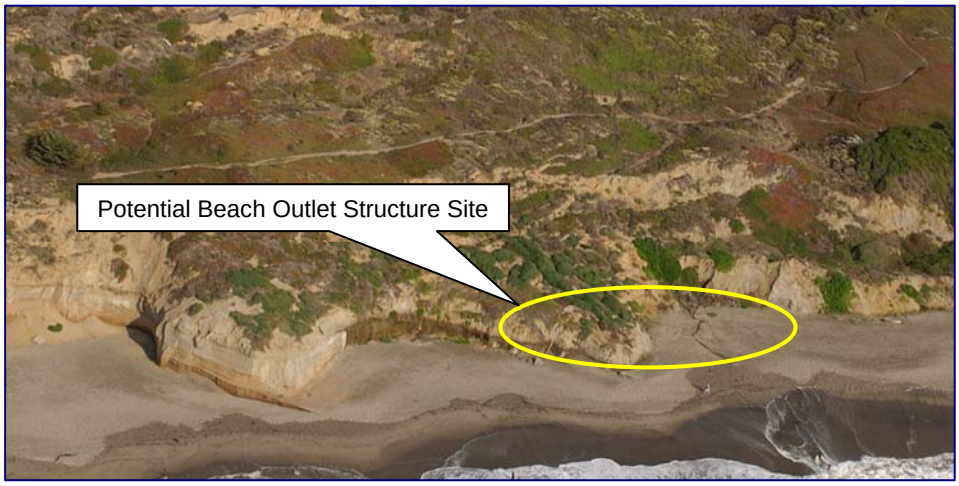



**Figure 5-11 San Francisco CSO Structure**

## Alternative 2 – Doelger Community Center Site

The inlet of Alternative 2 would be located in the parking lot of the Doelger Community Center. The tunnel inlet structure would be located underground and the tunnel would extend west under Lake Merced Boulevard and the Olympic Club Golf Course. Figure 5-12 shows the profile view of the tunnel alignment with approximate groundwater levels. The tunnel would be approximately 4,900 ft long. Figure 5-13 presents the inlet area of Alternative 2. As shown, the three Daly City storm drain trunk lines would be rerouted to converge at the Doelger Community Center parking lot. Additionally, a pump station and force main would convey flow collected in the storm drain system downstream of the tunnel. This "remainder" stormwater would flow toward the existing Vista Grande canal but then be pumped back to the tunnel inlet structure. The force main would be installed in an existing box storm drain on Lake Merced Boulevard.

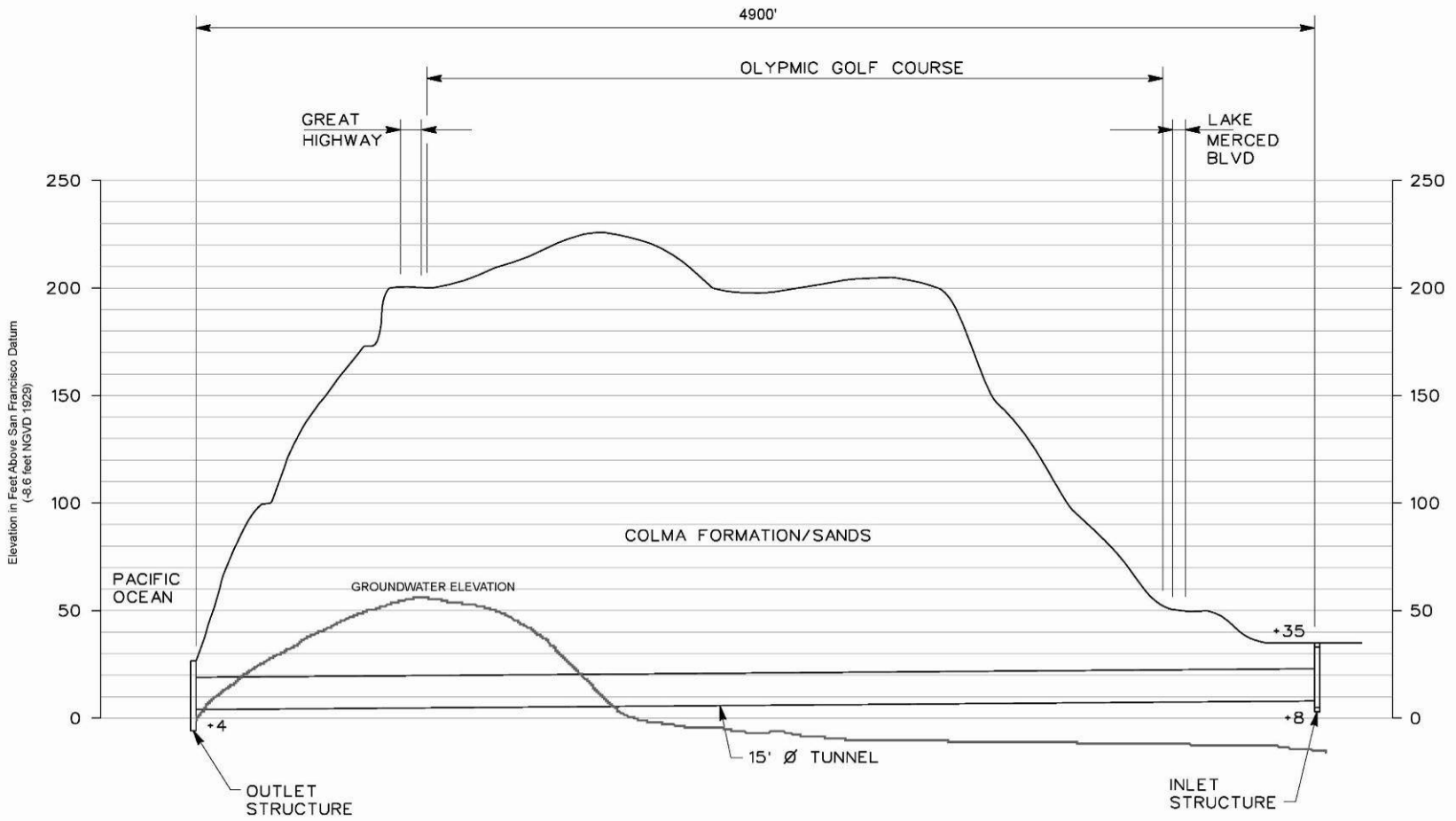



**Figure 5-12 Alternative 2 Tunnel Profile**

| | | | | |
|---|---|---|---|---|
| DRAWN BY D.H. | JACOBS ASSOCIATES | CITY OF DALY CITY AND SFPUC<br>RMC WATER & ENVIRONMENT, INC | SCALE AS NOTED<br>JOB NUMBER 3957 | REV. 0 |
| DATE 10/05 | Engineers/Consultants<br>465 California Street, Suite 1000 San Francisco, CA 94104 | VISTA GRANDE PROJECT<br>PROFILE FROM SENIOR CENTER | DRAWING NUMBER PROFILE 2 | |

**Figure 5-13 Doelger Community Center Site**

### *Construction Considerations*

The following are a list of construction considerations specific to for Doelger Community Center site:

- A 32-foot diameter access shaft sized to permit subsequent tunneling and construction of a permanent, cast-in-place inlet structure. The access shaft would be located in the Doelger Community Center parking lot. The lot would be restored after construction.
- Construction of a 550-ft long microtunnel between the new inlet structure work area and a tie-in point to the 60-inch storm drain located on Cliffside Drive. This includes construction of an access shaft over the tie-in location used to recover the microtunneling machine and affect the tie-in.
- Construction of 300 linear feet of box culvert connecting a tie-in with the existing 7-ft by 6-ft box culvert and 24-inch storm drain along Lake Merced Boulevard and the new inlet structure.
- Construction of a 21,000 gpm pump station and approximately 1300-ft of 27-inch force main to convey stormwater flows from the drainage basin cut off by the tunnel alignment. The force main would be set in the existing box culvert, attached to the roof.

### *Outlet Structure*

The beach outlet structure for Alternative 2 is assumed to be in the same location as the beach outlet structure for Alternative 1. Details regarding the outlet structure are assumed to be similar to those described for Alternative 1.

## Alternative 3 – John Daly Alignment

The location of the John Daly alignment is shown in Figure 5-2. The tunnel inlet structure of Alternative 3 would be located near the Westpark Shopping Center. The tunnel would extend west along John Daly Boulevard to Thornton State Beach. The primary construction site for Alternative 3 is located near the termination of John Daly Boulevard at Skyline Boulevard, between Daly City's Thornton Beach Vista and the horse stables to the north. Excavation of the tunnel would be staged from this location. Figure 5-14 illustrates this construction area. Figure 5-15 shows the profile view of the tunnel alignment with approximate groundwater levels. The tunnel would be approximately 5,400 ft long.

**Figure 5-14: John Daly Alignment Primary Construction Site**

Note: The figure does not show Daly City's recent construction of the Thornton Beach Vista.

### *Construction Considerations*

The Alternative 3 tunnel would be mined in two sections. The first section would be mined with a tunneling shield and would extend from an access shaft at the primary construction site to the beach. The second section of the tunnel would extend east from the access shaft to a secondary construction site near the Westlake Shopping Center.

Alternative 3 would require the following construction work at the primary construction site:

- A 215-ft deep, 32-ft diameter access shaft sized to permit subsequent tunneling, in two directions with limited disturbance to the general public. The access shaft would be located near Daly City's Thornton Beach Vista and access would be obtained from the vista parking area or Olympic Way.
- A permanent, 12-ft diameter access shaft to be installed in the excavation shaft after tunnel construction is complete. Excavation material would be used to fill in the remainder of the shaft.

The secondary construction site would serve as the retrieval location, the site where a construction shaft is excavated and the EPBM is retrieved. The retrieval location and the upstream inlet of the alternative would be located at the intersection of South Mayfair Avenue and Park Plaza Drive, as shown in Figure 5-16.

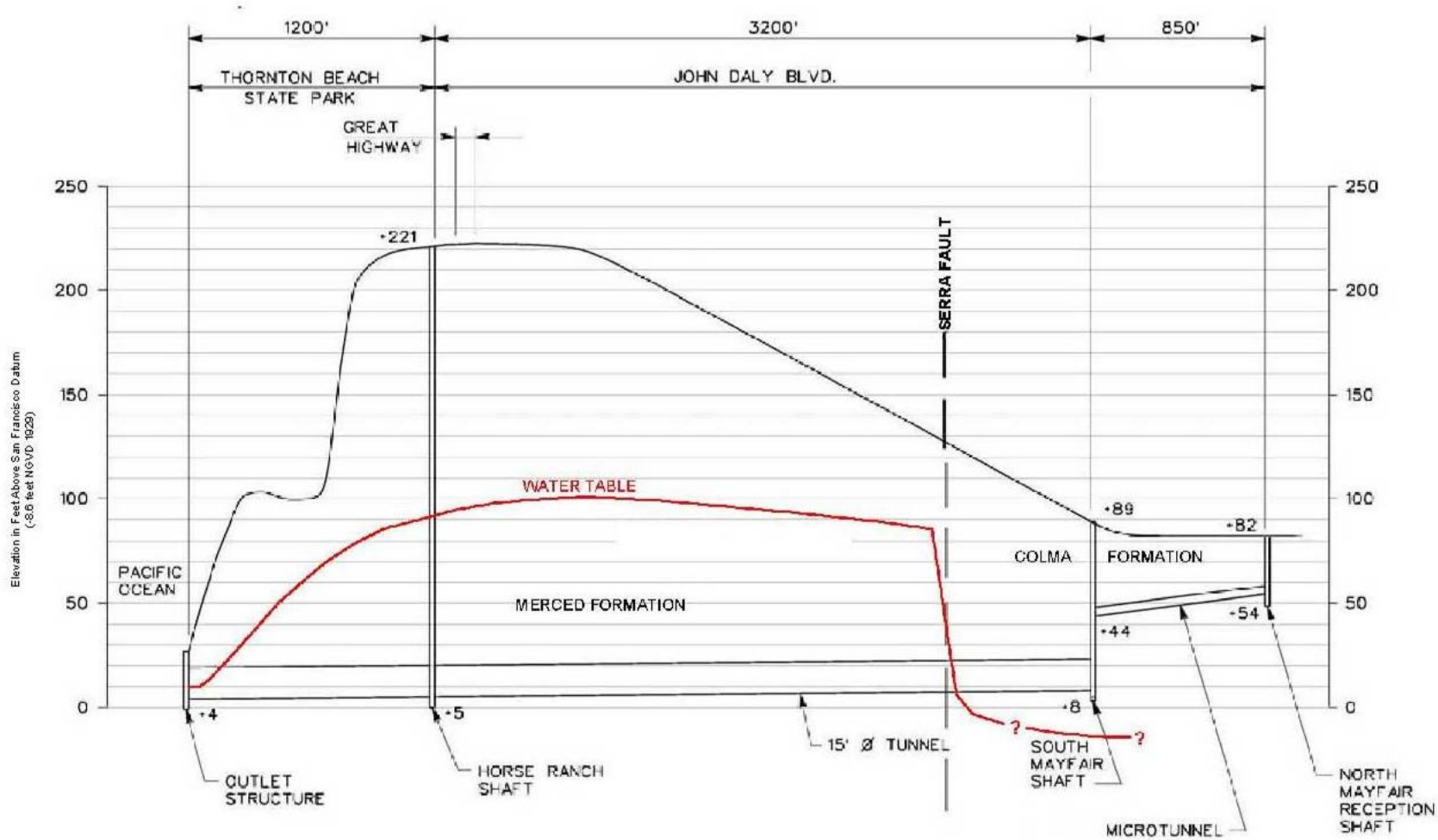
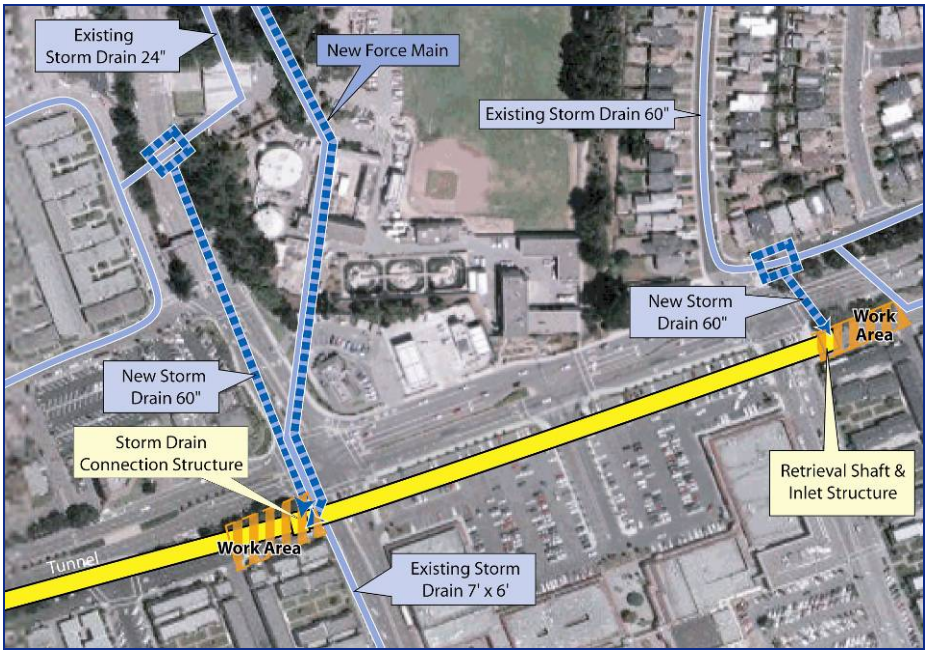



**Figure 5-15 Alternative 3 Tunnel Profile**

| | | | | |
|---|---|---|---|---|
| DRAWN BY D.H. | JACOBS ASSOCIATES | CITY OF DALY CITY AND SFPUC | SCALE AS NOTED | REV. |
| | | RMC WATER & ENVIRONMENT, INC | JOB NUMBER 3957 | 0 |
| DATE 01/06 | Engineers/Consultants | VISTA GRANDE PROJECT | DRAWING NUMBER PROFILE 3 | |
| | 465 California Street, Suite 1000 San Francisco, CA 94104 | PROFILE ALONG JOHN DALY BLVD. | | |

Note: The profile shown here is representative of Alternative 3 with an alternate retrieval location. Refer to Appendix G for more information on the alternate retrieval location.

**Figure 5-16 John Daly Alignment Retrieval Location Construction Site**




Extensive storm drain connections are required to connect Daly City's three storm drain sub-basins to the tunnel. As illustrated in Figure 5-16, the following construction work would be required:

- An 80-ft deep, 25-ft diameter retrieval shaft sized to allow recovery of the EPBM and construction of a permanent, cast-in-place inlet structure. The retrieval shaft would be located at the intersection of South Mayfair Avenue and Park Plaza Drive.
- Construction of a 200-foot long, 60-inch micro-tunnel connecting the existing 60-inch storm drain to the tunnel at the retrieval shaft location. This work includes construction of an access shaft at the connection location to recover the micro-tunneling machine and a tie-in structure.
- Construction of an 80-ft deep storm drain connection structure located at South Mayfair Avenue and Lake Merced Boulevard. This structure would facilitate connections to the 24-inch and 7-ft x 6-ft box stormwater sub-basins.
- Construction of approximately 20-ft of reinforced concrete pipe, pipe-jacked tunnel, connecting the existing manhole in Lake Merced Boulevard (7-ft x 6-ft storm drain) to the new connection shaft and inlet structure.
- Construction of a 700-foot long, 60-inch micro-tunnel connecting the new inlet structure with the 24-inch storm drain at an existing manhole. This work includes construction of an access shaft at the connection location to recover the micro-tunneling machine and a tie-in structure. Both micro-tunnel connections for Alternative 3 were assumed to use the same micro-tunnel size for construction cost savings. The size of both micro-tunnels would be refined during the design process based on the findings of the upstream storm drain improvements program included in the Vista Grande Watershed Study.
- Installation of a 27,000 gpm pump station and 33-inch force main to convey stormwater collected in the sub-basins downstream of the connection points. The pump station would be located underground near the Vista Grande canal and the force main would be installed in the existing 7-ft x 6-ft box storm drain.

Through field visits and discussions with Daly City staff, an alternate retrieval location at the intersection of South Mayfair Avenue and Lake Merced Boulevard was also investigated. Details regarding this alternate retrieval location can be found in Appendix E.

***Outlet Structure***

The beach outlet structure for Alternative 3 would be located at Thornton State Beach, a California State Park that is currently closed. The outlet structure design is assumed to be similar to Alternatives 1 and 2 and could be socketed into the cliff face and equipped with a steel grate and sand pocket. Construction is estimated to be staged entirely from within the tunnel. Figure 5-17 shows the location of the outlet structure for Alternative 3.

**Figure 5-17: Thornton State Beach Outlet Location**

### 5.2.5 Planning Level Cost Estimate

Preliminary planning level cost estimates were developed for each of the tunnel alignment alternatives. These cost estimates include construction of all project components as described above and represent the current expected low bid for construction. A 30-percent allowance was included for contingency to reflect the current bidding climate in the underground construction industry and the recent volatility in material prices for such items as steel and cement. The estimates do not include right-of-way and land acquisition costs.

The cost estimates were prepared using all available information, with judicial assessments where no information was available, and comprise production-type cost estimating methods, including the following assumptions:

- Current prevailing labor rates were taken from California Department of Industrial Relations and are fully burdened rates, including payroll taxes and insurance, and worker's compensation and commercial general liability insurance.
- Equipment rates were developed using the current USACE Construction Equipment Ownership and Operating Expense Schedule (Region VII), published in 2003 for the western states (USACE, 2005).
- Material and subcontract costs are based on current market prices. Quotes were obtained for large items such as bolted, gasketed tunnel segments.

Table 5-3, Table 5-4, and Table 5-5 provide summaries of the planning level cost estimates for each of the tunnel alternatives. Detailed cost estimate information can be found in Appendix E. Total capital project

cost estimates for Alternative 1, Alternative 2, and Alternative 3 are $56.1 million, $63.2 million, and $81.6 million, respectively (December 2005 dollars).

Costs for the tunnel alternatives were escalated to the assumed approximate midpoint of construction (winter 2010/2011). Escalated costs for Alternative 1, Alternative 2, and Alternative 3 are $71.6 million, $80.7 million, and $104.1 million, respectively. Note that this escalated cost does not include origination costs associated with bond financing, which typically equate to about 10 percent of the bonded amount.

**Table 5-3 Estimated Costs for Tunnel South of County Line**
**Alternative 1 – John Muir Drive Site**

| Description | Cost |
|---|---|
| TUNNEL CONSTRUCTION | |
| Prepare Site & Construct Shaft | $471,000 |
| Assemble Earth Pressure Balance TBM and Backup | $238,000 |
| Excavate/Support Tunnel | $15,497,000 |
| Disassemble Earth Pressure Balance TBM / Backup through Tunnel | $334,000 |
| Construct Outlet Structure | $363,000 |
| Construct Inlet Structure | $268,000 |
| Remove Tunnel Services & Restore Site | $41,000 |
| Backfill Temporary Diversion and Effect Tie-in | $59,000 |
| STORMDRAIN CONNECTIONS | |
| N/A | |
| PUMP STATION AND FORCEMAIN | |
| Construct Pump Station and Install Force Main | $2,340,000 |
| MOBILIZATION/INDIRECT COSTS | |
| Mobilization/Demobilization | $6,981,000 |
| General Operation, Tunnel Support & Other Indirect Costs | $2,552,000 |
| Markup | $3,599,000 |
| Cost Estimate Subtotal: | $32,743,000 |
| Contingency (30% Allowance): | $9,823,000 |
| Construction Cost Estimate: | $42,566,000 |
| Implementation (30% Allowance): | $12,770,000 |
| Environmental Compliance: | $750,000 |
| **Project Total (2005 dollars):** | **$56,100,000** |
| **Cost Escalated to Approximate Midpoint of Construction (Winter 2010):** | **$71,600,000** |

**Table 5-4 Estimated Costs for Tunnel South of County Line**
**Alternative 2 – Doelger Community Center Site**

| Description | Cost |
|---|---|
| TUNNEL CONSTRUCTION | |
| Prepare Site & Construct Shaft | $228,000 |
| Assemble Earth Pressure Balance TBM and Backup | $238,000 |
| Excavate/Support Tunnel | $16,129,000 |
| Disassemble and Retrieve Earth Pressure Balance TBM | $334,000 |
| Construct Outlet Structure | $363,000 |
| Construct Inlet Structure | $268,000 |
| Remove Tunnel Services & Restore Site | $41,000 |
| STORMDRAIN CONNECTIONS | |
| Construct New Box Culvert Connection (7'x6' & 24-inch stormdrain) | $484,000 |
| Construct Microtunnel Connections (60-inch stormdrain) | $1,180,000 |
| Construct Microtunnel Retrieval Shaft and Drop Structure | $185,000 |
| PUMP STATION AND FORCEMAIN | |
| Construct Pump Station and Install Force Main | $3,513,000 |
| MOBILIZATION/INDIRECT COSTS | |
| Mobilization/Demobilization | $7,075,000 |
| General Operation, Tunnel Support & Other Indirect Costs | $2,828,000 |
| Markup | $4,074,000 |
| Cost Estimate Subtotal: | $36,940,000 |
| Contingency (30% Allowance): | $11,082,000 |
| Construction Cost Estimate: | $48,022,000 |
| Implementation (30% Allowance): | $14,407,000 |
| Environmental Compliance: | $750,000 |
| **Project Total (2005 dollars):** | **$63,200,000** |
| **Cost Escalated to Approximate Midpoint of Construction (Winter 2010):** | **$80,700,000** |

**Table 5-5 Estimated Costs for Tunnel South of County Line Alternative 3 – John Daly Alignment**

| Description | Cost |
|---|---|
| TUNNEL CONSTRUCTION | |
| Prepare Site & Construct Shaft | $1,533,000 |
| Assemble Excavation Shield and Backup | $152,000 |
| Excavate/Support Tunnel with Shield | $4,377,000 |
| Assemble Earth Pressure Balance TBM and Backup | $475,000 |
| Excavate/Support Tunnel | $13,675,000 |
| Disassemble and Retrieve Earth Pressure Balance TBM | $180,000 |
| Construct Outlet Structure | $352,000 |
| Prepare and Excavate Retrieval Shaft | $838,000 |
| Construct Inlet Structure | $365,000 |
| Remove Tunnel Services & Restore Site | $105,000 |
| Construct Permanent Access and Backfill Temporary Shaft | $991,000 |
| STORMDRAIN CONNECTIONS | |
| Construct RCP Pipe-Jacked Connection (7'x6' stormdrain) | $178,000 |
| Construct Microtunnel Connections (24-inch and 60-inch stormdrains) | $1,954,000 |
| Microtunnel Retrieval Shafts and Drop Structures | $370,000 |
| Excavate/Support Connection Shaft and Drop Structure | $652,000 |
| PUMP STATION AND FORCEMAIN | |
| Construct Pump Station and Install Force Main | $4,008,000 |
| MOBILIZATION/INDIRECT COSTS | |
| Mobilization/Demobilization | $10,353,000 |
| General Operation, Tunnel Support & Other Indirect Costs | $2,383,000 |
| Markup | $4,926,000 |
| Cost Estimate Subtotal: | $47,867,000 |
| Contingency (30% Allowance): | $14,360,000 |
| Construction Cost Estimate: | $62,227,000 |
| Implementation (30% Allowance): | $18,668,000 |
| Environmental Compliance: | $750,000 |
| **Project Total (2005 dollars):** | **$81,600,000** |
| **Cost Escalated to Approximate Midpoint of Construction (Winter 2010):** | **$104,100,000** |

### 5.2.6 Operation and Maintenance

Operation and maintenance (O&M) of the tunnel would include routine inspection and associated maintenance. The tunnel itself has no moving parts, so maintenance is expected to be minimal. Trash racks would be used at the inlet structure and would require regular maintenance. The beach outlet structure, similar to the existing outlet, will have a simple gate mechanism that closes when it is not in use. It is assumed the new outlet structure will require minimal maintenance as well.

Access to the interior of the tunnel could be obtained from the upstream inlet location and the beach outlet location. These access points could be used in the future for maintenance and repairs of the tunnel. Additionally, Alternative 3 includes a permanent, 12-ft diameter access shaft located at the primary construction site. Maintenance crews would be able to enter the tunnel via the shaft and gain access to the entire length of the tunnel. The shaft would include a structure preventing unauthorized access.

Multiple locations have been identified to obtain access to the beach outlet structure. These access points could also be used to facilitate beach construction. They are as follows:

- Great Highway and Lincoln Road – Provides reliable access from the north that the Daly City Department of Water and Wastewater Resources (DWWR) has used before, however, it would require 4 miles of beach travel to reach the outlet structure for the alternatives.
- Great Highway and Sloat Road – Access site that DWWR has used previously, located approximately 2 miles north of the outlet site of the tunnel alternatives.
- Access from Fort Funston North – Approximately 7000 ft north of the outlet for Alternatives 1 and 2, a steep sand ladder connects a paved road to the beach in Fort Funston. Access to the paved road is available from: 1) Great Ocean Road near Oceanside Water Pollution Control Plant, or 2) the Fort Funston parking lot. Temporary road construction mats may be needed to use the sand ladder. Restoration of the site may include permanent erosion control measures and public access facilities.

The O&M considerations presented in this section provide an overview of the type of O&M that would be necessary for the tunnel to establish the feasibility and practicality of this proposed solution. These considerations are not intended to be a comprehensive O&M plan. A detailed O&M plan would be developed as part of project implementation.

### 5.2.7 Benefits/Objectives Met

The following have been identified as benefits of the Tunnel South of County Line option.

- Eliminates flooding at Vista Grande canal along John Muir Drive, and associated damages and risk
- Locates tunnel completely within San Mateo County
- Bypasses the existing Vista Grande canal
- Limits construction area needed in Daly City and San Francisco jurisdictions
- Eliminates safety hazard of open storm drainage channel
- Enables use of existing Vista Grande tunnel for gravity flows of treated effluent from NSMCSD Wastewater Treatment Plant. This simplifies operation of the wastewater treatment plant and eliminates need for periodic pumping of effluent through the force main.

### 5.2.8 Implementation Issues

#### Environmental Impacts

The EPBM operates primarily underground so there are minimal environmental impacts on the surface. Tunnel construction would have impacts at the openings at each end of the tunnel, in the construction work areas, and along access routes (VTA, 2002). While the environmental impacts of the Tunnel South of County Line project would be thoroughly examined during preparation of environmental compliance documents (CEQA/NEPA), the following section highlights some of the issues that are expected to be encountered.

The primary environmental considerations for the John Muir Drive construction site, Alternative 1, would be erosion and runoff into Impound Lake. The water quality of the runoff is expected to be of typical stormwater quality. The primary concerns include sediment and nutrient loaded runoff and stormwater with high concentrations of coliform. An effective construction BMP plan would be necessary to minimize erosion and runoff.

Construction impacts for Alternative 2 at the Doelger Community Center site and for Alternative 3 at the sites on South Mayfair Avenue, would also include erosion and runoff and would require BMP implementation; however, these sites are not located directly adjacent to Lake Merced as with Alternative 1.

Environmental impacts at the outlet structures south of Fort Funston and at Thornton State Beach would include temporary construction and access impacts, as well permanent impacts due to the outlet structure. Impacts due to construction could be minimized with an effective BMP plan. Impacts due to access would be largely dependent on the access route used, however, construction access is currently assumed to be obtained through the tunnel itself.

The cliff face south of Fort Funston and at Thornton State Beach is subject to erosion from wind, sea spray, rain, wave erosion at the base, and animal and human activity. The cliffs south of Fort Funston and at Thornton have also been subject to slides, including a large slide at Thornton State Beach in the early 1980s during El Nino winter storms that closed access to the beach. A failed storm drain was the reported cause of the severe gully erosion, which destroyed a section of road. As an erosion control measure, grout can be injected into the cliff face around the outlet structure for added stability. Permanent impacts due to the outlet structure could include beach wash away or channelized erosion. However, these phenomena have not been observed with the existing Daly City outlet or the San Francisco CSO outlet.

Impacts to plant and animal species from construction and operation of the tunnel would also need to be considered. The coastal zone surrounding Fort Funston provides habitat to certain species of birds including Bank swallows and Western Snowy Plover. Since the presence or absence of these species in the potential project area has not been confirmed, a detailed environmental analysis and survey for these species would need to be conducted prior to project implementation. Because the Western Snowy Plover uses beaches in the Bay Area for both breeding and wintering, any survey for Western Snowy Plover should incorporate both a winter and a nesting season element. Additional species and habitat analyses may include the potential impact to food resources used by large wintering flocks of sea ducks including Surf, White-winged and Black Scoters.

Construction activities and long-term outfall operation may have habitat impacts. Access routes will have to be examined further to determine impacts. A detailed environmental analysis would need to be conducted prior to project implementation to evaluate potential impacts to plant and animal species at the construction sites.

## Permitting

The Tunnel South of County Line is expected to trigger regulatory involvement from several State and Federal agencies. Table 5-6 summarizes the permitting requirements that have been identified for this preliminary program component. Chapter 6 provides a more detailed discussion of the regulatory requirements for the Vista Grande Watershed Study.

**Table 5-6 Summary of Permit Requirements for the Tunnel South of County Line**

| Agency | Permit or Requirement | Authority | Cause for Permitting Action | Time Frame |
|---|---|---|---|---|
| US Army Corps of Engineers (the Corps) | §404 Permit | Clean Water Act | If the Vista Grande canal is deemed part of the "waters of the United States", building the tunnel may trigger this permit due to its direct or indirect impacts to the canal.<br>The outlet structure may fall within the Corps jurisdiction for either a §404 permit or a §10 permit. | 4-6 months – Individual Permit<br>45-60 days – Nationwide Permit<br>An additional year or more if a biological opinion is required. |
| | §10 Permit | River and Harbors Act | | |
| US Fish and Wildlife Service | §7 Consultation | Endangered Species Act | The area around the Tunnel South of County Line may contain the appropriate habitat for endangered species. The Corps will consult with USFWS during the permit process. If endangered species or their habitat are believed to be affected, USFWS will prepare a biological opinion under a §7 Consultation. | 1-3 years |
| National Marine Fisheries Service | §7 Consultation | Endangered Species Act | The Corps will consult with NMFS during the permitting process. If the Corps or NMFS determines that the stormwater discharge into the ocean or the construction of the beach outlet structure will impact living marine resources, a §7 Consultation with NMFS will be required. | 1-3 years |
| San Francisco Regional Water Quality Control Board (RWQCB) | §401 Permit - Water Quality Certification | Clean Water Act §401 | Under §401 of the Clean Water Act, any activity subject to a permit from a Federal agency must be by the appropriate State that the activity meets all State water quality standards. | 60 days after application is deemed complete. Up to one year of additional time may be requested from the Corps. |
| | §402 Permit - NPDES: General Construction Activity Stormwater Permit | Clean Water Act §402 | Required for any construction activity that disturbs more than five acres of land, or if the overall program disturbs more than five acres of land. | Approximately six months |
| | Waste Discharge Requirements | Porter-Cologne Water Quality Control Act | Required for any activity that generates dredged material, fill or any other discharge that may directly or indirectly impacts the "waters of the State". Waived if §401 Permit required. | Approximately three months |

| Agency | Permit or Requirement | Authority | Cause for Permitting Action | Time Frame |
|---|---|---|---|---|
| California Coastal Commission (CCC) and/or Local Coastal Programs (LCPs) | Coastal Development Permit or Public Works Plan | California Coastal Act of 1976; Federal Coastal Zone Management Act | Required for any development in the coastal zone. The coastal zone begins at the shoreline and extends from 500 yards to 5 miles inland. The tunnel outlet structure and the inlet structure for the John Muir Drive alignment are within the coastal zone. | Six months to two years |
| Golden Gate National Recreation Area (GGNRA) | Special Use Permit | The National Park Service Organic Act | Construction on and around GGNRA land. | Six months to several years |
| | Right-of-Way Permit | | The installation of a tunnel through GGNRA property. The National Park Service (NPS) issues right-of-way agreements for utilities to pass over, under or through NPS property. | Six months to several years |
| Thornton State Beach, California State Parks | Right-of-Way Permit | California Public Resource Code §5012 | Permitting requirements similar in nature to GGNRA. | Six months to several years |
| California Department of Transportation (Caltrans) | Encroachment Permit | California Streets and Highways Code | Required for any project that occurs within, under, or over a State highway right-of-way. Both of the proposed tunnel alignments pass under State Highway 35. | 60 days after application is deemed complete |
| California State Lands Commission | General Lease – Right-of-Way | California Public Resources Code - Division 6 Public Lands | Required for any project within the California State Lands Commission's jurisdiction. Any work below the ordinary high-water mark in areas that are subject to tidal action would be within their jurisdiction. Thus, the tunnel outlet may fall within their jurisdiction. | 1-3 years |

Footnotes:

a. Alternatives 1 and 2 would not require permitting from Thornton State Beach. Only Alternative 3 would require permits from Thornton. These permit requirements may need to satisfy GGNRA permitting requirements as the ownership of Thornton State Beach may be transferred to the GGNRA in the future.

## Right-of-Way

Right-of-way and easement considerations for the Tunnel South of County Line alternatives include the following:

- Alternative 1 – The construction site is located partially on John Muir Drive and extends up to the existing Vista Grande canal. The canal is located on Olympic Club property but is under an easement held by the CCSF. An easement would be required for the length of the tunnel under the Olympic Club and at the construction site. Construction may also require temporary permissions from the CCSF and the GGNRA. This is particularly relevant to Alternatives 1 and 2.
- Alternative 2 – The construction site is located on Daly City property. Construction activities to reroute storm drains would also occur on Daly City property. Trenchless storm drain construction from the existing 60-in. storm drain to the inlet structure would necessitate an easement from a home owner in the neighborhood. Similar to Alternative 2, an easement would be required for the length of the tunnel under the Olympic Club. Access to the beach outlet for construction may require temporary right-of-way agreements from the GGNRA.

- Alternative 3 – The Alternative 3 tunnel is located primarily in the public right-of-way. An easement would be required from Thornton State Beach (California State Parks) for the beach outlet structure. The primary construction site may require an easement from land owners in the area, however Thornton Beach Vista, a public look out point owned by Daly City, could be used to facilitate tunnel construction.

### Additional Implementation Issues

A number of other considerations are necessary to examine. They include:

- Coordination with Olympic Club Golf Course – The Olympic Club is an established golf course known for the quality of its courses and grounds. It will host the US Open in June of 2012. Close coordination with the Olympic Club is necessary to ensure project implementation does not disrupt the golf course's normal activities.
- Details regarding liability assumptions for use of Thornton State Beach for Alternative 3 would have to be developed further with California State Parks. Additionally California State Parks may require that the project satisfy requirements set forth by the Golden Gate National Recreation Area (GGNRA) as the site may be the subject of a future land transfer between the organizations.
- Traffic – Traffic control would be necessary at inlet locations during construction including the following:
    - Alternative 1 – On John Muir Drive, the right-hand turning lane onto Lake Merced Boulevard would be used for construction. Temporary traffic control measures, such as a stop light at the intersection or a stop sign on Lake Merced Boulevard, would need to be implemented to ensure public safety.
    - Alternative 2 – At the Doelger Community Center site, the entrance from Lake Merced Boulevard would still be used, but the construction area would temporarily reduce the available parking.
    - Alternative 3 – The primary traffic considerations would include South Mayfair Avenue between Park Plaza Drive and the alleyway east of Park Plaza Drive, necessary to excavate the retrieval shaft, extract the EPBM, and install stormwater connections. Also, the construction sites at South Mayfair Avenue adjacent to Lake Merced Boulevard would have traffic impacts to excavate the connection shaft, install the drop down structure, and tie into the existing storm drains.
- Construction noise and light impacts – The construction schedule assumes that the tunnel excavation would operate 24-hours a day during peak construction periods. The majority of construction would be done in the tunnel itself and away from residential areas. Potential sources of noise include ventilation fans and a crane to lift and dump the spoil into a pile. Sound walls would help deflect noise. During the late evening and swing shift, muck would be stockpiled to be loaded and removed during the day. Back-up alarms for any trucks could be silenced and replaced with lights. The Richmond Transport tunnel constructed for the SFPUC had the main portal in a residential area and the amount of noise was controlled. There would also be lights at the site, but the lights can be directed away from the residential areas.

## 5.2.9 Implementation Schedule

The implementation for the tunnel alternatives assumes the same activities for all alternatives. The duration of the activities is the same for all alternatives except for construction, as listed below.

- Permitting and Environmental Compliance – 36 months
- Design – 12 months

- Bid Process – 4 months
- Construction:

  Alternative 1 – 18 months

  Alternative 2 – 21 months

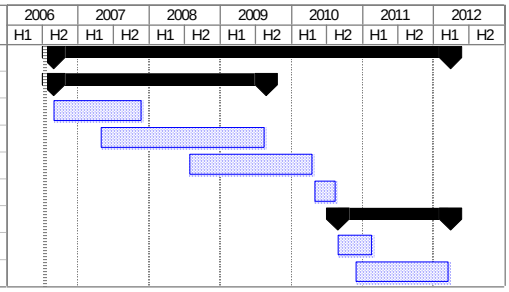
  Alternative 3 – 14 months

The construction schedule of the tunnel alternatives varies according to length of the tunnel and the ability to perform multiple construction activities simultaneously. The Alternative 3 construction schedule is shorter than the other alternatives due to construction activities occurring concurrently, such as the excavation of the retrieval shaft occurring while the EPBM excavates the tunnel.

Final tie-in of the existing storm drain system to the tunnel would be done in the dry season (April to October) and would not occur until the tunnel is fully operational. Typical construction activities are not expected to be affected by seasonal storm events, however conventional construction BMPs would be necessary to protect project sites from surface runoff. Figure 5-18 presents an example implementation schedule for Alternative 1. This implementation schedule includes only permitting, design and construction phases and is dependent on funding availability.

**Figure 5-18 Alternative 1 Implementation Schedule**

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **Tunnel** | **1456 days** | **Fri 9/1/06** | **Fri 3/30/12** |
| 2 | **Permitting** | **780 days** | **Fri 9/1/06** | **Thu 8/27/09** |
| 3 | Applications | 327 days | Fri 9/1/06 | Mon 12/3/07 |
| 4 | Approval | 608 days | Tue 5/1/07 | Thu 8/27/09 |
| 5 | Design | 458 days | Wed 7/30/08 | Fri 4/30/10 |
| 6 | Bid & Award | 85 days | Mon 5/3/10 | Fri 8/27/10 |
| 7 | **Construction** | **415 days** | **Mon 8/30/10** | **Fri 3/30/12** |
| 8 | Contractor Mobilization | 132 days | Mon 8/30/10 | Tue 3/1/11 |
| 9 | Field Construction | 349 days | Tue 11/30/10 | Fri 3/30/12 |




## 5.2.10 Summary and Next Steps

### Summary

Table 5-7 provides a summary of the three alternative tunnel alignments analyzed as part of the Vista Grande Watershed Study. There is no preferred alternative at this point, and all three alignments will merit further investigation as part of the permitting and predesign process.

**Table 5-7 Alternative Summary and Comparison**

| Criteria | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| Capacity | 1,500 cfs for a 25-year storm, 15-ft diameter | | |
| Length | • 4,750 ft | • 4,900 ft | • 5,400 ft |
| Construction | • Primary construction at Vista Grande Canal entrance<br>• Tunnel outlet south of Fort Funston | • Primary construction at Doelger Community Center<br>• Tunnel outlet south of Fort Funston | • Primary construction shaft at the Horse Ranch<br>• Retrieval shaft and connection shaft on South Mayfair Dr.<br>• Tunnel outlet at Thornton State Beach |

| Criteria | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| Advantages | • Minimal rerouting of storm drain utilities required<br>• Shorter construction schedule<br>• Shorter tunnel, less expensive | • Portal site is on Daly City property<br>• Larger construction area available | • Shorter construction schedule<br>• Alignment primarily in public right-of-way |
| Disadvantages | • Impacts to traffic on John Muir Drive<br>• ROW/land acquisition from Olympic Club at construction site | • Longer tunnel, more expensive<br>• Requires extensive rerouting of storm drains<br>• Impacts to the Community Center during construction | • Longest tunnel, most expensive<br>• Requires extensive rerouting of storm drains<br>• Requires easement from property owners and California State Parks |
| Construction Schedule | • 18 months | • 21 months | • 14 months |
| Project Cost (2005 dollars) | • $56 million | • $63 million | • $82 million |
| Escalated Cost (2010 dollars) | • $72 million | • $81 million | • $104 million |

## Next Steps

The project alternatives were defined at the planning level. Additional work is necessary to refine key details and make a determination on the best course of action for downstream flood protection. The following activities have been identified as "next steps" in the implementation plan associated with the Tunnel South of County Line. Additional next steps are included in the Chapter 6, Implementation Strategies.

- Beach Outlet Location – For each alternative alignment investigated the location of the beach outlet structure and construction access at the coast will be of vital importance. Any beach outlet structure will likely be located south of Fort Funston and may use the park for access. Potential beach outlet locations should be further examined to determine potential benefits, construction methods, and environmental impacts.
- Spoils Disposal – For cost estimating purposes, excavated material was assumed to be disposed of on local beaches within 10 miles as remediation material. Discussions with the GGNRA indicate that there is potential for reuse of the excavated material; however no specific use has been identified. Research into potential uses of the spoils should be conducted.
- Geotechnical Investigation – A preliminary geotechnical investigation would provide information to refine construction cost estimates and better characterize the project.
- Site Survey – A topographic survey would provide information necessary to refine inlet and outlet elevations and excavation requirements.
- Alternatives Analysis – A detailed alternatives analysis should be conducted to determine the final alignment of the Tunnel South of County Line. This analysis would incorporate information gained from further investigation into locations for the beach outlet structure and the site survey. This analysis may include the alternative alignments in this study, as well as additional alignments such as one from the Doelger Community Center to Thornton State Beach.
- Preliminary Design – The preliminary design of the Tunnel South of County Line should be conducted in parallel with permitting and environmental compliance activities. Preliminary design would include selection of the design storm level of protection, definition of final design criteria, selection of the recommended alternative, definition of tunnel profile and size, further

definition of storm drain connections, preparation of preliminary drawings and refined costs estimate and construction schedule.

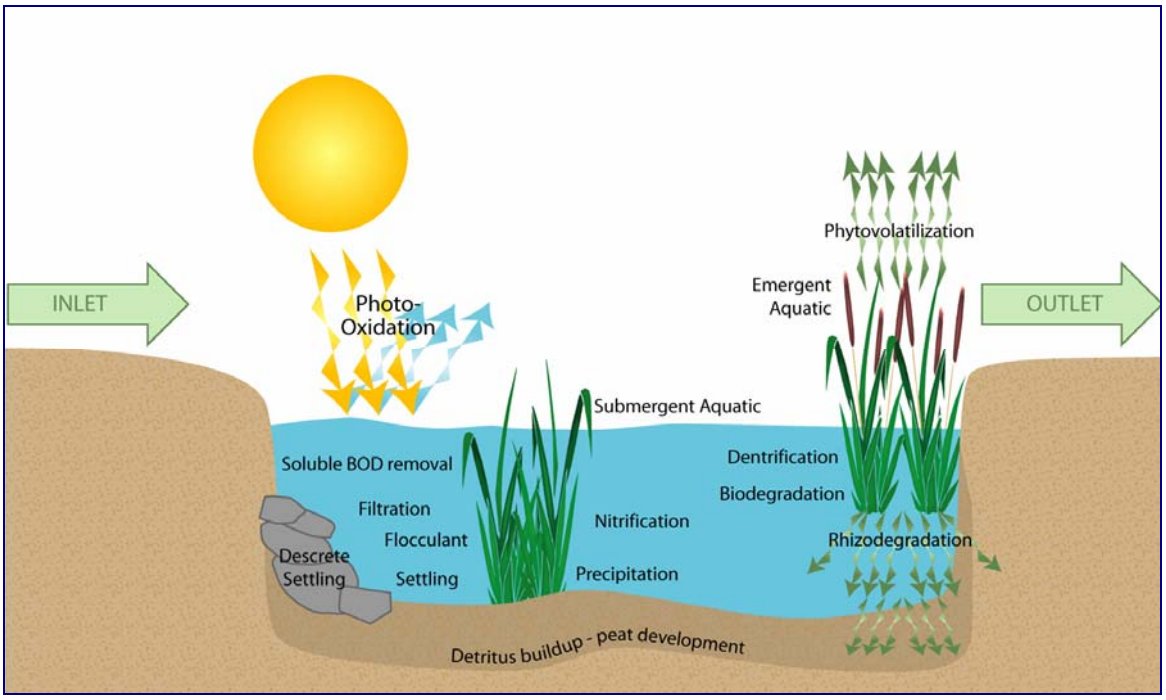
## 5.3 Vista Grande Wetland

### 5.3.1 An Overview of Constructed Stormwater Wetlands

Natural wetlands are one of the most diverse and productive ecosystems on the earth. Not only do they provide habitat for many plants and animals, they also provide important benefits to ecosystems. Water quality enhancement, through filtration and microbial breakdown of pollutants, is one of the most important benefits that natural wetlands provide. Constructed stormwater wetlands are designed to mimic and improve on the treatment mechanisms of natural wetlands to provide effective treatment of stormwater runoff.

Constructed wetlands remove pollutants through a variety of mechanisms. Abundant vegetation throughout the wetland causes the velocity of stormwater flowing into the wetland to drop, allowing many of the suspended solids to settle out, absorb to wetland sediments, or be trapped by the vegetation. In addition to the physical removal of pollutants, biological processes play an important role in improving water quality. For example, microorganisms breakdown pollutants, transforming them into less soluble forms that can be used by the wetland plants. Typical processes occurring in a wetland are illustrated in Figure 5-19. Through these mechanisms, constructed wetlands effectively treat stormwater while providing additional watershed benefits including increased habitat and recreational opportunities.

**Figure 5-19: Typical Processes Occurring in a Treatment Wetland**




### 5.3.2 Vista Grande Wetland Project Description and Location

As described in Chapter 1, the 10-year, 4-hour storm in the Vista Grande Watershed produces approximately 1,300 cfs of runoff each year. In order to treat this entire flow volume using a constructed wetland a very large area would be required (as much as 2,500 acres). Since Daly City and San Francisco are developed areas where land availability is limited and land acquisition costs are high, building a wetland to treat all of the stormwater from the Vista Grande watershed would be infeasible.

The Vista Grande Wetland (the wetland) would provide an aesthetically pleasing method to treat a portion of the stormwater from the Vista Grande watershed to augment the water levels of Lake Merced. The wetland would be located along the existing Vista Grande canal, between John Muir Drive and the

Olympic Club (Figure 5-21). Stormwater would be diverted from the inlet structure of the new tunnel into the wetland, where it will be treated before being discharged into South Lake. Approximately eight acres of land are available in this area for the construction of the wetland if the existing Vista Grande canal is abandoned after implementation of the Tunnel South of County Line (as described in Section 5.2).

This site is ideal for a constructed treatment wetland. Its elongated shape encourages plug-flow through the wetland and helps prevent stormwater from short-circuiting wetland features. It is located outside of existing natural waterways, avoiding damage to natural wetland areas and other aquatic resources. It is located nearby existing wetland habitat, providing an extension of this habitat to the local and migratory bird populations. In addition, this site's proximity to Lake Merced will minimize conveyance costs of treated water, making this location well suited for a lake level enhancement project. Finally, developing a wetland on this site will restore beneficial uses to this area once the existing Vista Grande canal is abandoned.

### 5.3.3 Objectives

The Vista Grande Wetland would meet many of the primary and secondary objectives developed for this watershed study including Lake Merced lake level enhancement, habitat protection, groundwater recharge, recreation, and public education opportunities.

The primary objective of the wetland is to supply water of an acceptable quality and quantity to augment the water levels of Lake Merced. In addition, the wetland would provide additional habitat for local and migratory birds adjacent to existing habitat along Lake Merced. It would protect existing recreational activities and provide additional educational opportunities for school groups and the general public. Overall, the Vista Grande Wetland would meet several project objectives, providing multi-faceted benefits and enhancing watershed activities.

### 5.3.4 Design Assumptions

The Vista Grande Wetland conceptual design consists of three cells, each approximately 1,100 feet long. The water would be pumped from a proposed concrete box where the existing 24-inch storm drain, the 60-inch storm drain and the 7-foot by 8-foot box culvert would discharge into the proposed Tunnel South of County Line. Flow control facilities installed at the concrete box would limit stormwater flows into the wetland to a maximum of 2.0 mgd (3.1cfs). The inlet to the wetland would be above the invert of the tunnel inlet structure so stormwater would need to be pumped into the wetland. Flows from the concrete basin would be pumped to the settling basin via an 8-inch pipeline. The 80-foot long, 5-foot deep settling basin would provide approximately 4 hours of residence time. Downstream of the settling basin, stormwater would flow by gravity into Cell No.1. Consecutive cells would be separated by a three to five foot high, fifteen foot wide berm (top width) and connected via three 8-inch pipelines located two feet above the cell invert, ensuring a cell depth of two feet. Water from one cell would overflow into the next cell when the water rises above two feet. The three 8-inch pipelines between the cells would be spaced equally to prevent short-circuiting within each cell. It is assumed that water from Cell No. 3 would flow by gravity into South Lake through the existing Lake Merced overflow structure.

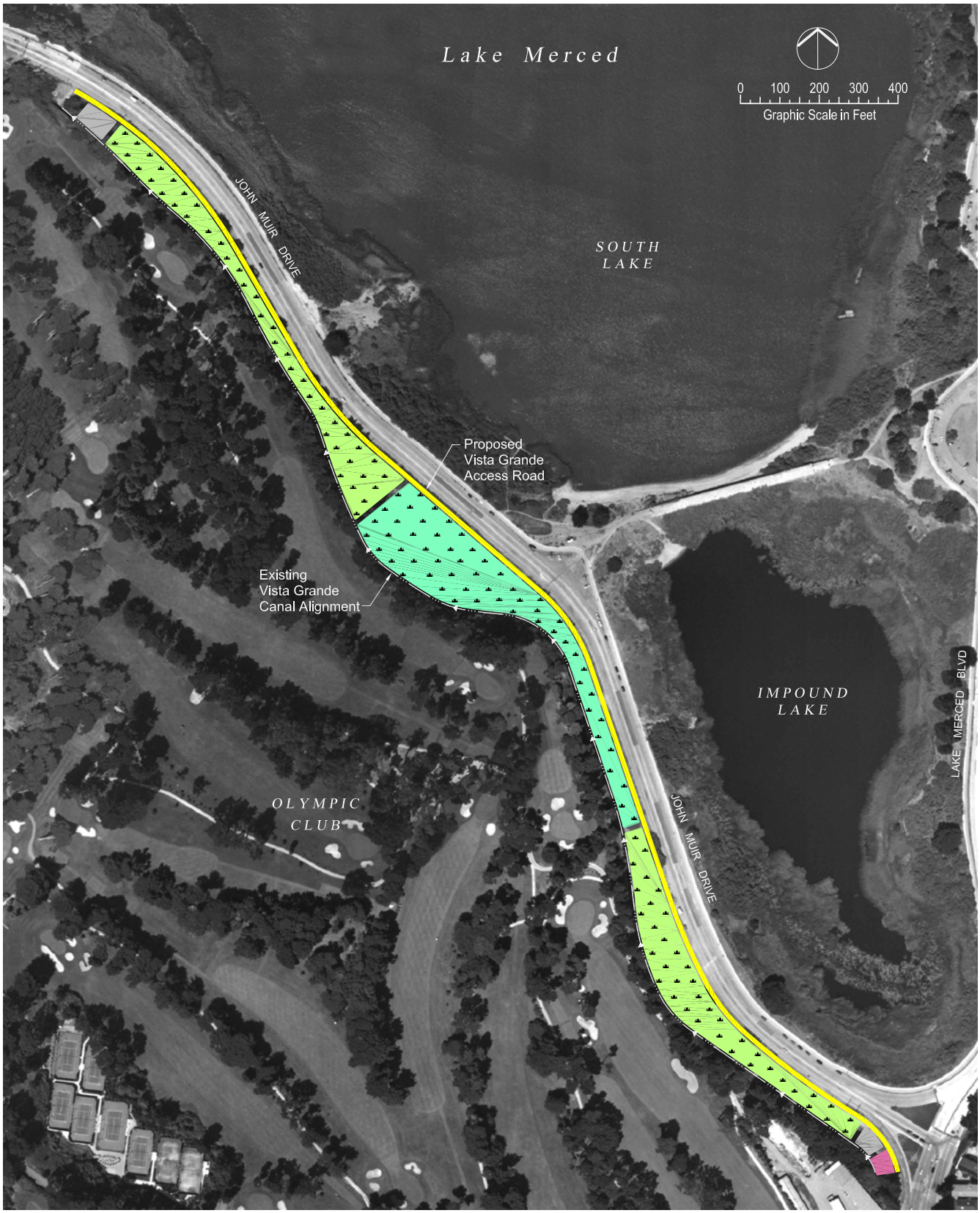
### 5.3.5 Preliminary Layout

The proposed Vista Grande Wetland would be located between the northeast limits of the Olympic Golf Course and John Muir Drive, along 3,600 feet of the existing Vista Grande canal. The wetland encompasses approximately 8 acres. Cell No.1 and No. 3 would be planted with cattail, while Cell No. 2 would be planted with bulrush. Native bulrush and cattail species are preferred for use in the wetland. If it is determined that the bulrush and cattail species that are present at Lake Merced are unique from other native bulrush and cattail species in California, seeds or starts from Lake Merced species could be used in the wetland.

The cattail in Cell No. 1 and the bulrush in Cell No. 2 would be broken up by a deep open-water pool in each cell. In addition to the design elements discussed above, an access road located on the northeast edge of the wetland, southwest of John Muir Boulevard, would provide maintenance access along the wetland cells and berms. A 10-foot buffer would be introduced between John Muir Drive and the northeast edge of the wetland. A traffic barrier would be installed between the buffer and the access road. The 10-foot buffer would remove a five foot wide corridor from John Muir Boulevard. Narrowing John Muir Boulevard would serve the dual purpose of slowing traffic along this corridor, and providing additional area for the wetland. The layout for the wetland is provided in Figure 5-22.

**Figure 5-20: Cattail and Bulrush**

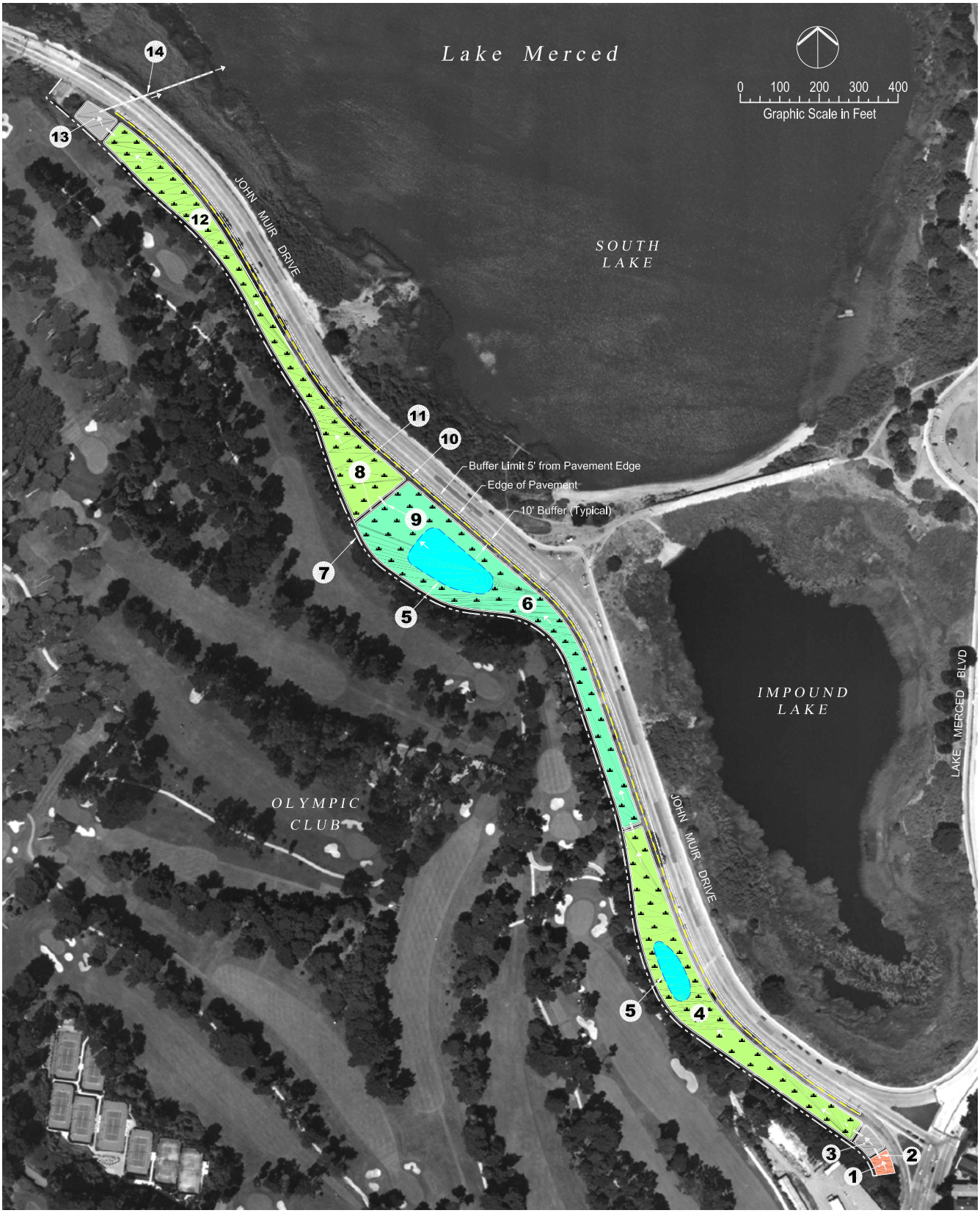
The Vista Grande Wetland depth, invert elevations and water levels are illustrated in the profile shown in Figure 5-23**.** Cross-sections of the Vista Grande Wetland at station 0+00 and 35+00 are provided in Figure 5-24. The data used as the basis for Figures 5-18 and 5-19 come from a series of sources, including field observation by RMC and existing reports. This level of data was appropriate for a planning level analysis but will need to be refined for further evaluations. As is illustrated in Figure 5-24, slopes of 2:1 (horizontal: vertical) were assumed along the cells. Slopes of 3:1 were considered for each berm. After slope adjustments, the wetland area available for treatment is estimated to be approximately 5.5 acres. The full-water depth in the wetland was set at two feet, in general, to enhance plant growth and provide sufficient volume to provide effective treatment. The corresponding wetland volume will be 11 AF.




FILE: OVGW-PLANr.dwg DATE: 02-20-2006 PROJECT: RMC – VISTA GRANDE WETLANDS

Aerial Photo: 2001

**Figure 5-21**
**Lake Merced**
**Vista Grande Wetland**
**Plan View**



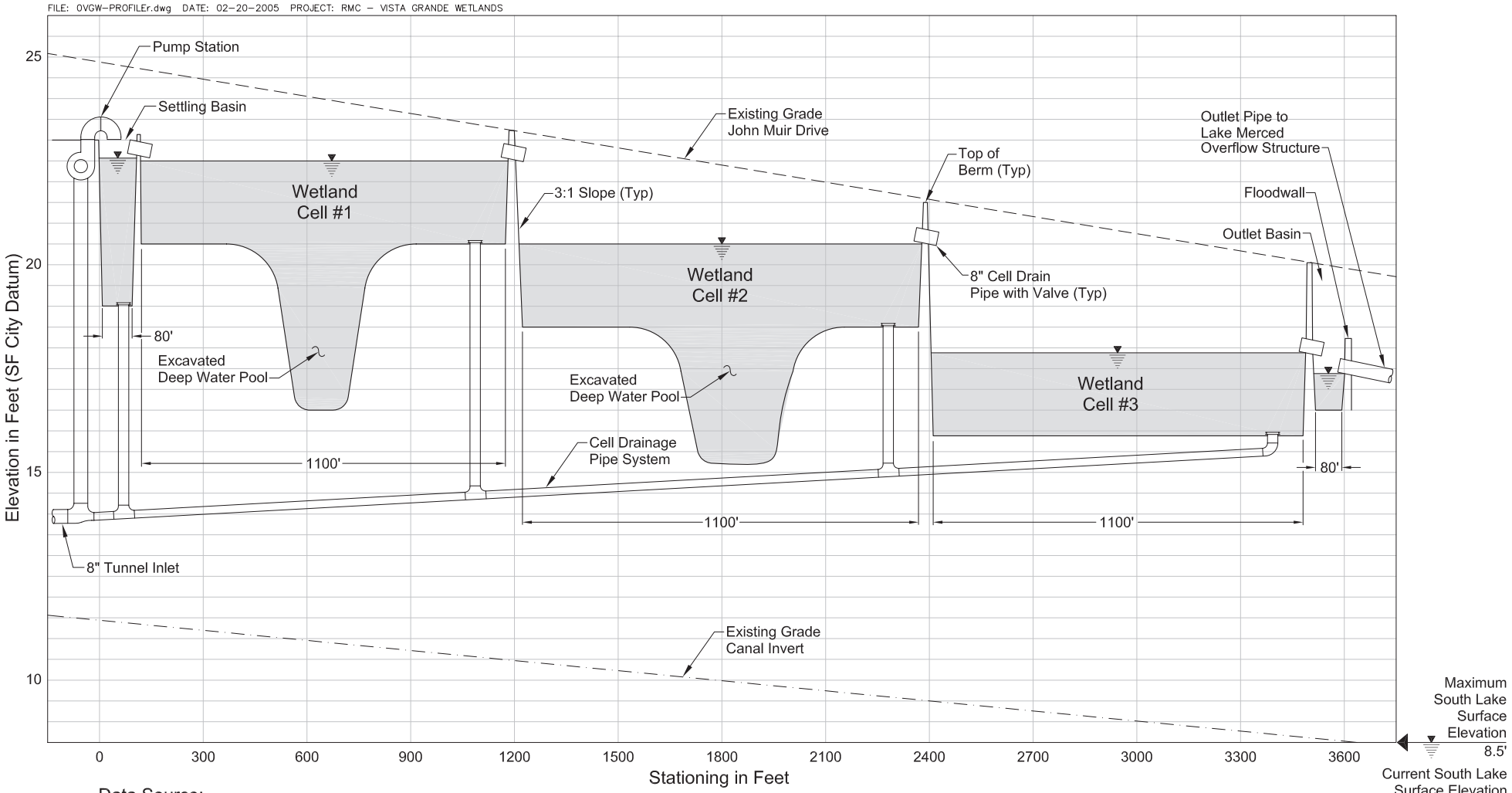

FILE: OVGW-LAYOUT.dwg DATE: 02-20-2005 PROJECT: RMC – VISTA GRANDE WETLANDS

Aerial Photo: 2001

LEGEND:

1. Tunnel / Wetland Interface
2. 8" Drain Pipe into Tunnel / Wetland Interface
3. Settling Basin
4. Wetland - Cell No. 1 Shallow Water with Emergent Cattails
5. Area of Excavated Deep Water Pool
6. Wetland - Cell No. 2 Shallow Water with Emergent Bullrush
7. Olympic Club / Wetland Project Boundary
8. Wetland Cell Partition Berm (Typical)
9. 8" Cell Drain Pipe with Valve (Typical)
10. Traffic Barrier at ℄ of 10' Buffer
11. Wetland Access Road
12. Wetland - Cell No. 3 Shallow Water with Emergent Cattails
13. Outlet Basin
14. 8" Drain Pipe into South Lake

**Figure 5-22**
**Lake Merced**
**Vista Grande Wetland**
**Project Layout Plan**

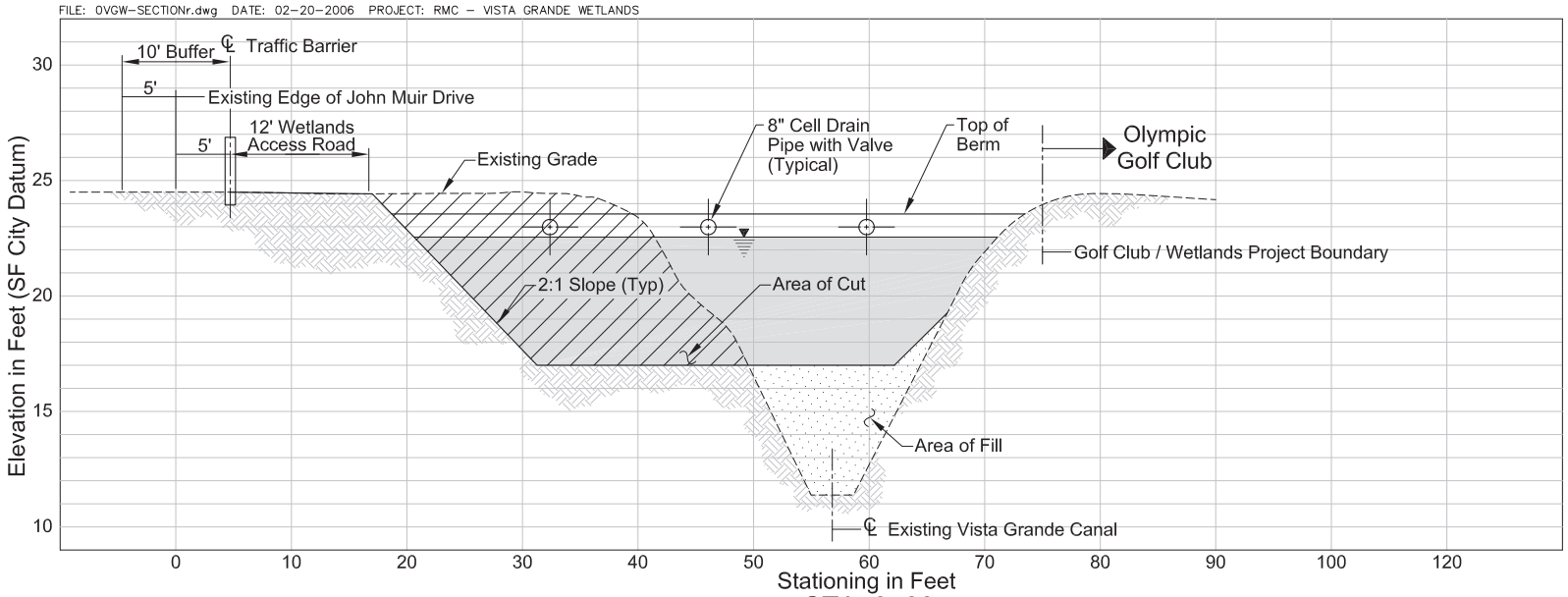



Data Source:

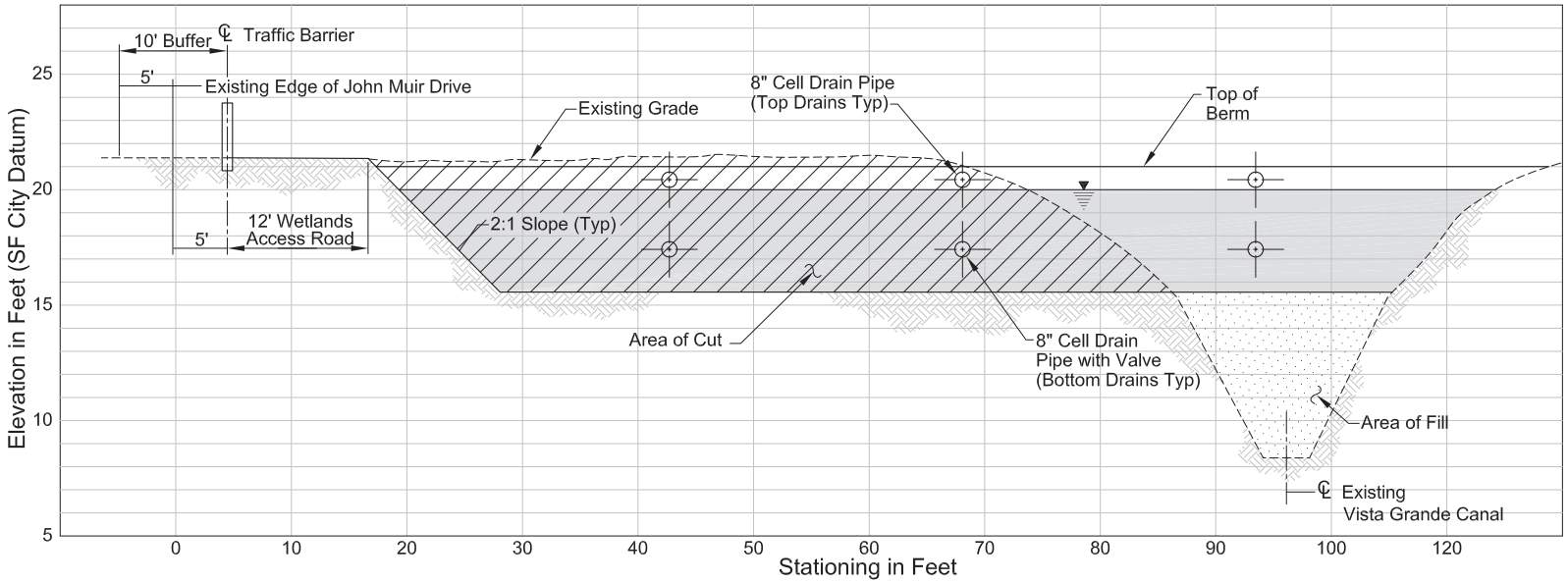
- Existing canal invert elevations are from Vista Grande Sewer Storm Canal Widening & Repair Details (Sheets 1 & 2, 1973).
- John Muir Drive elevations are from 2001 5-foot contour data provided by SFPUC.
- Water table level is from Gus Yates Memo dated October 5, 2005.
- South Lake maximum level is from EDAW, September 2004a.
- South Lake current level and wetland elevations are approximate and based on field observation by RMC.

**Figure 5-23**

**Vista Grande Wetland Profile**
**Alternative 'A'**




STA. 0+00




STA. 35+00

Data Source:

- Existing canal invert elevations are from Vista Grande Sewer Storm Canal Widening & Repair Details (Sheets 1 & 2, 1973).
- John Muir Drive elevations are from 2001 5-foot contour data provided by SFPUC.
- Water table level is from Gus Yates Memo dated October 5, 2005.
- South Lake maximum level is from EDAW, September 2004a.
- South Lake current level and wetland elevations are approximate and based on field observation by RMC.

**Figure 5-24**

**Vista Grande Wetland Sections**
**Alternative 'A'**

Two alternatives were evaluated for the Vista Grande Wetland. Alternative A, discussed above, is located close to the existing road level, above the existing canal, providing a more aesthetic, accessible wetland which minimizes excavation costs. Alternative B is a passive wetland system, where the first cell of the wetland begins below the new tunnel invert so that stormwater can be conveyed into the wetland via gravity. A brief discussion of Alternative B is provided as follows, and associated profile and cross-sections for Alternative B are provided in Appendix F.

- The wetland invert would be 13 feet to 8 feet lower than John Muir Drive. Such a significant elevation drop over a short distance could pose a potential hazard for vehicles and pedestrians along John Muir Drive.
- The steep drop in elevation between John Muir Boulevard and the Vista Grande canal would require significant excavation. Additionally, a retaining wall would be needed along the access road, resulting in an estimated cost twice as high as the estimated cost for Alternative A.
- Because of the 2:1 slope requirements, a significant portion of the wetland area would be unusable. After adjusting the area to exclude the slopes, the wetland would cover about 2.25 acres; this would correspond to a volume of 4.5 AF, significantly lower than the 11 AF of Alternative A.

For these reasons, Alternative B is not the recommended alternative and is not further discussed in this document.

### 5.3.6 Water Quality Considerations and Treatment Characteristics

The water quality of the source and receiving waters must be considered in the design of the Vista Grande Wetland. The following describes the water quality of Vista Grande stormwater, the primary source water for the Vista Grande Wetland, and South Lake, the receiving water for treated wetland effluent. Based on the source water characteristics and receiving water quality requirements, the treatment characteristics of the wetland can be defined. Baseline concentrations of critical constituents in South Lake and Vista Grande stormwater are summarized in Table 5-8.

**Table 5-8 Baseline Average Concentrations of Critical Constituents**

| Water Quality Parameter | Units | South Lake [a] | Vista Grande Canal Stormwater [a] |
|---|---|---|---|
| Alkalinity | mg/L | 195 | 48.7 |
| Ammonia ($NH_3$-N) | mg/L | 0.05 | 0.7 |
| Biochemical Oxygen Demand | mg/L | -- | <3 - 22.0 |
| Chlorophyll "a" | mg/L | 0.029[b] | -- |
| Dissolved Oxygen | mg/L | 0.1-11.2 | 5.4-10.8 |
| Hardness | mg/L | 209 | 106 |
| Nitrate | mg/L | 0.02 | 2.3 |
| pH | | 7.5-8.7 | 7.1-8.6 |
| TDS | mg/L | 414 | 41.5 |
| Temperature | $^{o}$F | 51.1-70.9 | 55.0-63.1 |
| Total Coliform | MPN/100mL | 0-2500[d] | 126,421 |
| Total Nitrogen | mg/L | 3.69 | 6.7 |
| Total Organic Nitrogen | mg/L | 3.61[c] | -- |
| Total Phosphorus | mg/L | 0.16 | 0.4 |
| TSS | mg/L | -- | 153 |
| Turbidity | NTU | 11.6 | 51 |

a. (EDAW, September 2004a), Table 4-14, except where noted
b. (EDAW, September 2004a), Table 2-4
c. (EDAW, September 2004a), Table 2-3
d. (EDAW, September 2004b), Table 2-21

### *South Lake Water Quality*

Lake Merced, including South Lake, is one of the most significant natural resources of the San Francisco peninsula (CH2M Hill, 2001). It is a major recreational area and provides habitat for surrounding wildlife. Over time, urbanization and other human activities have increased the pollutants that flow into Lake Merced. Increased rates of nutrient addition, in particular those of nitrogen (N) and phosphorus (P), have contributed to algal blooms and decreased clarity (CH2M Hill, 2001). In addition, Lake Merced is listed as an impaired water body with respect to dissolved oxygen and pH (EPA, 2002). The critical constituents for South Lake's water quality are shown in Table 5-8.

The concentration of algae, measured by chlorophyll "a", is the primary indicator of water quality used to assess the water quality of the wetland. In most lakes, algal growth is controlled by either concentrations or nitrogen. The limiting nutrient can be determined by looking at the ratio of nitrogen to phosphorus (N:P ratio). Traditionally, this ratio is calculated using the total nitrogen and the total phosphorus concentration. However, high concentrations of organic nitrogen, which is not is easily used by algae or other organisms, can distort this ratio. In lakes that have high levels of organic nitrogen, it is more appropriate to use the ratio of the total bioavailable nitrogen to the total bioavailable phosphorus (Horne, 2005). The bioavailability of different forms of nitrogen and phosphorus, as wells as the N:P ratios for both the bioavailable and total concentrations of these nutrients is shown in Table 5-9.

**Table 5-9 N:P Ratios for South Lake**

| Nutrient | Concentration (mg/L) [a] | Bioavailability | Total Bioavailable Concentration (mg/L) |
|---|---|---|---|
| Nitrate | 0.02 | High | 0.02 |
| Ammonia | 0.05 | High | 0.05 |
| Organic Nitrogen | 3.61 | Unavailable | 0 |
| Total Nitrogen | 3.69 | Mostly Unavailable | 0.07 |
| **Total Bioavailable Nitrogen** | | | **0.07** |
| Total Phosphorus | 0.16 | ~80% available | 0.128 |
| **Total Bioavailable Phosphorus** | | | **0.128** |
| **Total Bioavailable Nitrogen : Total Bioavailable Phosphorus** | | | **0.55** |
| Balanced Growth Ratio | | | 10-15 |

a. (EDAW, September 2004a), Table 2-3

As shown in Table 5-9, the nitrogen to phosphorus (N:P) ratio for South Lake indicates that the lake is strongly nitrogen limited. Because organic nitrogen concentrations are high, the ratio of total bioavailable nitrogen to total bioavailable phosphorus (Total Bioavailable Nitrogen: Total Bioavailable Phosphorus) should be used to determine if the lake is nitrogen or phosphorus limited (Horne, 2005). The balanced growth ratio, where the lake could be either phosphorus or nitrogen limited, ranges from 10 to 15. For a lake to be nitrogen limited, the N:P ratio should be less than 10; for the lake to be phosphorus limited, the N:P ratio should be greater than 15. As shown in Table 5-9, the Total Bioavailable Nitrogen: Total Bioavailable Phosphorus is 0.55, indicating that the lake is strongly nitrogen limited (Horne, 2005).

Because South Lake is nitrogen limited, the bioavailable nitrogen added to the lake will be converted into algae. Therefore, raising the nitrogen concentrations in the lake will have a direct impact on the water quality. However, raising the phosphorus concentrations will not affect the concentrations of algae in South Lake because phosphorus is already abundant in the lake's ecosystem. Thus, while it is important to consider both nitrogen and phosphorus in order to protect the water quality of Lake Merced from increased eutrophication, nitrogen is the primary nutrient of concern and is used to evaluate the treatment capacity of the wetland.

In addition to evaluating the impact of nutrients on the water quality of South Lake, it is also important to consider pathogen addition to the lake since they pose a threat to human health and water quality. Other parameters, such as total suspended solids (TSS) and temperature, can affect water quality but their effects are small compared to nutrient and pathogen loading.

### *Vista Grande Stormwater Quality*

Stormwater is typically high in metals, nutrients, coliform, oil and grease, and other pollutants. Previous studies have shown that the composition of stormwater in the Vista Grande canal is typical of stormwater in other Bay Area communities except that it has elevated concentrations of total coliform (EDAW, September 2004a). Therefore, the primary constituents of concern in stormwater are nitrogen (as nitrate), phosphorus and total coliform, which is considered an indicator of the presence of pathogens, because of their impact on the water quality of South Lake.

## Vista Grande Wetland Treatment Characteristics for Stormwater

### *General Treatment Parameters for Vista Grande Stormwater*

The preliminary layout of the Vista Grande Wetland has been optimized to effectively remove the primary constituents of concern from Vista Grande stormwater: nitrogen, phosphorus, and pathogens. In

addition to treating for nutrients and pathogens, the wetland will remove many heavy metals, hydrocarbons, pesticides, other exotic organic compounds, and suspended solids from its source water.

Anoxic conditions in wetlands can lead to slightly lower pH and dissolved oxygen levels in the wetland's effluent. However, it is assumed that the wetland effluent would be conveyed into South Lake via the existing Lake Merced overflow structure and allowed to cascade down the South Lake's banks before entering the water. This cascade would oxygenate the water and raise pH levels by modifying the carbon dioxide equilibrium.

Several different inflow rates were evaluated for the wetland conceptual design. To assess the treatment capacity of the Vista Grande Wetland the following parameters were calculated for each constituent of concern (nitrate, phosphorus, and pathogens):

- Total removal
- Effluent concentration
- Estimate chlorophyll "a" in South Lake.

Total Removal

The total removal for the primary constituents of concern (nitrate, total phosphorus, and total coliform) is dependent on the hydraulic residence time in the wetland and water temperature. During winter months, typical removal of nitrate is 200 mg/m$^2$day, whereas the removal of phosphorus is 8.1 mg/m$^2$day (Horne, 2005). Coliform die-off was modeled through the first-order kinetics equation, $C=C_0e^{-kt}$, where $C_0$ is the initial pathogen concentration, *t* is the hydraulic residence time, and *k* is a die-off constant which has been assumed to be 0.40/day, as it was for previous studies (EDAW, September 2004a). This die-off model does not account for removal processes added from treatment in the wetland. The wetland will enhance coliform and pathogen removal through several processes including grazing by microbes and other animals, sedimentation and sorption, and physical blockage by wetland vegetation (Horne, 2005). However, these processes are difficult to quantify so the die-off model was used as an estimate of the minimum coliform removal in the wetland. Thus, the actual coliform concentrations are expected to be lower than those calculated for the conceptual design of the wetland (as shown in Table 5-10).

Effluent Concentration

The effluent concentration of each parameter was based on the remaining concentration and the outflow volume of the wetland.

Estimated in chlorophyll "a" in South Lake.

Finally, the estimated chlorophyll "a" in South Lake, after the addition of treated water, provides a good assessment of the direct impact of nitrogen and phosphorus on the water quality and clarity of the lake. Chlorophyll "a" makes up 1% (by dry weight) of algae. Nitrate and total phosphorus make up 5% and 0.3% of algae (by dry weight), respectively. The estimated chlorophyll "a" due to nitrate and phosphorus addition was calculated using these values and an empirical model based on the research of Dr. Alex Horne (Horne, 2005). This calculation demonstrates how these nutrients are used within the lake's ecosystem.

***Stormwater Treatment Characteristics***

The total removal of the constituents of concern, the resulting effluent concentration, and the estimated chlorophyll "a" concentrations were calculated for inflow rates ranging from 0.5 mgd to 2.0 mgd. The effluent nitrate and phosphorus concentrations are calculated based on the average concentrations from existing water quality data as shown in Table 5-8, and removal assumptions for winter conditions. The existing South Lake concentration in chlorophyll "a" resulting from nitrate and phosphorus additions

assumes that the additional chlorophyll "a" is added to the ambient chlorophyll "a" concentration into South Lake. The results of these analyses are shown in Table 5-10.

**Table 5-10 Pollutants Removal for Different Stormwater Inflow Rates at the Vista Grande Wetland**

| Wetland Inflow (mgd) | 0.5 | 0.7 | 1.0 | 1.50 | 1.90 | 2.0 |
|---|---|---|---|---|---|---|
| Residence Time (days) | **7.2** | **5.1** | **3.6** | **2.4** | **1.9** | **1.8** |
| **Nitrogen Removal** | | | | | | |
| Loading (kg/day) | 4.4 | 6.1 | 8.7 | 13.1 | 16.5 | 17.4 |
| Removal for residence time (kg) | 31.9 | 22.8 | 16.0 | 10.6 | 8.4 | 8.0 |
| Nitrate Remaining in Effluent (kg) | 0.0 | 0.0 | 0.0 | 2.4 | 8.1 | 9.4 |
| Effluent Concentration (mg/L) | 0.000 | 0.000 | 0.000 | 0.426 | 1.132 | 1.246 |
| Estimated Chlorophyll "a" (mg/l) [c] | 0.026 | 0.026 | 0.024 | 0.025 | 0.029 | 0.030 |
| **Phosphorus Removal** | | | | | | |
| Loading (kg/day) | 0.8 | 1.1 | 1.5 | 2.3 | 2.9 | 3.0 |
| Removal for residence time (kg) | 1.3 | 0.9 | 0.6 | 0.4 | 0.3 | 0.3 |
| Phosphorus Remaining (kg) | 0.0 | 0.1 | 0.9 | 1.8 | 2.5 | 2.7 |
| Effluent Concentration (mg/L) | 0.000 | 0.052 | 0.229 | 0.324 | 0.353 | 0.357 |
| Estimated Chlorophyll "a" (mg/l) [c] | 0.026 | 0.028 | 0.040 | 0.053 | 0.060 | 0.062 |
| **Pathogens Removal** | | | | | | |
| Influent Concentration (MPN/100mL) | 126,421 | 126,421 | 126,421 | 126,422 | 126,423 | 126,424 |
| Coliform Remaining in Effluent (MPN/100mL) | 7,187 | 16,306 | 30,144 | 48,611 | 59,446 | 61,731 |
| Coliform Remaining in Effluent (MPN/100mL) @ t+1 | 4,818 | 10,930 | 20,206 | 32,585 | 39,848 | 41,380 |
| Coliform Remaining in Effluent (MPN/100mL) @ t+2 | 123 | 633 | 2,165 | 5,630 | 8,419 | 9,079 |
| Coliform Remaining in Effluent (MPN/100mL) @ t+3 | 2 | 25 | 155 | 652 | 1,192 | 1,335 |
| Total Coliform Remaining in Effluent (MPN/100mL) | 12,130 | 27,895 | 52,670 | 87,478 | 108,905 | 113,526 |
| Concentration in Lake (MPN/100mL) | 1,273 | 1,329 | 1,468 | 1,797 | 2,113 | 2,197 |

a. (EDAW , September 2004a)
b. (EDAW , September 2004b)
c. For a 6-month period.

Given the treatment characteristics presented in Table 5-10, the wetland could be operated to handle stormwater inflow rates of up to 1.90 mgd with no impact to the water quality of Lake Merced, assuming that Lake Merced is nitrogen limited. The 1.90 mgd inflow into South Lake would result in an effluent concentration in nitrate of 1.132 mg/L. The nitrate loading from the wetland effluent would result in a concentration of chlorophyll "a" into South Lake of 0.029 mg/L after accounting for dilution.

If Lake Merced were to become phosphorus limited, the wetland could be operated to handle inflow rates of up to 0.70 mgd with no impact to the water quality of Lake Merced. The 0.70 mgd inflow into South Lake would result in an effluent concentration in phosphorus of 0.052 mg/L. The phosphorus loading from the wetland effluent would result in a concentration of chlorophyll "a" into South Lake of 0.028 mg/L after dilution is accounted for.

For diversion rates from 0.5 mgd to 1.5 mgd, and assuming a baseline coliform concentration of 1,250 MNP/100mL into South Lake, the coliform concentration in the lake after dilution would increase from 1,273 to 1,797 MPN/100mL. This increase is likely to be insignificant and numerically undetectable. Diversion rates higher than 1.5 mgd would result in a small but quantifiable increase in coliform in South Lake.

Over the past two years, NSMCSD and the SFPUC have been jointly conducting the Vista Grande-Lake Merced Wetland Pilot Stormwater Treatment Study. This study includes diverting stormwater through CDS units and a vegetated buffer along South Lake before diversion into Lake Merced. Findings of this project show that the stormwater diversions did not significantly increase concentrations of *E. coli* in South Lake and that the concentrations of the three bacterial indicators monitored during the study (total coliform, E.coli, and enteroccus) met single water quality criteria for bull body contact recreation. Monitoring results also suggest that a combination of die-off, dilution and treatment by the riparian buffer effectively reduced bacterial concentrations in the stormwater. In addition, no metals were detected in surface soil samples suggesting that metals did not accumulate in the riparian buffer soils (EOA Inc., 2005). Additional monitoring is recommended to address data gaps, and confirm the diversion volume threshold. However, the Pilot Project results are in line with expected water quality resulting from Vista Grande Canal diversions as discussed above.

## Vista Grande Wetland Treatment Characteristics for Recycled Water

Wetlands require a continuous source of water to sustain their vibrant plant and aquatic life. Existing dry-weather flows from the Vista Grande Watershed may provide a sufficient water supply for this purpose but the volumes available have not been quantified. As an alternative, recycled water was analyzed for its suitability as a dry-weather water supply.

### *Recycled Water Quality*

Unlike stormwater, where nutrient levels are generally low and pathogen concentrations high, recycled water typically has higher levels of nitrogen and phosphorus, and low pathogen concentrations. Recycled water from the Daly City recycled plant has a typical ammonia concentration of 25 mg/L. If this water is to be used as a dry-weather source for the wetland, it would require nitrification to protect the wetland's mosquitofish, which are necessary for mosquito abatement. For purposes of determining wetland performance with recycled water, the nitrate concentration for recycled water after nitrification was assumed to be 15 mg/l. Typical phosphorus concentrations of recycled water are around 4 mg/L. Total coliform concentrations are regulated by Chapter 3, Division 4, Title 22, California Code of Regulations (California Department of Health Services, 2003). Title 22 states that the total coliform concentration cannot exceed 240 MPN/100mL at any time over a thirty-day period. Since this thirty-day peak concentration of total coliform is an order of magnitude lower than the ambient total coliform concentration in South Lake, total coliform removal was not considered in the analysis of the wetland treatment characteristics for recycled water.

### *General Treatment Parameters for Recycled Water*

To assess the treatment capacity of the Vista Grande Wetland for recycled water, the following parameters were calculated for each constituent of concern: the total removal, the effluent concentration, and the estimated chlorophyll "a". These calculations are the same as those used for the treatment of Vista Grande stormwater but are modified for the typical nutrient concentrations in recycled water and for increased temperatures during summer months. During the summer months, when recycled water would most likely run though the wetland, higher water temperatures raise the typical removal of nitrate to 500 $mg/m^2day$, and the removal of phosphorus to 50 $mg/m^2day$ (Horne, 2005).

In addition, the warmer and drier weather during the summer months results in water losses as the water flows through the wetland. Losses occur through both evaporation and leakage. Evaporation and leakage were assumed to be 4ft per year per acre and 10% of the inflow, respectively.

### *Recycled Water Treatment Characteristics*

The total removal of the constituents of concern, the resulting effluent concentration, and the estimated chlorophyll "a" concentrations were calculated for inflow rates ranging from 0.25 mgd to 1.0 mgd. Again, the effluent concentration calculations were based on the average concentrations from existing water

quality data as shown in Table 5-8, and removal assumptions for summer conditions. The existing South Lake concentration in chlorophyll "a" assumes that the additional chlorophyll "a" generated by nitrate loading is added to the ambient chlorophyll "a" concentration into South Lake. Table 5-11 show the treatment characteristics of the wetland if recycled water is used as a water source.

**Table 5-11 Pollutants Removal for Different Recycled Water Inflow Rates at the Vista Grande Wetland**

| Wetland Inflow (mgd) | 0.25 | 0.45 | 0.50 | 0.75 | 0.85 | 1.0 |
|---|---|---|---|---|---|---|
| Evaporation (mgd) | 0.039 | 0.039 | 0.039 | 0.039 | 0.039 | 0.039 |
| Leakage (mgd) | 0.025 | 0.045 | 0.050 | 0.075 | 0.085 | 0.100 |
| Flow Out (mgd) | 0.19 | 0.37 | 0.41 | 0.64 | 0.73 | 0.86 |
| Residence Time (days) | **14.3** | **8.0** | **7.2** | **4.8** | **4.2** | **3.6** |
| **Nitrogen Removal** | | | | | | |
| Loading (kg/day) | 14.2 | 25.5 | 28.4 | 42.6 | 48.3 | 56.8 |
| Removal for residence time (kg) | 159.5 | 88.6 | 79.8 | 53.2 | 46.9 | 39.9 |
| Nitrate Remaining (kg) | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 16.9 |
| Effluent Concentration (mg/L) | 0.000 | 0.000 | 0.000 | 0.000 | 0.485 | 5.183 |
| Estimated Chlorophyll "a" (mg/l) [c] | 0.028 | 0.027 | 0.027 | 0.026 | 0.027 | 0.043 |
| **Phosphorus Removal** | | | | | | |
| Loading (kg/day) | 4.7 | 8.5 | 9.5 | 14.2 | 16.1 | 18.9 |
| Removal for residence time (kg) | 16.0 | 8.9 | 8.0 | 5.3 | 4.7 | 4.0 |
| Phosphorus Remaining (kg) | 0.0 | 0.0 | 1.5 | 8.9 | 11.4 | 14.9 |
| Effluent Concentration (mg/L) | 0.000 | 0.000 | 0.955 | 3.688 | 4.147 | 4.584 |
| Estimated Chlorophyll "a" (mg/l) [c] | 0.028 | 0.027 | 0.056 | 0.193 | 0.236 | 0.295 |

a. (EDAW , September 2004a)
b. (EDAW , September 2004b)
c. For a 6-month period.

Given the treatment characteristics presented in Table 5-11, the wetland could be operated to handle recycled water inflow rates of up to 0.85 mgd with no impact to the water quality of Lake Merced, assuming that Lake Merced is nitrogen limited. The 0.85 mgd inflow into South Lake would result in an effluent concentration in nitrate of 0.485 mg/L. The nitrate loading from the wetland effluent would result in a concentration of chlorophyll "a" into South Lake of 0.027 mg/L after accounting for dilution.

If Lake Merced were to become phosphorus limited, the wetland could be operated to handle inflow rates of up to 0.45 mgd with no impact to the water quality of Lake Merced. With a 0.45 mgd inflow into South Lake, all the phosphorus would be removed from the effluent. The nitrate loading from the wetland effluent would result in a concentration of chlorophyll "a" into South Lake of 0.027 mg/L after accounting for dilution.

## Water Quality Summary

As discussed earlier, the Vista Grande Wetland could treat stormwater and recycled water effluents, provided inflow rates are adjusted to produce an effluent of an acceptable water quality. A summary of the maximum inflow rates for stormwater and recycled water is presented in Table 5-12, along with the resulting chlorophyll "a" and coliform concentration in South Lake. The wetland could treat stormwater and recycled water flows of up to 1.9 mgd and 0.85 mgd, respectively, with no anticipated water quality impacts. To treat higher recycled water flows, additional denitrification and phosphorus removal processes would be required prior to wetland treatment in order to provide acceptable effluent water quality for discharge to Lake Merced (Horne, 2005.)

**Table 5-12: Maximum Recommended Wetland Treatment Rates for Stormwater and Recycled Water**

| Water Supply | Flow (mgd) | Estimated Chlorophyll in Lake Merced (mg/L) [a] | | Coliform bacteria in L. Merced (MPN/100 mL) [b] | |
|---|---|---|---|---|---|
| | | With wetland | Ambient | With wetland | Ambient |
| **Stormwater** | | | | | |
| | 1.9 | 0.029 | 0.029 | 2,113 | 1,250 |
| **Recycled Water** | | | | | |
| | 0.85 | 0.027 | 0.029 | NA [c] | 1,250 |

a. Chlorophyll "a" levels based on the limiting nutrient. Nitrogen appears to be the limiting element for plant growth in Lake Merced based on the bioavailable N:P ratio of 0.5 where < 10 = N-limiting, > 15 = P-limiting (see Table 4.2). If P becomes the limiting nutrient, then water volumes would need to be reduced by about two-thirds to half.

b. The fecal coliform standard for non-contact recreation is 2,000 MPN/mL (RWQCB, 1995). Values are based on a simple die-off model but wetlands would actually remove more pathogens due to physical and biological processes.

c. NA = Not applicable, water source is disinfected at the waste water treatment plant (WWTP) prior to entry to the wetland.

Metals are other pollutants of concern to consider when constructing treatment wetlands. Particulate metals (mineral or metal ores) will settle out and remain in the sediments without posing a hazard. Most soluble metals will become sulfides (insoluble metal ores) at the low redox present in the deeper sediments, and will not pose a hazard. The main potential hazard occurs between the initial sorbtion of the soluble metal and its entry into the sulfide mineral. This hazard appears to be small since no unusual metal concentration in biota has been found in the studies carried out for this purpose (Horne, 2005 - Preliminary Results). The few free metal ions not forming insoluble sulfide can be found in the outer root surfaces as detected by scanning electron microscopy (Horne, 2000).

### 5.3.7 Wetland Construction, Operation and Maintenance

#### Construction

Construction of the wetland would impact the area encompassed between John Muir Drive and the Olympic Club Golf Course. The area northeast of the existing Vista Grande canal is essentially covered with wild oat grassland at the southeastern end, evolving into mixed exotic and ice plant herbaceous. The San Francisco spine flower (Chorizanthe cuspidata), a Federal Species of Concern and a California Native Plant Society (CNPS) List 1b plant, occurs in the wild oat grassland. This area is also covered with approximately fifty pine trees, several eucalyptus trees, and approximately two small oak trees and two large oak trees. Construction of the wetland would result in removal of the plants and trees. However, it is believed that such loss will be minimal. This potential loss could be further minimized by planting trees and other plants in other appropriate habitats at Lake Merced. Mitigation of the removal of the large oak trees may include relocating those trees, or collecting acorns from the trees and propagating them for planting in the vicinity.

There are several structures above ground (including electric utilities), and there are several known utilities running along the Vista Grande canal. These existing underground utilities include a 33-inch pipeline and an abandoned 18-inch sewer pipeline from the NSMCSD wastewater treatment plant. Other existing utilities in the area include a sewer pipeline from the Olympic Club, and the Continuous Deflective Separation (CDS) units installed as part of the Vista Grande-Lake Merced Wetland Pilot Stormwater Treatment Project. It is assumed that the existing Lake Merced overflow structure could be used as the Vista Grande Wetland overflow into South Lake.

An important component of the wetland is the interface between the proposed Tunnel South of County Line and the wetland. It is anticipated that the interface would be a concrete box where the three existing storm drains (i.e. 24-inch and 60-inch storm drains and 7-foot by 8-foot box culvert) would discharge stormwater flows into the Tunnel South of the County Line (depending on the alignment selected).

Stormwater flows would be pumped to the proposed wetland. Regulating stormwater inflows into the wetland is critical to provide a level of treatment compatible with Lake Merced water quality objectives. Flows into the wetland would be regulated through flow control facilities located at the tunnel/wetland interface.

Another aspect of construction is the need for excavation. Prior to grading and other construction activities, the area shown in Figure 5-25 would need to be cleared of all vegetation and debris. Then the site should be excavated to design specifications. The Vista Grande Wetland will require approximately 15,000 cubic yards (CY) of excavation. After excavation is complete, the subgrade will have to be properly compacted to minimize settling.

**Figure 5-25: Area Along Existing Canal Proposed for Construction of Vista Grande Wetland**

## Operation and Maintenance

Operation of the wetland will depend on the water source used for the wetland during different times of the year. Several water supplies could be used at the Vista Grande Wetland. Stormwater would be diverted into the wetland during winter (i.e. from November to April). In summer, depending on the availability of year-round flows, the Vista Grande Wetland could treat either dry weather flows or recycled water from the NSMCSD recycled water facility or recycled water from potential facilities in San Francisco. Alternatively, pumped water from Lake Merced could be used as an alternative water supply during the summer period. However, re-circulating water from Lake Merced will limit the lake level augmentation benefit of the wetland.

There are several maintenance activities that would have to be conducted to ensure the efficacy of the wetland. It is recommended that these maintenance activities be summarized in an O&M plan. Maintenance activities include maintenance of inlet and outlet structures, desilting of the settling basin, management of vegetation, odor control, control of nuisance pests and insects, and maintenance of berms and other constructed water control structures.

Water level control is the most critical operational parameter as it ensures the proper function of the system. Therefore, proper maintenance of water control structures such as berms, piping, inlet and outlet structures needs to occur routinely to ensure proper hydraulic conditions. Maintenance activities include

removal of debris and sediment, periodic flushing of pipes and the use of high-pressure water sprays for periodic cleaning.

Another significant component of wetland maintenance relates to the control of nuisance pests, especially mosquitoes. Wetlands are known to be ideal breeding ground for mosquitoes, which can transmit diseases to humans. Scientific research has shown that mosquito problems associated with treatment wetlands are rare (Interstate Technology & Regulatory Council (ITRC), 2003). However, mosquito abatement will be a critical maintenance element of the Vista Grande Wetland. An effective mosquito abatement strategy consists of introducing mosquitofish into the wetland. Mosquito abatement strategies will be coordinated with the mosquito abatement programs implemented by San Francisco and San Mateo County Mosquito Abatement Districts. An O&M plan will likely be required by the regulatory agencies as part of the permitting process.

#### Monitoring

Monitoring is needed to ensure proper performance of the wetland. It is recommended that a monitoring plan be developed and maintained throughout the wetland life. The monitoring plan will likely include recording of water quality parameters listed in the San Francisco Bay Basin Plan (Basin Plan), water flows, rainfall, and plant cover for dominant species (RWQCB, 1995). A monitoring plan is likely to be required by the regulatory agencies as part of the permitting process.

### 5.3.8 Preliminary Capital Costs

The preliminary capital cost estimates for the wetland is provided in Table 5-13. Two Vista Grande Wetland alternatives were evaluated for the Vista Grande Watershed Study. Alternative A is the recommended alternative, described earlier in this section. Alternative A is estimated to cost approximately $8.6 million (December 2005 dollars). Escalating costs to the assumed midpoint of construction at a rate of 5% per year increases the cost estimate to $11.2 million (2012 dollars)[1]. For informational purposes, the cost estimate for Alternative B is provided in Appendix F. Information on cost escalation is provided in Appendix G.

It is important to note that Alternative A cost only includes the cost to divert stormwater and construct the treatment wetland. Costs for upgrading recycled water facilities to provide nitrification and for distributing the recycled water to the wetland are not included. Also, the cost estimates provided in Table 5-13 do not include the cost for a pump station to pump water from Lake Merced to the wetland headwaters, in case Lake Merced water is used. Last, the cost estimate presented above assumes that the existing Lake Merced overflow structure is used as an outlet into South Lake, and that no pump station is needed to discharge the wetland effluent into South Lake.

[1] Note that this escalation does not include financing costs associated with obtaining a bond measure, such as a debt service reserve fund.

**Table 5-13: Vista Grande Wetland Alternative A Planning Level Capital Cost Estimate**

| Description | Units | Unit Cost | Quantity | Total Cost |
|---|---|---|---|---|
| SITE PREPARATION / MOBILIZATION | | | | |
| Clear and grub brush including stumps | acre | $10,000 | 6.5 | $65,000 |
| Removal of heritage oaks | - | - | - | $50,000 |
| Relocate Olympic GC Sewer Pipeline | lf | $96 | 3600 | $346,000 |
| Relocate 30" Sewer Pipeline | lf | $360 | 3600 | $1,296,000 |
| Demolition 18" Sewer Pipeline | lf | $20 | 3600 | $72,000 |
| Relocate Above-ground Structures | Allowance | $500,000 | - | $500,000 |
| Mobilization/Demobilization | each | 10% | - | $435,000 |
| CONSTRUCTION | | | | |
| Mass excavation and hauling | cy | $38 | 15,000 | $570,000 |
| Grading, compacting, and transporting fill | day | $10,000 | 10 | $100,000 |
| Traffic Barrier | lf | $50.50 | 3,600 | $182,000 |
| Embankment Construction | cy | $32 | 1,300 | $42,000 |
| Roadways / trains (maintenance access) | sf | $5 | 48,000 | $240,000 |
| Pump Station | Allowance | $150,000 | 1 | $150,000 |
| Inlet structure | Allowance | - | 1 | $50,000 |
| Flow Control Facilities | Allowance | - | 1 | $50,000 |
| Outlet Basin | Allowance | - | 1 | $50,000 |
| Standard Piping | lf | $40 | 850 | $34,000 |
| Draining Piping | lf | $40 | 3,600 | $144,000 |
| Draining Valving | Allowance | $20,000 | 1 | $20,000 |
| Wetland planting - propagation / harvesting / installation | acre | $30,000 | 5.5 | $165,000 |
| Replanting during wetland establishment | acre | $30,000 | 5.5 | $165,000 |
| Landscaping | acre | $30,000 | 2.0 | $60,000 |
| Subtotal:[a] | | | | $4,800,000 |
| Contingency (30%)[a]: | | | | $1,400,000 |
| Construction Cost Estimate[a]: | | | | $6,200,000 |
| Implementation (30% Allowance)[a]: | | | | $1,900,000 |
| Environmental Compliance[a]: | | | | $500,000 |
| Capital Cost Estimate (December 2005 dollars)[a]: | | | | $8,600,000 |
| Cost Escalated to the Midpoint of Construction[a, b]: | | | | $11,200,000 |

a. Costs are rounded to the closest $100,000.
b. Costs have been escalated to the midpoint of construction (2012) at a rate of 5% per year. See Appendix G for more information.

### 5.3.9 Benefits

#### Lake Merced Lake Level Augmentation

Beneficial uses for Lake Merced are set forth in the San Francisco Bay Basin Plan (Basin Plan) (RWQCB, 1995). The Basin Plan lists Lake Merced as a potential municipal water source, as both a water-contact and non-water contact recreational source, as a warm and cold fresh water habitat, and as

wildlife and fish spawning habitat. Maintaining appropriate water levels is a critical factor to preserve Lake Merced beneficial uses. However, Lake Merced water levels declined from the late 1980's to the early 2000's, as reported in a series of reports (EDAW, September 2004a, b). To mitigate those declining water levels the SFPUC has been evaluating a range of target lake levels and supplemental water sources. Several water supplies were looked at in order to achieve the various water levels. Water supplies that were evaluated include: 1) stormwater from Vista Grande canal; 2) recycled water; 3) SFPUC system water, and groundwater. Currently, SFPUC system water is used periodically for lake level enhancement. However, the Vista Grande Wetland could provide an alternative water supply in lieu of SFPUC system water.

The variability of the water supply and the wetland treatment capacity will dictate the additional volume to Lake Merced and resulting lake level enhancement. Previous model runs and field data show that lake level enhancement is also affected by hydrologic conditions (i.e. dry year versus wet year) (EDAW, September 2004a). Three water supply scenarios to the Vista Grande Wetland were considered. Scenario #1 assumes a constant water supply addition (wetland-treated stormwater) of 1.0 mgd throughout the year. Scenario #2 assumes a winter supply addition (wetland-treated stormwater) of 1.9 mgd, and a summer supply of recycled water of 0.85 mgd. Scenario #3 assumes a winter supply addition (wetland-treated stormwater) of 1.9 mgd, and assumes that water from Lake Merced would be recirculated to the wetland in summer time to sustain the wetland ecosystem. The three scenarios and their impacts on lake levels are captured in Table 5-14. As shown in Table 5-14, the year-round addition of 1.0 mgd (Scenario #1) would sustain a lake level of less than 8.0 feet SF city datum during average years. Scenario #2 would result in lake level of 8.0 feet during average years. Similarly, Scenario #3 would result in lake level fluctuating between 5-6 feet and 8.0 ft during average years. Dry year water requirements to maintain similar lake levels as discussed above will be higher but have not been quantified.

**Table 5-14: Scenarios for Providing Supplemental Water to Lake Merced and Effect on Lake Water Level**

| Water Source Combination | Season | Flow (mgd) | Volume Added to South Lake (AF) | Effect on Water Level at Lake Merced (ft) |
|---|---|---|---|---|
| **Scenario #1** | | | | |
| **Stormwater** | **Year-round** | **1.0** | **1,120** | <8.0 ft (average year) |
| **Scenario #2** | | | | |
| Stormwater | Winter (6 months) | 1.9 | 1,050 | 8.0 ft (average year) |
| Recycled Water | Summer (6 months) | 0.85 | 470 | |
| **Stormwater + Recycled Water** | **Year-round** | **1.38 (annual average)** | **1,520** | |
| **Scenario #3** | | | | |
| Storm water | Winter (6-months) | 1.9 | 1,050 | 5-6 ft - 8.0ft (average year) |
| Water Recirculation from Lake Merced | Summer (6 months) | - | - | |
| **Stormwater + Lake Merced** | **Year-round** | **0.95 (annual average)** | **1,050** | |

## Habitat

The area northeast of the Vista Grande canal is part of San Francisco Significant Natural Resource Areas (EIP Associates, 2005). The Natural Areas Program was developed in the late 1990s to preserve, restore, and enhance remnant Natural Areas and promote environmental stewardship of these areas. Because of its proximity to South Lake and Impound Lake, it is likely that the Vista Grande Wetland will provide an extension of the nearby wetland habitat for local and migratory bird populations.

**Figure 5-26: Impound Lake Fringe Habitat**

## Recreation

Lake Merced and the area around the Vista Grande canal is an important habitat area for migrating birds from August through November. As such, it is also heavily used for bird watching during that time. The Vista Grande Wetland will incorporate an access road for maintenance purposes, which could be used as a public trail, thus providing an area for bird watchers to enjoy this resources without trespassing or disturbing golfers. Therefore, there are opportunities to use the Vista Grande Wetland for recreational and educational purposes through a public trail and educational signage documenting the wetland purpose and function of constructed wetlands.

### 5.3.10 Implementation Issues

## Environmental Considerations

Constructed treatment wetlands are considered appropriate technology for treating stormwater and are generally looked upon favorably by regulatory agencies. Although stormwater wetlands are considered to be ecologically sound solutions to stormwater treatment, they are designed specifically to treat the contaminants most commonly found in stormwater, so they generally do not replicate the extensive diversity and productivity of natural wetlands. As a result, they are not suitable and will not qualify as a replacement habitat wetland.

Construction for the wetland could create some erosion and additional runoff into Lake Merced. It will require clearing all vegetation from the site, which could disturb some existing habitat. However, the area will be replanted for the wetland, creating additional, suitable quality habitat for birds and wildlife.

After treatment in the wetland, water that is discharged into South Lake will contain low concentrations of nitrate, phosphorus, and other nutrients. Nutrients are one of the driving forces in the eutrophication process but the concentrations in the wetland effluent are expected to have a minimal impact on the lake. Pathogens and other microorganisms in the stormwater will be significantly reduced through treatment in the wetland. For “first flush” stormwater entering the wetland, which may have high concentrations of total coliform, the wetland effluent and the localized concentration near the discharge area in South Lake may exceed the action level for total coliform concentrations. In this situation, all stormwater flows could

be sent through the new tunnel and flow into the wetland could be temporarily suspended, limiting water quality impacts to the lake.

Construction of the wetland would result in the removal of the plants and trees located along the existing Vista Grande canal, including two large oak trees. The trees in this area are a valuable component of a small habitat that supports many birds all year and is a significant stopover point for many migrating landbirds. The potential loss of these trees could be mitigated by planting new trees in the vicinity and relocating the large oak trees, if feasible. In addition, the grasses and other plants along the Vista Grande canal form a weedy area that sparrows and finches use for feeding from late summer through mid-spring. Planting some of the open uplands around Lake Merced with Native grasses, lupine, coyote bush, or other appropriate vegetation could help replace this habitat.

Overall, the Vista Grande Wetland is expected to be an environmental enhancement project since it will create habitat and increase water levels in Lake Merced.

## Permitting Requirements

The Vista Grande Watershed is expected to trigger regulatory involvement from several State and Federal agencies. Table 5-15 summarizes the permitting requirements that have been identified for this preliminary program component. Chapter 6 provides a more detailed discussion of the regulatory requirements for the Vista Grande Watershed Study.

**Table 5-15: Summary of Permit Requirements for the Vista Grande Wetland**

| Agency | Permit or Requirement | Authority | Cause for Permitting Action | Time Frame |
|---|---|---|---|---|
| US Army Corps of Engineers (the Corps) | §404 Permit | Clean Water Act | The Vista Grande Wetland requires filling and abandoning the Vista Grande canal. If the Vista Grande canal is deemed part of the "waters of the United States", the wetland will require a §404 permit from the Corps. Any work along the bank of Lake Merced may also trigger this permit and could require a §10 permit as well. | 4-6 months – Individual Permit<br>45-60 days - Nationwide Permit<br><br>An additional year or more if a biological opinion is required |
| | §10 Permit | River and Harbors Act | | |
| US Fish and Wildlife Service | §7 Consultation | Endangered Species Act | The area around the Vista Grande Wetland may contain the appropriate habitat for endangered species. The Corps will consult with USFWS during the permit process. If endangered species or their habitat are believed to be affected, USFWS will prepare a biological opinion under a §7 Consultation. | 1-3 years |
| San Francisco Regional Water Quality Control Board (RWQCB) | §401 Permit - Water Quality Certification | Clean Water Act §401 | Under §401 of the Clean Water Act, any activity subject to a permit from a Federal agency must be by the appropriate State that the activity meets all State water quality standards. | 60 days after application is deemed complete. Up to one year of additional time may be requested from the Corps. |

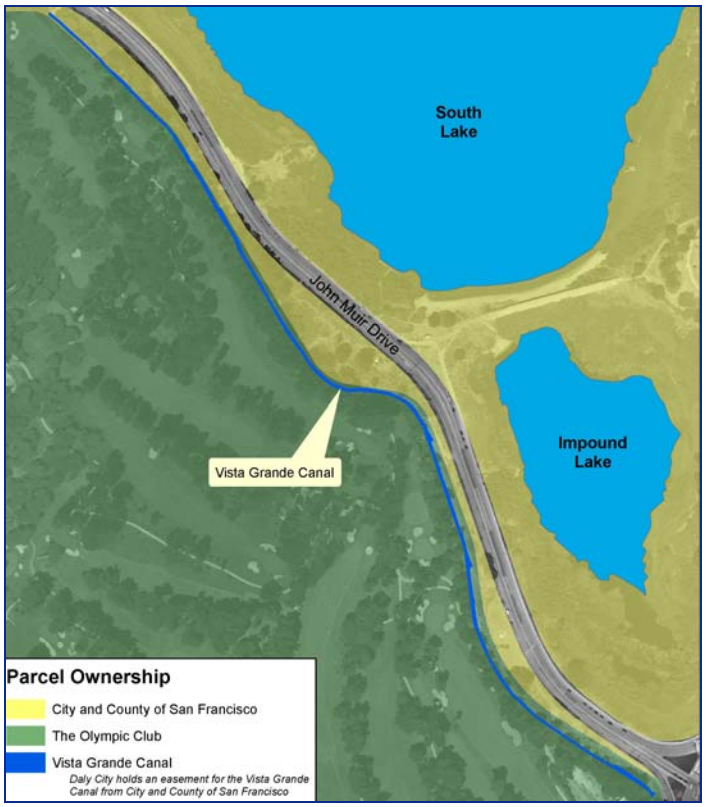
| Agency | Permit or Requirement | Authority | Cause for Permitting Action | Time Frame |
|---|---|---|---|---|
| | §402 Permit - NPDES: General Construction Activity Stormwater Permit | Clean Water Act §402 | Required for any construction activity that disturbs more than five acres of land, or if the overall program disturbs more than five acres of land. | Approximately six months |
| | Waste Discharge Requirements | Porter-Cologne Water Quality Control Act | Required for any activity that generates dredged material, fill or any other discharge that may directly or indirectly impacts the "waters of the State". Waived if §401 Permit required. | Approximately three months |
| California Department of Fish and Game (CDFG) | Streambed Alteration Agreement (§1602 permit) | Fish and Game Code §1602 | Required before undertaking any activity that will significantly change any river, stream, or lake. The jurisdiction of CDFG includes the Vista Grande canal. | 30 days after application submittal to evaluate completeness; 60 days after application is deemed complete. |
| California Coastal Commission (CCC) and/or Local Coastal Programs (LCPs) | Coastal Development Permit or Public Works Plan | California Coastal Act of 1976; Federal Coastal Zone Management Act | Required for any development in the coastal zone. The coastal zone begins at the shoreline and extends from 500 yards to 5 miles inland. The coastal zone extends around Lake Merced and includes the Vista Grande Canal area. | Six months to two years |
| California State Lands Commission | General Lease – Right-of-Way | California Public Resources Code - Division 6 Public Lands | Required for any project within the California State Lands Commission's jurisdiction. Any work below the ordinary low-water mark on Lake Merced would be within their jurisdiction. It would need to be determined if other project areas, such as the canal are within their jurisdiction. | 1-3 years |

## Property

Securing the rights to the land along the existing Vista Grande canal is essential to the success of the wetland. Currently, the Olympic Club owns the property where the canal is located, and Daly City has an easement from CCSF for the canal, as shown in Figure 5-27. The land between the canal and the road is owned by the CCSF. In order to build the wetland, the land owned by the Olympic Club will need to be acquired. Negotiation with the Olympic Club will be necessary to secure this land.

In addition, John Muir Drive will need to be narrowed to allow for the buffer zone between the road and the wetland. The current conceptual design assumes that five feet of the road will be available for this buffer. Narrowing the road may provide for enhanced recreational opportunities along the wetland area, but the traffic impacts of this modification should be evaluated during the design stage of the wetland, and coordination with SF DPW will be required.

**Figure 5-27 Property Ownership around the Vista Grande Canal**




## Dry-Weather Flow Monitoring

Constructed wetlands must have a source of water throughout the year so that the wetland plants and other organisms within the wetland ecosystem can continue to grow and thrive. Summertime flows have been observed in the Vista Grande canal year-round. However, these flows have not been quantified. An essential step in the implementation of the wetland project will be to monitor flows in the Vista Grande canal year-round to assess whether an alternative water supply such as recycled water will be necessary to support the wetland ecosystem during summer months (May to November). Monitoring should begin during the next dry season (summer 2006) so that quantity and quality of available flows are known before design of the wetland begins.

## Alternative Water Sources

Depending on the results of the summertime flow monitoring, an alternate water supply may be necessary to support the wetland during dry periods. Recycled water could be used as an alternative source of water for wetland maintenance and lake-level augmentation. Prior to using recycled water, nitrification will need to be added to the recycled water facility to lower ammonia to protect mosquitofish in the wetland. If the water quality of the recycled water effluent is still not compatible with Lake Merced water quality objectives, additional treatment (i.e. denitrification and phosphate removal processes) would be required to lower nitrate and phosphorus concentrations in the recycled water.

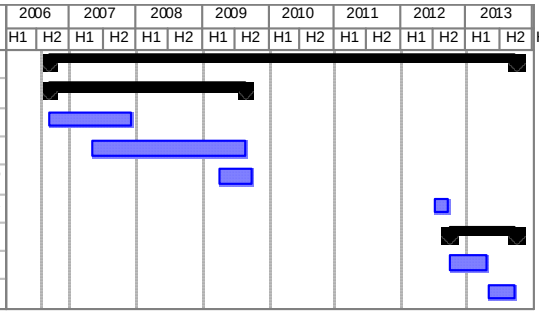
Re-circulation from Lake Merced is another option for year-round wetland maintenance. This option would require installing a pump station to transport water from Lake Merced into the wetland. This alternative would not provide any lake-level augmentation benefit during the re-circulation period since the water would be extracted directly from the lake. However, re-circulation from Lake Merced may provide a viable alternative to maintain the wetland ecosystem during the dry season if flows are shown to be insufficient to support wetland life and recycled water use is determined infeasible.

### 5.3.11 Implementation Schedule

The Vista Grande canal will be removed during the construction of the Vista Grande Wetland. Since the canal is still an essential stormwater conveyance structure, construction on the wetland cannot begin until construction of the new Tunnel South of County Line is complete and the tunnel is operational. However permitting and design for the wetland can be conducted concurrently with the permitting and design of the tunnel. Overall, the permitting, environmental documentation, and design phases of the Vista Grande Wetland are expected to take approximately three years. Construction is estimated to take an additional nine months. If construction of the wetland starts when construction of the tunnel is complete, wetland operations could begin by mid-2013. An implementation schedule for the Vista Grande Wetland is shown in Figure 5-28. This implementation schedule includes only permitting, design and construction phases and is dependent on funding availability and the proposed schedule for the Tunnel South of County Line.

**Figure 5-28 Vista Grande Wetland Implementation Schedule**

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **Wetland** | **1848 days** | **Fri 9/1/06** | **Tue 10/1/13** |
| 2 | **Permitting** | **780 days** | **Fri 9/1/06** | **Thu 8/27/09** |
| 3 | Applications | 327 days | Fri 9/1/06 | Mon 12/3/07 |
| 4 | Approval | 608 days | Tue 5/1/07 | Thu 8/27/09 |
| 5 | Design | 130 days | Wed 4/1/09 | Tue 9/29/09 |
| 6 | Bid & Award | 66 days | Fri 6/29/12 | Fri 9/28/12 |
| 7 | **Construction & Monitoring** | **262 days** | **Mon 10/1/12** | **Tue 10/1/13** |
| 8 | Construction | 152 days | Mon 10/1/12 | Tue 4/30/13 |
| 9 | Wetland Monitoring | 110 days | Wed 5/1/13 | Tue 10/1/13 |




### 5.3.12 Recommendation and Next Steps

It is recommended to construct the Vista Grande Wetland alternative discussed in this section (Alternative A). The Vista Grande Wetland is an effective way to supply additional water to Lake Merced to raise water levels and enhance habitat around Lake Merced. The wetland described in this section would maximize the area available for treatment and enhance recreational and educational opportunities. The benefits of the use of the stormwater from the Vista Grande Wetland should also be examined as part of an alternatives analysis report looking at the different options for raising Lake Merced water levels. Three scenarios are available to operate the Vista Grande Wetland year-round, as shown in Table 5-16. Water supply scenarios include: 1) stormwater supply year-round; 2) stormwater supply in winter and recycled water supply during summer; and, 3) stormwater supply during winter and water pumped from Lake Merced during summer.

**Table 5-16: Possible Combinations of Water Supplies for Operation of the Vista Grande Wetland**

| Scenario | Season | Flow (mgd) | Estimated Chlorophyll in Lake Merced (mg/L) [a] | | Coliform bacteria in L. Merced (MPN/100 mL) [b] | | Water Level change in Lake Merced (ft) [c] | | Recommendation |
|---|---|---|---|---|---|---|---|---|---|
| | | | With wetland | Ambient | With wetland | Ambient | With wetland | Ambient | |
| **Scenario #1** | | | | | | | | | |
| Stormwater | Year-round | 1.0 | 0.024 | 0.029 | 1,468 | 1,250 | <8.0 (average year) | 0 | Preferred |
| **Scenario #2** | | | | | | | | | |
| Stormwater | Winter | 1.9 | 0.029 | 0.029 | 2,113 | 1,250 | | | |
| Recycled Water | Summer | 0.85 | 0.027 | 0.029 | NA [d] | 1,250 | | | |
| Stormwater + Recycled Water | Year-round | 1.38 | 0.028 | 0.029 | ≤ 2,113 | 1,250 | 8 (average year) | 0 | Preferred |
| **Scenario #3** | | | | | | | | | |
| Storm water | Winter | 1.9 | 0.029 | 0.029 | 2,113 | 1,250 | | | |
| Recirculated Lake Merced Water | Summer | - | - | - | - | - | | | |
| Stormwater + Lake Merced | | .95 | 0.029 | 0.029 | ≤ 2,113 | 1,250 | 5-6 ft - 8.0 ft (average year) | 0 | Less preferred due to reduced benefit to lake level enhancement and potential impacts to Lake Merced |

a. Chlorophyll "a" levels based on the limiting nutrient. Nitrogen appears to be the limiting element for plant growth in Lake Merced based on the bioavailable N:P ratio of 0.5 where < 10 = N-limiting, > 15 = P-limiting (see Table *). If P becomes the limiting nutrient, then water volumes would need to be reduced by about two-thirds to half.
b. The coliform standard for non-contact recreation is 2,000 MPN/mL. Values are based on a simple die-off model but wetlands would actually remove more pathogens.
c. Long-term average value after initial groundwater demand is met.
d. NA = Not applicable, water source is disinfected at the WWTP prior to entry to the wetland.

The first step in implementing the Vista Grande Wetland is to perform flow monitoring in the Vista Grande canal year-round to determine the seasonal availability of stormwater. If the flow monitoring confirms the availability of storm water flows year-round, it is recommended to pursue Scenario #1. Scenario #1 is the preferred alternative as it would reduce dry-weather flow discharges through the Tunnel South of County Line outlet structure; it is also the least costly alternative. If stormwater is not available during summer, it is recommended to treat up to 0.85 mgd of recycled water, as illustrated in Scenario #2. Issues surrounding emerging contaminants and pharmaceuticals in recycled water would need to be considered when investigating the overall feasibility of Scenario #2. If Scenario #2 is not pursued, then Scenario #3 could be implemented. Scenario #2 is preferred over Scenario #3, as it would reduce the wastewater effluent discharge to the beach during summer and would enhance South Lake level. Scenario #3 identifies Lake Merced water as a potential water supply to the wetland during summer if no other source of water is available.

If there is public and political support for the Vista Grande Wetland, the critical step for project implementation would be to secure funding. Securing funding could occur concurrently with the wetland monitoring phase and construction of the tunnel. After funding is secured, the project design and construction phases could occur as described earlier.

## 5.4 Upstream Storm Drain Improvements

### 5.4.1 Overview of Storm Drain Improvements

The watershed approach to solving flooding in the Vista Grande drainage area outlined in this Study will require a combination of upstream and downstream solutions and improvements. Downstream improvements included in the Vista Grande Watershed Study's preliminary program recommendations include a new Tunnel South of County Line and Vista Grande Constructed Wetland (as described in Sections 5.2 and 5.3, respectively.) Upstream improvements include improvements to the storm drain conveyance system to alleviate flooding for the 10-year design storm event. It is important to note that before undertaking any upstream storm drain flow capacity improvements, downstream infrastructure improvements must be completed, as increased flow capacity upstream would require adequate flow capacity downstream. Additionally, in order to specifically identify the required improvements in the Vista Grande storm drain system, a storm drain master planning process should be undertaken, which would involve flow monitoring, model calibration, and the development of a capital improvement program.

This section describes the existing Vista Grande storm drain collection system, discusses general types of improvements that would be implemented to address storm drain system deficiencies, outlines the steps necessary to complete a storm drain master plan, and provides information on costs and the implementation schedule for storm drain improvements.

### 5.4.2 Existing System Description and Constraints

The Vista Grande storm drain collection system collects stormwater runoff from an approximately 2.5 square mile area of Daly City. The area includes a portion of unincorporated San Mateo County, and is bordered by San Francisco County to the north, Colma Creek to the south and east, and the Pacific Ocean to the west, as shown in Figure 1-1. During the wet weather season, rainfall runoff generated within this drainage area is captured in the existing Vista Grande storm drain collection system. This underground collection system routes storm flows northwest to Vista Grande canal and tunnel for discharge to an outfall structure at the beach below Fort Funston. The existing Vista Grande storm drain system is comprised of storm sewers, box culverts, manholes, catch basins, and flow equalizations facilities, with approximately 30 miles of pipe, ranging in size from 6 to 72 inches diameter, plus some box culverts (CH2MHill, 2002.) Pipe materials include reinforced concrete, vitrified clay, corrugated metal, and plastic.

The watershed area drained by the Vista Grande stormwater conveyance system periodically experiences localized flooding during the wet weather season due to capacity constraints throughout the system. Previous studies have shown that many parts of the storm drain system do not have adequate capacity to accommodate rainfall runoff from the 10-year design storm event (Kennedy/Jenks, 1983; CH2MHill, 2002.) Flooding is a public safety concern that causes traffic issues, and can potentially cause road and property damage as shown in Figure 5-29.

The 10-year storm event was used to evaluate the current performance of the storm drain system and to evaluate storm drain improvement options because 10-year level protection has become a typical storm drain design level because it provides a balance between level of service and affordability. The actual level of protection provided by storm drain improvements would be determined as part of future analyses associated with storm drain master planning.

**Figure 5-29 Localized Flooding near Daly City's City Hall**

### 5.4.3 Improvements to Address Storm Drain Capacity Issues

The Vista Grande stormwater conveyance system is in need of capacity improvements to alleviate localized flooding in the upstream areas of Daly City. Although downstream improvements are necessary to solve backwater and overflow issues, subsequent upstream solutions must be implemented to ensure a 10-year level of protection watershed-wide. Upstream improvement options may include conveyance solutions or local detention. Any conveyance improvements to the upstream storm drain system will increase flows downstream, and therefore, must be implemented after downstream improvements are constructed.

#### Conveyance Improvements

Structural improvements may include pipe or box replacement or new storm drains and pump stations. All options have their benefits and limitations and applicability to the upstream Vista Grande storm drain system, as discussed below.

***Pipe Replacement or New Storm Drain Placement***

Storm drain infrastructure improvements may involve enlarging the storm drain system through a series of pipe (and/or box) improvements and/or new storm drain construction. The standard practice for most Bay Area communities is to provide a 10–year level of protection for stormwater conveyance systems. The 10-year event has become the standard because it provides a balance between level of service and affordability. The Vista Grande Watershed Study assumes that the 10-year storm event will be selected as the design criteria for any upstream conveyance improvements, and preliminary cost estimates and sizing of downstream facilities has been done based on this assumption. However, the final design storm for storm drain improvements would be determined as part of future analyses associated with the development of upstream conveyance alternatives.

Pipe replacement is an option utilized when the capacity of an existing pipe is inadequate or when a pipe is in poor condition. Flow modeling of an existing storm drain system under specified design conditions identifies specific pipe sections where flow capacity is inadequate, and also demonstrates areas of localized flooding. Often, flooding results in a stormwater model can be substantiated with observations made in the field by City staff. For the assessment of a solution, new pipe diameters can be utilized in stormwater modeling to investigate the hydraulic performance of the system with the proposed improvement(s).

The placement of new storm drains, where pipes do not already exist, may be necessary in certain situations. Some of these instances follow:

- Pipe replacement is prohibitive due to soil/geologic conditions at existing location;
- Pipe replacement is cost prohibitive, so a parallel pipe is installed;
- Redevelopment of a site changes stormwater flow paths and a new flow route is established;
- Diversion of flow from one storm drain with capacity issues to another with capacity available; and,
- Consolidation of flows from multiple storm drains into a single new pipe.

***Pump Stations***

Pump stations can aid in the management of stormwater by facilitating the movement and timing of stormwater conveyance through a system. Pump stations are used in many ways to mechanically control flow through a storm drain system and alleviate localized flooding. Some stormwater uses for a pump station follow:

- To lift flow within the drainage system or from the storm drain system to an open channel or other structure;
- To force flow through a specific low-lying area or through an outfall where backwater issues may occur; and,
- To remove stormwater from an off-line detention structure and place it back into a storm drain after peak flows have passed.

## Local Storage

Detention basin storage can be constructed on a local scale in lieu of conveyance improvements where cost effective. Local detention storage is often designed to store increased runoff from new developments or redevelopments, and is designed to handle storage of local overflows for smaller drainage areas.

Some benefits of local detention storage include the following:

- Most applicable to new development standards that require no net increase in stormwater from a site
- Reduces localized flooding in small developments or neighborhoods
- May provide groundwater recharge and water quality improvements
- Reduces size upgrades to local storm drains

Limitations exist to the use of local detention storage within Daly City. Some of these limitations are listed below:

- Does not solve watershed-wide flooding;
- Difficult to site storage facilities in developed areas; and,
- Large volumes of stormwater are very costly to store in an urbanized setting.

Local detention storage was included in the evaluation of alternatives for the Watershed Study as discussed in Section 4.1.3. Because of the limitations described above, and its inability to solve watershed-wide flooding, it was dropped as an alternative for flood protection. However, its applicability and cost effectiveness to solve local flooding issues can be evaluated as part of a storm drain master planning effort. Additionally, phasing requirements for local detention storage are different that those of

conveyance improvements. Because detention storage does not increase conveyance of stormwater flows downstream, it does not require that downstream flood protection improvements be completed before it is implementation.

### 5.4.4 Runoff Reduction Practices

From a larger watershed perspective, runoff to storm drains can be reduced community-wide through innovative re/development planning and implementation of structural best management practices (BMPs). Utilizing runoff reduction practices maximizes stormwater locally by managing its movement with structures which allow more stormwater to be captured on-site. Structures that off-set the stormwater impacts from impervious surfaces include strategically-placed vegetated buffers, grassy strips and swales, and permeable pavement. The implementation runoff reduction structures can have additional benefit of slowing and reducing the volume runoff to storm drains, and allowing water infiltrated into the ground, promoting groundwater recharge. However, implementation of structural BMPs in an already developed area such as Daly City can be expensive and is generally done over a long period of time as redevelopment occurs. The ongoing implementation of both structural and nonstructural BMPs in Daly City is guided by compliance with Daly City's NPDES permit, as discussed in Section 5.5.

### 5.4.5 Storm Drain Master Planning

In order to implement storm drain improvements as recommended in the Vista Grande Watershed Study, Daly City will need to conduct a formal storm drain master planning process. This process will ultimately identify and prioritize capital improvements projects necessary to provide capacity to convey the design storm event throughout the Vista Grande storm drain system. This preliminary analysis was based on the 10-year storm event however, the actual level of protection to be used in the development of a storm drain master plan would be determined as part of future analyses associated with storm drain master planning.

Depending on a community's specific needs, storm drain master planning steps and tasks may vary. Daly City has already begun a key component of the master planning process by developing a model of the Vista Grande storm drain system that includes all major pipes within the drainage basin (CH2MHill, 2002.) However, further data collection and calibration of this model are required. The primary phases of a storm drain master planning process include data collection and verification, modeling and conceptual alternatives development, alternatives analysis and development of a capital improvement program. The phases, and a description of the steps required in each phase for the Vista Grande storm drain system are described below.

Phase I – Data Collection and Verification

1. Infrastructure review and field verification: Previous studies conducted using the existing Vista Grande storm drain system model recommended that existing infrastructure data, such as manhole and pipe attribute data, be reviewed to identify where data validation is warranted (CH2MHill, 2002.) This step would include review of the infrastructure data within the model and required field surveying to verify structure locations and elevations within the system. CCTV can also be used for existing condition assessment.

2. Design standards: The City's design standards for system improvements is the 10-year design storm event and will be used to evaluate the storm drain facilities.

3. Rainfall and flow monitoring: Previous studies conducted using the existing Vista Grande storm drain system model recommended that additional rainfall and flows data be collected to calibrate the model (CH2MHill, 2002.) As such, this step requires collection of data for multiple storm events at multiple locations throughout the storm drain system. Based on the size of the storm drain system, flow monitoring should be conducted at approximately 12 locations in the system. Daly City initiated a rainfall and flow monitoring program in December 2005. This program will be complete in 2006.

4. Runoff estimation: This step would result in runoff estimations based on land area, land use, percent pervious surfaces, slope, and other watershed characteristics.

Phase II – Modeling and Conceptual Alternatives Development

1. Model calibration: The flow and rainfall data collected as part of Phase 1 would be used to calibrate the existing model to a selected storm event.
2. Design flow simulation: Stormwater modeling will then be conducted for a number of design events to identify system deficiencies and correlate them with areas of known flooding.
3. Improvements analysis and alternatives development: This step will include modeling conceptual improvements to assess potential benefits to the system and developing a suite of conceptual alternatives.

Phase III – Detailed Alternative Analyses

1. Evaluate alternative feasibility: Once alternatives are a developed in Phase 2, a feasibility analyses will be conducted based on evaluation criteria such as performance criteria, preliminary cost estimates, contractility assessment, community impacts and maintenance issues.
2. Recommendations: This step includes developing improvement recommendations based on cost, feasibility, and potential impacts.

Phase IV – Development of Capital Improvement Program

1. Prioritization of recommendations: This step includes prioritizing and phasing recommended improvements against a set of evaluation criteria.
2. Capital Improvement Program Development: This step includes preliminary cost estimating of the recommended improvements and development of a schedule for program implementation. Additionally, funding options for the recommended program improvements should be identified.

Conducting a storm drain master planning process, as outlined above would identify deficient infrastructure and provide solutions to alleviate localized flooding and overflows for a 10-year flow event, assess the validity of proposed recommendations, prioritize the most feasible recommendations, and provide a capital improvement program for storm drain improvements. Ultimately, storm drain improvements identified through this process will aid in the greater watershed goal to resolve flooding issues for the 10-year design storm event.

### 5.4.6 Preliminary Planning Level Cost Estimate

A storm drain master planning process will identify required capital improvements, from which capital cost estimate can be developed. Until this process is complete it is difficult to develop an accurate capital cost estimate for storm drain upgrades. Previous studies have estimated that capacity deficiencies occur throughout the storm drain system (Kennedy/Jenks, 1983; CH2MHill, 2002.) This information, combined with a review of other recent storm drain capital improvement programs in the Bay Area, was used to develop preliminary planning level cost estimate of $25,000,000 to $35,000,000 for storm drain improvements in the Vista Grande watershed based on December 2005 dollars. Escalating these costs to the estimated midpoint of construction at a rate of 5% per year yields a cost range of $35,200,000 to $49,200,000[1]. See Appendix G for more information on cost escalation.

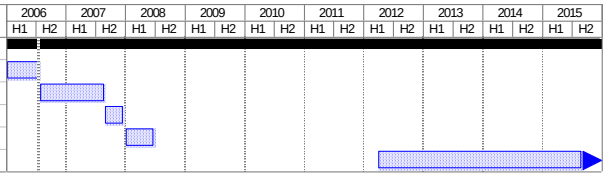
[1] Note that this escalation does not include financing costs associated with obtaining a bond measure, such as a debt service reserve fund.

### 5.4.7 Planning and Implementation Schedule

Like development of cost estimates, a detailed implementation schedule for storm drain improvements cannot be fully developed until the storm drain master planning process is completed. A key consideration for planning of upstream conveyance improvements is that they cannot be implemented until after downstream infrastructure improvements occur. A schedule which includes the timing of the key phases of the master planning processes and the potential timing of storm drain improvement implementation, which considers the timing of downstream flood protection improvements, is presented in Figure 5-30. This schedule assumes that downstream improvements are implemented by 2012 and that adequate funding is available.

**Figure 5-30 Implementation Schedule for Storm Drain Improvements [a]**

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **Vista Grande Storm Drain Master Plan** | **2604 days** | **Mon 1/9/06** | **Thu 12/31/15** |
| 2 | Data Collection/Verification | 147 days | Mon 1/9/06 | Tue 8/1/06 |
| 3 | Modeling & Conceptual Alternatives Analysis | 284 days | Tue 8/1/06 | Fri 8/31/07 |
| 4 | Detailed Alternatives Analyses | 85 days | Mon 9/3/07 | Fri 12/28/07 |
| 5 | CIP Development | 126 days | Mon 1/7/08 | Mon 6/30/08 |
| 6 | Implementation of Improvements | 979 days | Mon 4/2/12 | Thu 12/31/15 |




a. Assumes that downstream improvements are implemented by 2012.

## 5.5 Ongoing Implementation of Best Management Practices

### 5.5.1 Overview of Stormwater Regulation in Daly City

Daly City has jurisdiction over, and maintenance responsibility for, their municipal separate storm sewer systems and watercourses that they own and operate in San Mateo County. The stormwater generated within Daly City, such as that of the Vista Grande watershed, is regulated by the San Francisco Bay Regional Water Quality Control Board (RWQCB) through a NPDES stormwater permit. In order for urban areas to discharge stormwater into San Francisco Bay or the Pacific Ocean, dischargers are required by the Federal Clean Water Act and the California Porter-Cologne Water Quality Control Act to obtain a NPDES stormwater discharge permit. This chapter describes the NPDES permit structure in San Mateo County and the implementation of required components, including BMPs, by Daly City.

### 5.5.2 Regional NPDES Permit Coordination and Implementation

The NPDES stormwater discharge permit in San Mateo County is a single permit (No. CAS0029921), with 20 cities and the County listed as co-permittees of the permit. A county-wide stormwater management program called the San Mateo Countywide Stormwater Pollution Prevention Program (STOPPP) was created to coordinate implementation and compliance with NPDES requirements.

STOPPP is a consortium of local governments, represented by all 20 cities within San Mateo County and the County itself, partnering to implement stormwater-related activities and BMPs for their respective storm drain systems. As a co-permittee (discharger) on the NPDES permit, Daly City participates in the STOPPP program as well as implementing local source control and pollution prevention programs.

Regional STOPPP coordination and management is overseen by the City/County Association of Governments (C/CAG) of San Mateo County, a joint powers authority that acts on issues of regional significance to San Mateo County communities. Annual reporting on STOPPP activities is provided by C/CAG to the RWQCB, and is developed from and comprised of, semi-annual reporting documentation provided by each co-permittee, including Daly City. C/CAG has also established a NPDES Technical Advisory Committee (TAC), comprised of local municipal representatives with expertise in various fields related to stormwater including engineering, science, planning, environmental health, wastewater treatment, source control inspection, and public works administration. The TAC has established a number of subcommittees to help implement all of the program components of STOPPP. Daly City chairs the Commercial/Industrial/Illicit Discharge subcommittee.

Through STOPPP, Daly City participates in other regional collaborative efforts related to stormwater management including:

- Bay Area Stormwater Management Agencies Association (BASMAA) Monitoring Committee,
- Bay Area Macroinvertebrate Bioassessment Information Network
- San Francisco Estuary Regional Monitoring Program
- Clean Estuary Partnership

With program implementation and compliance, the San Mateo Countywide NPDES permit was, and can continually be, reissued to the communities participating in STOPPP. The success of the STOPPP partnership relies on the diligence of each community to implement required stormwater pollution prevention and control activities, including BMPs, in their local area.

### 5.5.3 STOPPP Stormwater Management Plan

To collectively demonstrate stormwater management implementation through STOPPP, C/CAG, and the San Mateo Countywide NPDES co-permittees have collaborated to develop a Stormwater Management Plan (SMP). The SMP for STOPPP guides participating communities, such as Daly City, with the implementation of stormwater control and pollution prevention activities, or a series of BMPs, and

enables them to meet the associated stormwater requirements for San Mateo County. More specifically, the SMP is intended to aid communities in the reduction of stormwater pollutants to the maximum extent practicable, and to effectively prohibit non-stormwater discharges into local storm drain systems and waterways.

Through the SMP, STOPPP has established baseline levels of effort and performance standards by which each discharger in San Mateo County must comply. The State recognizes the SMP as a comprehensive stormwater control program, and requires the SMP be implemented to meet the stated stormwater goals and objectives. Implementation requires that dischargers meet specified performance standards for each of the six program components through implementation of the BMPs in the SMP. These standards are a yard-stick by which the RWQCB can measure the effectiveness of STOPPP.

### SMP Components

The SMP is organized around six components that outline performance standards, including BMPs, for discharger compliance with the NPDES permit.

- **Municipal Maintenance** – This component includes standards for street sweeping, storm drain cleaning, parks and corporation yard maintenance and other maintenance-related activities in a way that minimizes pollutant discharges during these activities.
- **Commercial/Industrial/Illicit Discharge** – This component establishes measures for commercial and industrial facility inspection and educational outreach to eliminate illicit discharges to storm drains.
- **New Development and Construction** – This component includes standards to minimize impacts of land development on the beneficial use and water quality during and after construction, prohibit non-stormwater discharges from sites, reduce stormwater pollutant flow, require compliance with stormwater BMPs and erosion/sediment control at sites.
- **Integrated Pest Management -** Integrated pest management is a methodology to minimize the use of toxic pesticides. This component is typically incorporated into municipal operations as well as the Public Information/Participation component.
- **Public Information/Participation** – This component includes educating the public about causes of stormwater pollution and its environmental effects, encouraging public to use more environmentally-friendly practices related to stormwater management, and increasing public involvement in STOPPP activities. Daly City has developed number off public outreach activities, including Gateway Gardens (shown in Figure 5-31), which demonstrates Integrated Pest Management, recycled water, and other stormwater pollution prevention activities.
- **Watershed and Monitoring** – This component includes assessing water quality conditions to determine stormwater constituents of concern and developing plans to address these specific pollutants, and evaluating the effectiveness of BMPs utilized and examine the overall effectiveness of STOPPP.

**Figure 5-31 Gateway Gardens**

Each of these components contains a set of performance standards that are to be implemented by Daly City and all other co-permittees in order to comply with the San Mateo regional stormwater NPDES permit. The most recent STOPPP SMP (effective 2004-2010) that guides Daly City in its compliance efforts serves as the basis for the third NPDES permit reissued by the Regional Board to STOPPP. The updated SMP incorporates new RWQCB requirements related to Provision C.3, an amendment to the New Development and Construction component of the SMP, whose goals is to minimize impacts of land development on beneficial use and water quality during and after construction. Provision C.3 strengthens the New Development and Construction component requirements by identifying and implementing appropriate site design, source control, and stormwater treatment measures.

### Performance Standards

In order to achieve the goals and objectives of STOPPP, performance standards must be implemented by Daly City and all other co-permittees to demonstrate compliance with the countywide NPDES permit. Performance standards include BMPs, actions, and activities related to the execution of all required components of the SMP. The specific performance standards and BMPs that Daly City conforms to are described in detail in the SMP (City/County Association of Governments, 2004.) Utilizing its own staff (or other arrangements such as outside consultants), each co-permittee has the choice of how they will successfully implement and achieve the performance standards.

## 5.5.4 Daly City Ongoing Implementation of Performance Standards, BMPs, and other NPDES Permit Requirements

Daly City actively participates in STOPPP compliance efforts by implementing SMP components and performance standards, including BMPs, and providing necessary reporting information each period to C/CAG.

### Daly City Implementation Approach

As presented in Table 5-17, a number of departments from throughout the City are involved with implementation of all required components and associated performance standards of the SMP. Overall STOPPP implementation at Daly City is coordinated by the Director of Water and Wastewater Resources for Daly City. Furthermore, Daly City financially supports, and provides operation and maintenance for BMPs and other performance standard implementation. As with all other dischargers, Daly City adopts and enforces required ordinances, and implements component BMPs to aid in the overall control and reduction of stormwater pollution from San Mateo County.

**Table 5-17: Daly City Stormwater Implementation Team**

| STOPPP Components | City Department Responsible For Implementation |
|---|---|
| Municipal maintenance | Department of Public Works |
| Commercial/industrial/illicit discharge | Department of Water and Wastewater Resources |
| New development and construction | Department of Economic and Community Development |
| Integrated pest management | Department of Parks and Recreation |
| Public information/participation | Department of Water and Wastewater Resources |
| Watershed and monitoring | Department of Water and Wastewater Resources |

## Ongoing Implementation of SMP Performance Standards and NPDES Requirements

Daly City demonstrates its compliance with the requirements of the SMP and the NPDES permit through its participation in STOPPP and through its semi-annual submittals to STOPPP for countywide annual reporting. The details of the most recent Daly City participation in STOPPP, performance standard and BMP implementation, and compliance with the NPDES permit can be found in the STOPPP Fiscal Year 2004/2005 Annual Report, dated August 31, 2005. (City/County Association of Governments, 2005.) Table 5-18 presents a summary of some of the representative activities that have been undertaken by Daly City related to SMP requirements including BMPs, actions and activities in Fiscal Year 2004/2005.

**Table 5-18: Summary of Daly City's Ongoing Implementation of Stormwater BMP, Activities, and Actions Related to the STOPPP SMP for Fiscal Year 2004/2005**

| SMP Component | Daly City Compliance Status with SMP and NPDES Permit | Representative 2004-2005 BMPs and Other Activities |
|---|---|---|
| Municipal Maintenance | In compliance | • Trained maintenance staff on BMPs through attendance at BMP workshops<br>• Developing stormwater pollution prevention plans for corporation yards<br>• Conducted sediment management and removal at corporation yards<br>• Continued ongoing street sweeping, litter control, and maintenance activities for storm drainage facilities<br>• Participated in STOPPP working group meetings |
| Commercial / Industrial / Illicit Discharge | In compliance | • Chaired sub committee, and participated in working group meetings<br>• Performed educational visits to provide BMP info to contractors and residents before illicit discharges occur<br>• Conducted both regular and random inspections for stormwater control compliance; with over 200 inspections occurring in 2004<br>• Performed illicit discharge inspections and responded to calls for inspections as part of ongoing inspection program<br>• Completed source identification forms based on collected illicit discharge information<br>• Compiled summary of stormwater inspections and violations<br>• Distributed informational brochures during inspections and made brochures available during permit issuance for contractors for demolition |
| New Development and Construction | In compliance | • Designated staff from the Department of Economic and Community Development to oversee implementation of this component<br>• Developed specific stormwater conditions of approval, including construction and post construction stormwater control measures<br>• Developed modifications to the development review process to incorporate stormwater approvals throughout all phases of the review process including during conceptual review, plan submittal, CEQA assessment, design review, plan check, and permit issuance phases<br>• Reviewed and analyzed existing site design standards and guidance for inclusion in the development review process<br>• Completed Operation and Maintenance Information of Stormwater Treatment Measures forms and Impervious Surface Data Collection worksheets<br>• Promoted San Francisco Estuary Project's/Regional Board's General Construction Site Management workshop on erosion and sediment controls<br>• Conducted review and analysis and implementation of local site design standards and guidance in accordance with Provision C.3.j of STOPPP permit amendment dated February 19, 2003<br>• Instituted pesticide reduction is a condition of approval for development and significant redevelopment |
| Integrated Pest Management | In compliance | • Attended annual training on current IPM performance standards, policy and techniques, and BMPs, and attended spray applicator workshops<br>• Restricted pesticide usage (to last resort) and documented usage<br>• Implemented a Model Integrated Pest Management policy<br>• Adopted an IPM Policy/Ordinance<br>• Ensured that City contractor follows existing IPM techniques, which will be updated in next contractual period<br>• Implementation of hand weed control and mowing for Parks Department maintenance activities<br>• Participated in subcommittee working group meetings, trainings, and activities |

| SMP Component | Daly City Compliance Status with SMP and NPDES Permit | Representative 2004-2005 BMPs and Other Activities |
|---|---|---|
| Public Information and Participation | In compliance | • Attended and participated in subcommittee meetings<br>• Purchased 1000 thermoplastic markings to replace existing stencils in FY 05/06.<br>• Conducted a mercury thermometer exchange program<br>• Creation of Gateway Gardens which public information by show casing Integrated Pest Management, recycled water, and other stormwater and pollution management activities.<br>• Provided a pharmaceutical waste drop-off<br>• Conducted school outreach activities related to stormwater education<br>• Co-sponsored and promoted Coastal Clean-up Day, and Make a Difference Day<br>• Staffed STOPPP booth at San Mateo County Fair<br>• Sent direct mail letters to commercial property managers about catch basin cleaning of parking lots, corridors, etc.<br>• Demonstrated proper storm drain cleaning for Public Works Week<br>• Continued to supported and promote Household Hazardous Waste Programs<br>• Created an IPM demonstration garden<br>• Developed public outreach materials to accompany utility bills including materials on IPM, pet waste disposal, and street sweeping<br>• Contributed education messages and articles on stormwater for the Website/Fogcutter Newsletter<br>• Continued distribution of IPM, BMP, & Pollution Prevention Materials<br>• Participation in Bay Area Pollution Prevention Group |
| Watershed and Monitoring (WAM) | Countywide requirement / Regional effort | • Participation on WAM subcommittee<br>• Continued support and involvement in several regional activities through participation in WAM subcommittee including:<br>• Development of watershed assessment reports for watersheds throughout San Mateo County<br>• Development of plans to address specific pollutants of concern through San Mateo County<br>• Participation in Bay Area Stormwater Management Agencies Association (BASMAA) monitoring committee<br>• Participation in the San Francisco Estuary (SFE) Regional Monitoring Program<br>• Participation in the Clean Estuaries Partnership |

### 5.5.5 Recommendations for Ongoing BMP Implementation Related to Vista Grande Watershed Study

As part of the implementation of the long-term components in the Vista Grande Watershed Study, it is intended that Daly City will continue to implement BMPs and other activities incompliance with San Mateo Countywide SMP and NPDES permit. Ongoing implementation of BMPs by Daly City under the countywide NPDES will include those related to municipal maintenance, commercial/industrial/illicit discharge, new development and construction, integrated pest management and watersheds and monitoring.

As part of provision C.3 of the countywide NPDES permit, Daly City will continue to include conditions of approval in permits for applicable new development and redevelopment projects. The timing of C.3 provisions and projects to which they apply are summarized in Table 5-19.

**Table 5-19 Projects Affected by C.3 Provisions for the San Mateo Countywide NPDES permit.**

| Project Types | | Timing |
|---|---|---|
| Group 1 Projects | Commercial, industrial, or residential developments that create one acre (43,560 square feet) or more of impervious surface, including roof area, streets and sidewalks. | February 15, 2005 |
| | Streets, roads, highways, and freeways that are under the Dischargers' jurisdiction and that create one acre (43,560 square feet) or more of new impervious surface. | |
| | Significant Redevelopment projects defined as a projects on a previously developed site that results in addition or replacement, which combined total 43,560 $ft^2$ or more of impervious surface on such an already developed site | |
| Group 2 Projects | The Group 2 Project definition is in all ways the same as the Group 1 Project definition above, except that the size threshold of impervious area for new and Significant Redevelopment projects is reduced from one acre (43,560 $ft^2$) of impervious surface to 10,000 square feet. | August 15, 2006 |

The goal of the C.3 requirements is to address pollutant discharges and changes in runoff flows from new development and significant redevelopment projects, through implementation of post-construction and treatment measures, source control, and site design measures, to the maximum extent practicable. BMPs related to the C.3 provision in the countywide permit may include implementation of design characteristics to maximize infiltration where appropriate, providing landscape characteristics that slow runoff and maximize potential detention or retention, and minimization of impervious land cover.

In the Bay Area, small storms, such as those with the two-year recurrence interval, produce approximately eighty percent of the total annual rainfall (BASMAA, 1999) BMPs, which are not designed for flood protection but which address stormwater from these smaller storm events, can help manage water quality and quantity to address a large part of the overall stormwater produced by the Vista Grande watershed. As such, ongoing implementation of BMPs in compliance with the San Mateo Countywide Stormwater NPDES permit is an important component for long-term implementation of the Vista Grande Watershed Study.

# Chapter 6

# Implementation Strategies

# Chapter 6 Implementation Strategies

This chapter presents the steps that will be necessary to fully implement the Vista Grande Watershed Study. Implementation will depend on securing funding, developing a public outreach plan, complying with regulatory requirements, and establishing long term agreements between the involved parties. Strategies and procedures for addressing each of these issues are discussed in the following chapter. The chapter continues with a discussion of the program phasing, the overall implementation schedule and recommendations for the next steps in making the Vista Grande Watershed Study a reality.

## 6.1 Funding Strategies

Implementation of the Vista Grande Watershed Study's preliminary program recommendations is dependent on the availability of sufficient funding. Financing a project of this magnitude requires a well planned strategy for acquiring funds from a variety of sources. Innovative local financing techniques combined with State and Federal funding opportunities will generate the support necessary to make these preliminary program recommendations a reality.

### 6.1.1 Local Financing Options

This section reviews various financing options available to the District for the long-term preliminary program components in the Vista Grande Watershed Study. Because of the unique nature of stormwater projects and relevant California law, potential revenue sources are restricted, and must be approved by voters. However, once a revenue source has been secured, it can be used to borrow funds through a debt issuance that can then be used to finance the projects. In addition, ongoing revenue streams are available for pay-as-you-go improvements on a continuing basis, as well as operating and maintenance expenses. The summary and general approach for each of the long-term components of the Vista Grande Watershed Study is below.

Tunnel South of County Line: The Tunnel South of County Line is the most critical component from a project sequencing perspective. In addition, the project must be funded at one time, as phasing of construction costs is not a realistic option. Potential funding options include debt financing and/or state or Federal appropriations or grants. Debt financing would require an identified, steady revenue stream, such as service charges or parcel charges.

Storm Drain Improvements: These improvements are most appropriately funded using a pay-as-you-go financing strategy. Revenues to fund these improvements may be funded from sewer service charges and/or a new drainage service charge.

Vista Grande Wetland: The construction of wetlands at the Vista Grande canal will improve water quality in Lake Merced and increase water input into the lake. As such, CCSF would likely take the lead in financing this component of the study. Additionally, because of the enhancement benefits of this project, there would likely be opportunities for grant funding to help cover the costs of the Vista Grande Wetland. State and Federal grant opportunities are discussed in Section 6.1.2.

#### Financing Alternatives

Financing alternatives must consider both sources of capital and sources of revenue, as discussed below.

***Sources of Capital***

Capital may be generated in a lump sum for the Tunnel South of County Line component of the preliminary program through one of three debt issuance strategies: General Obligation (GO) bonds, Joint Powers Authority (JPA) revenue bonds, or Certificates of Participation (COPs).

GO Bonds: Many flood control agencies have used GO bonds to finance capital projects. Authorization of such bonds requires two-thirds voter approval. The approving vote also authorizes the use of property taxes to repay the bonds – this makes GO bonds the only debt financing instrument that creates a source of revenue and a source of capital at once. Property taxes are collected proportionate to assessed value.

JPA Bonds: NSMCSD could form a Joint Powers Authority with the City of Daly City or another agency, which would then be able to issue revenue bonds solely by Board action. However, JPA bonds are not an option unless a source of revenue has previously been established to support debt service.

COPs: Certificates of participation are revenue-supported debt instruments, differing from traditional revenue bonds only in name and legal structure. NSMCSD could issue COPs solely by Board action, similar to JPA revenue bonds. Like JPA bonds, COPs also need a previously established revenue source to support the debt service on the COPs.

***Sources of Revenue***

Revenue sources for storm water projects are limited. Aside from GO bonds, which create their own property tax revenue stream, service charges are the only practical source of revenue. Service charge revenues could come from either Board-approved increases to sewer service charges or voter-approved storm water charge, or to some extent based on benefit, sewer service charges. Service charge revenues can be used to support debt financings, contribute to pay-as-you-go capital expenditures, and pay for ongoing operations and maintenance expenses.

Sewer service charges: Sewer service charges can be used to support the components of the preliminary program to the extent to which they are sewer-related. Where a portion of capital or O&M expenses for a project component can reasonably be described as providing benefit to the District's sewer customers, that portion of costs can be allocated to sewer service charges and revenues collected. This would include a portion of debt service on a debt issuance providing shared sewer-storm water benefits, and ongoing O&M expenses. However, costs for projects exceeding the benefit provided to sewer customers may not be recovered through sewer service charges, limiting the amount of revenue generated for storm water-related projects through this revenue source.

Drainage service charges: The Vista Grande drainage area currently does not have any drainage service charges. However, the provisions of Proposition 218 (now Articles 13 C and 13 D of the California Constitution) outline a procedure to implement such a charge with voter approval. It may fund both capital improvements and O&M and requires a rate structure study showing that costs of service are proportional to charges.

To approve a charge, the County would prepare an Engineer's Report and mail a notice to all property owners stating the amount of the proposed fee, the basis for calculating the fee, and information regarding a public hearing on the proposed fee. The public hearing must be held not less than 45 days from the date the notices were mailed. If the County receives written protests from a majority of property owners, the County is precluded from proceeding further. If no majority protest occurs, then the County may proceed with a ballot measure not earlier than 45 days from the public hearing. A mailed ballot to all property owners would require an affirmative vote (50% +1) to authorize new charges.

### 6.1.2 State and Federal Funding Opportunities

The preliminary program recommendations of the Vista Grande Watershed Study integrate several water management elements, including flood protection, stormwater management, water quality and treatment, wetlands creation, and habitat creation. As a result, these preliminary program recommendations would potentially be eligible for funding through a variety of State and Federal funding mechanisms. Potential funding sources are presented in Table 6-1. Additional discussion of each of these potential vehicles is provided below.

**Table 6-1 Potential Funding Sources**

| Funding Program | Description | Administration | Program Funding Available | Project Limit |
|---|---|---|---|---|
| Proposition 40 | Nonpoint Source Pollution Control Program | SWRCB | Up to $19 million | $5 million |
| Proposition 40 | Urban Stormwater Grant Program | SWRCB | Up to $14.25 million | $1 million |
| Proposition 50 | Coastal Nonpoint Source Pollution Control Program | SWRCB | Up to $43.1 million | $5 million |
| Federal Clean Water Act Section 319(h) | Nonpoint Source Implementation Program | SWRCB | $4.5 - $5.5 million/year | $1 million |
| Water Resources Development Act (WRDA) | Water Resources funding through Army Corps of Engineers | Federal | Variable | |

## Proposition 40

A variety of grant programs are currently being offered, and will continue to be offered in coming years, through Proposition 40 (Prop 40), the California Clean Water, Clean Air, Safe Neighborhood Parks, and Coastal Protection Act of 2002. Prop 40 resulted in $2.6 billion in State funds dedicated to water quality, air quality, open space, wildlife, and State and neighborhood parks. Grant programs funded by Prop 40, for which the preliminary program recommendations of the Vista Grande Watershed Study may be eligible, are described below.

### *Nonpoint Source Pollution Control Program*

The Nonpoint Source Pollution Control Program is a new funding program being administered by the State Water Resources Control Board (SWRCB). Specific requirements for the program are currently under development. However, the program will provide up to $19 million in funding to local public agencies and nonprofit organizations for projects that protect the beneficial uses of water throughout the State through control of nonpoint source pollution. It is expected that projects will be eligible for up to $5 million in funding. Funds awarded through this program must be spent prior to December 31, 2008.

The preliminary program recommendations of the Vista Grande Watershed Study will control nonpoint source pollution by resolving flooding issues and through ongoing implementation of BMPs in accordance with the San Mateo Countywide NPDES permit. Further, the preliminary program protects the beneficial uses of Lake Merced by eliminating water quality impacts to the Lake Merced resulting from nonpoint source pollution.

### *Urban Stormwater Grant Program*

Like the Nonpoint Source Pollution Control Program, the Urban Stormwater Grant Program is a new funding program being administered by the SWRCB, and specific requirements for the program are currently under development. The program is intended to provide funding assistance to plan and implement urban pollution runoff controls. Up to $14.25 million in funds, with a $1 million limit per project, will be available to local public agencies for projects to implement stormwater runoff pollution reduction and prevention programs such as diversion of dry weather flows to publicly owned treatment works for treatment, acquisition and development of constructed wetlands and the implementation of

approved best management practices, as required by stormwater permits. Funds awarded through this program must be spent prior to December 31, 2008.

The preliminary program recommendations of the Vista Grande Watershed Study are expected to be eligible for funding through this program due to its focus on urban stormwater management. The details of the grant program specifically identify constructed treatment wetlands and associated land acquisition (made possible through tunnel completion) as projects eligible for funding. Furthermore, the wetland will treat dry weather flows, another action identified in the grant.

## Proposition 50

Proposition 50 (Prop 50) authorized $3.44 billion in general obligation bonds to fund water projects including water use efficiency project, Colorado River water use projects, protection of coastal wetlands near urban areas, water management and quality improvements, river parkways, water system security, and desalination. The preliminary program recommendations of the Vista Grande Watershed Study are expected to be eligible for the Coastal Nonpoint Source Pollution Control Program funded by Prop 50. This program is described in further detail below.

### *Coastal Nonpoint Source Pollution Control Program*

The Coastal Nonpoint Source Pollution Control Program is a new Prop 50 funding program being administered by the SWRCB. The program is expected to make up to $43.1 million available for funding projects that will restore and protect water quality and the environment of coastal waters, estuaries, bays, nearshore waters, and groundwater. Projects will be eligible for up to $5 million in funding. Funding awarded through this program must be spent prior to June of 2010.

Because it is expected to reduce pollution, protect surface water and groundwater quality, and create wetlands in a coastal area, the preliminary program recommendations of the Vista Grande Watershed Study may be eligible for funding through this program.

## Federal Clean Water Act Section 319(h)

The Federal Clean Water Act Section 319(h) program is an annual federally funded program that is intended to control activities impairing beneficial uses and limit pollutants caused by those activities. Details of this the Nonpoint Source Implementation Program are provided below.

### *Nonpoint Source Implementation Program*

As part of Section 319 of the Federal Clean Water Act legislation, states are required to establish and prioritize lists of impaired waters and develop Total Maximum Daily Loads (TMDLs) to improve water quality in impaired waters.

Approximately $4.5 to $5.5 million is made available each year through the Nonpoint Source Implementation Program for projects that implement measures to reduce nonpoint source pollution to surface and groundwater, with a $1 million limit per project. This program will give preference to projects addressing TMDL implementation and problems in impaired waters. In addition, projects focused on management activities intended to reduce or prevent pollution leading to impairment of surface and ground waters are given preference in the selection process.

The preliminary program recommendations of the Vista Grande Watershed Study are expected to be eligible for funding through this program, as it is intended to reduce nonpoint source pollution affecting surface and groundwater quality through flood prevention and stormwater management. Further, Lake Merced is currently listed as an impaired waterbody for dissolved oxygen and pH. As such, the preliminary program recommendations address program preferences by reducing pollution to the impaired Lake Merced.

## Water Resources Development Act

The Water Resources Development Act (WRDA) is a U.S. Army Corps of Engineers (Corps) "omnibus" bill, generally enacted every two years. WRDA legislation provides the Corps with authority and funding to study water resources problems and construct solutions. Project proponents nationwide frequently partner with the Corps to have projects written in to new WRDA legislation.

To obtain funding through the WRDA, the project would need to first partner with the San Francisco District U.S. Army Corps of Engineers. To receive funding, the project would require support from State senators and legislators, who would lobby to have the project included in future WRDA legislation.

## State and Federal Legislators

Communication and support from State and Federal legislators will be essential to acquire funding through these programs. The current representatives for Daly City and San Francisco are listed in Table 6-2.

**Table 6-2 State and Federal Legislators**

**Daly City**

| | |
|---|---|
| California State Assembly | |
| Assemblyman Leland Yee | 12th Assembly District |
| Assemblyman Gene Mullin | 19th Assembly District |
| California Senate | |
| Senator Jackie Speier | District 8 |
| US House of Representatives | |
| Congressman Tom Lantos | District 12 |
| US Senate | |
| Senator Dianne Feinstein | California |
| Senator Barbara Boxer | California |

**San Francisco**

| | |
|---|---|
| California State Assembly | |
| Assemblymember Mark Leno | 13th Assembly District. |
| Assemblymember Leland Yee, PhD | 12th Assembly District. |
| California Senate | |
| Senator Carole V. Migden | District 3 |
| Senator Jackie Speier | District 8 |
| US House of Representatives | |
| Congresswoman Nancy Pelosi | District 8 |
| Congressman Tom Lantos | District 12 |
| US Senate | |
| Senator Dianne Feinstein | California |
| Senator Barbara Boxer | California |

## 6.2 Public Outreach and Community Involvement

The education and involvement of the community is essential to the successful implementation of the preliminary program laid out in the Vista Grande Watershed Study. The magnitude of the preliminary program and the complex relationships involved have the potential to generate concern among the community. A successful outreach strategy will dispel myths, develop understanding, and help generate public understanding and support for the program.

Many of the regulatory requirements for this program will involve public notification processes. However, these requirements will not fulfill the need for a comprehensive public outreach plan. A successful public outreach plan involves active measures to educate and involve the public. Recognizing and addressing public concern lays the foundation for creating consensus among the interested parties. Effective public outreach requires a well developed, cohesive approach; ad hoc, sporadic actions are unlikely to result in the desired public understanding and support.

A key component in developing a comprehensive outreach strategy will be to appoint a public outreach coordinator to oversee the development and implementation of a public outreach plan specific to the Vista Grande Watershed Program. The coordinator will ensure that the plan covers all program components and promotes the appropriate message to the public.

The steps involved in developing an effective, executable public outreach plan involve defining the goals and objectives of the plan, learning about community interests and concerns, preparing and distributing a unified message for outreach efforts, and forming a process to evaluate the value of different outreach approaches (US Environmental Protection Agency (EPA), 2003). These steps are described in more detail as follows.

A public outreach plan must establish clear, specific goals for public outreach and community involvement. This requires developing an understanding of the driving forces and interested stakeholder groups within the project area. Once the key issues are identifies, a goal and specific objectives can be developed to address those issues. In the Vista Grande watershed, many of the key stakeholder issues and agencies have already been identified and many of the issues addressed by the proposed project have already been identified. However, further investigation will ensure that the public outreach plan addresses all of the community's concerns.

Once the goals and objectives have been defined, a message to achieve project objectives must be established. For the Vista Grande Watershed Study, the message should be designed to raise general awareness about the proposed program, the problems it addresses, and how they benefit the surrounding community. The plan should then develop methods to package and distribute this message. Websites, newsletters, advertisements and special events could all be good methods for communicating the message to the public.

The last step in developing a public outreach plan should be to establish a method to evaluate the effectiveness of the plan. A public outreach plan must be able to evolve as additional issues arise or if the stakeholders involved change. Since the Vista Grande Watershed Study presents a long-term solution, public concern may shift as the program is developed and implemented. An established process to evaluate the plan and revise it if it is falling short of its goals will increase its long-term effectiveness (EPA, 2003).

The Vista Grande Watershed Study involves a wide range of stakeholders, each with their own interests and concerns. If these stakeholders are not informed and involved in the program, oppositions to the program could develop. Any organized opposition will significantly slow project planning, permitting and implementation. Public support is necessary for the program's overall success. Developing and implementing a well thought out strategy to educate and involve the public will improve support for the project, ease project financing, and increase the efficiency of the implementation process.

## 6.3 Regulatory Requirements

Regulatory compliance is essential for the success of the Vista Grande Watershed Study. While navigating the permitting process can be complicated and cumbersome, developing a strong understanding of the requirements of each agency early in the project will streamline the permitting process and prevent delays in the implementation of the Watershed Study. This section provides an overview of the local, State and Federal agencies that have jurisdiction over the preliminary program components, the required permits or agreements, an overview of the application process, and recommendations for maximizing efficiency throughout the regulatory process (Peterson, 2005; Weintraub and Anderson, 2005).

### 6.3.1 Local permits

Before the long-term components in the Vista Grande Watershed Study can be implemented, they must comply with the requirements of Daly City, the CCSF, and San Mateo County. Each city has jurisdiction over project components within their city boundaries. Since this project is sponsored by the cities involved, it is expected that they will provide guidance in complying with all applicable permitting requirements.

In addition to building and planning permit considerations, it is important to evaluate any potential public health risks. Consulting with representatives from San Mateo County Department of Public Health and the CCSF Department of Public Health established that the recommended project components would not be expected to present a public health hazard that would require a permit from these agencies. However, both agencies will be involved throughout the planning process to ensure that proper precautions are taken to minimize risks.

### 6.3.2 State and Federal Permits

Several aspects of the preliminary program will trigger both State and Federal involvement in the project. The key agencies involved in the permitting process are as follows.

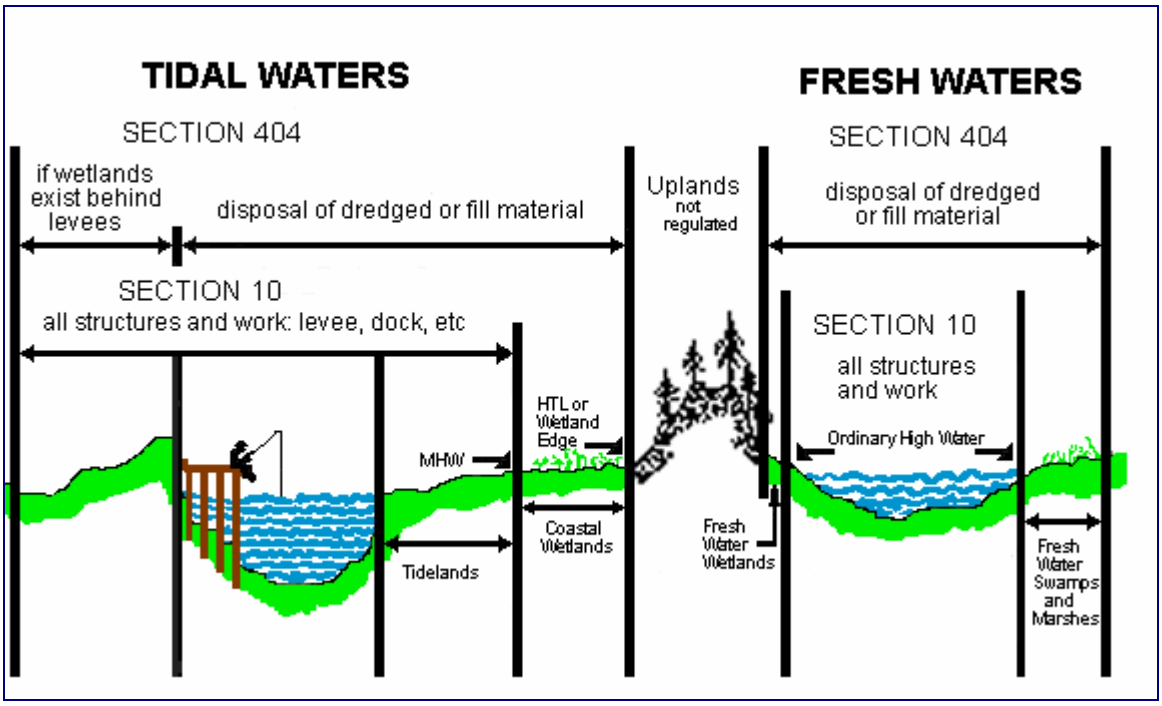
#### U.S. Army Corps of Engineers (Corps)

In its regulatory capacity, the Corps strives to “protect the Nation’s aquatic resources, while allowing reasonable development through fair, flexible, and balanced permit decisions” (Corps, 2005). The Corps derives its primary regulatory authority from two Federal laws: the Federal Clean Water Act and the River and Harbors Act. Under these two Acts, the Corps regulates activities that impact the “waters of the United States”. §404 of the Federal Clean Water regulates any activity where dredged or fill material is intentionally or unintentionally discharged into any “waters of the United States”, including wetlands adjacent to “waters of the United States”. §10 of the Rivers and Harbors Act applies to any activity that may alter or obstruct “navigable waters”. Since all “navigable waters” are part of the “waters of the United States”, an activity within these areas may require both §404 and §10 permits. It will be important to consider the Corps’s jurisdiction under both Acts when pursuing permits from the Corps to ensure all of the necessary approvals are obtained.

***Jurisdiction under the Federal Clean Water and the Rivers and Harbors Act***

The jurisdiction of the Corps within and around these regulated waters is delineated based on historical water levels at the given water body. The Corps’s jurisdiction is illustrated in Figure 6-1. For non-tidal waters, the Corps’s jurisdiction begins at the ordinary high water mark for both §404 and §10. However, for tidal waters, the Corps’s §404 jurisdiction begins at the mean higher high water level (the long-term average of the higher of the two daily high tides) whereas its §10 jurisdiction begins at the mean high water level (the long-term average of all high tides). Since the mean high water level is lower than the mean higher high water mark, the Corps’s §10 jurisdiction is completely contained within its §404 jurisdiction for tidal waters.

**Figure 6-1 Regulatory Jurisdiction of the U.S. Army Corps of Engineers (CERES, 2002)**




***Jurisdiction over the Preliminary Program Components***

The upstream components of the watershed study are not expected to fall under the Corps's jurisdiction since they will not impact any "waters of the United States". However, the Tunnel South of County Line and the Vista Grande Wetland involve work in and around the Pacific Ocean, Lake Merced, and the wetlands surrounding Lake Merced, which are all "waters of the United States". These two downstream program components will also impact and modify the Vista Grande canal, which may be considered part of the "waters of the United States". As a result, both the Tunnel South of County Line and the Vista Grande Wetland may require permits from the Corps.

The Vista Grande canal is an artificial water channel that was constructed specifically to convey stormwater to the Vista Grande tunnel. It is essentially just a surface feature of the storm drain system. However, it could be deemed part of the "waters of the United States" if it intercepts, or ever intercepted, flow from a natural channel. Therefore, a jurisdictional determination will be necessary to clarify whether the Corps has jurisdiction over the canal.

If the jurisdictional determination establishes that the Vista Grande canal is part of the "waters of the United States" the Vista Grande Wetland will require a §404 permit. The wetland may also require a permit if a cascade for water being conveyed from the wetland to Lake Merced is installed on the banks of Lake Merced. However, this portion of the wetland could be designed to avoid Corps involvement by placing the cascade above the ordinary high water mark and avoiding any natural wetland areas surrounding Lake Merced. The banks of Lake Merced near the project area should be included in the jurisdictional determination to establish the exact locations of regulated wetlands so that impacts to wetlands can be avoided or addressed in the permit.

The Tunnel South of County Line will also likely fall within the jurisdiction of the Corps. Although neither of the proposed inlets for the Tunnel South of County Line will likely trigger Corps involvement, the beach outlet structure may fall within the Corps jurisdiction. Depending on the exact elevation of mean high water level and the mean higher high water level at the outlet location, the outlet structure may

fall within both the Corps's §404 and its §10 jurisdiction. Including the outfall area in the jurisdictional determination would clarify the jurisdiction of the Corps over the beach outlet structure.

***Permitting Process for §404 and §10 Permits***

The necessary permits can be secured from the Corps in two ways: a nationwide permit or an individual permit. Nationwide permits are generally faster and easier to obtain, but they only apply to specific activities as laid out in the permit (San Francisco Bay Area Joint Aquatic Resource Permit Application (JARPA), 2004).

The preliminary program components may be able to be permitted under Nationwide Permit #43 Stormwater Management Permit. This permit covers projects that discharge into non-tidal waters and do not impact more than 300 linear feet of streambed. However, it excludes wetlands that are adjacent to tidal waters. If the Vista Grande canal is deemed part of the "waters of the United States" the Vista Grande Wetland would not be eligible for this permit since it will impact more than 300 linear feet of the canal.

If an individual permit is required, a lengthier permit processing time will be necessary since this type of permit requires the preparation of a Public Notice and a 30 day period for public comment.

Either type of permit will require the submittal of a maintenance plan, a jurisdictional determination, and an alternatives analysis. In addition, the Corps will be required to comply with the National Environmental Policy Act (NEPA) prior to issuing permitting approvals. Thus, the appropriate NEPA documentation must be prepared to obtain the appropriate approvals from the Corps (JARPA, 2004).

During the permit review process, the Corps consults with the US EPA, US Fish and Wildlife Service (USFWS), and the National Oceanic & Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) to ensure all environmental impacts and regulations are considered (CERES, 2005).

## US Fish and Wildlife Service and the National Marine Fisheries Service

The mission of the USFWS is to "protect and enhance fish and wildlife, and their habitats, throughout the nation" (JARPA, 2004). Similarly, the NMFS's mission is to "conserve living marine resources while managing their use for the greatest benefit to the nation" (JARPA, 2004). USFWS focuses on the effects of projects on all non-marine fish and wildlife resources. NMFS has the primary responsibility for protecting marine mammals and marine, estuarine and anadramous fish and shellfish. Together, the USFWS and the NMFS administer the Federal Endangered Species Act. These agencies will need to be consulted if the project is thought to have an impact on any listed threatened or endangered species.

Under the Federal Endangered Species Act, permission from USFWS and/or NMFS is required prior to "taking" any endangered species or its habitat. This permission can be obtained in two ways: a permit under §10 of the Federal Endangered Species Act or a consultation under §7 of the Federal Endangered Species Act. A §10 permit is required only when there is no other Federal involvement in the project. Otherwise, a §7 consultation is generally completed as part of the permitting process for the Corps or another involved Federal agency.

Since the preliminary program recommendations of Vista Grande Watershed Study are expected to require a permit under the Corps, the requirements of the Endangered Species Act can be met through a §7 consultation with USFWS and/or NMFS. If the Corps determines that a §7 consultation is necessary, the USFWS and/or NMFS will be asked to write a biological opinion for the project.

Further investigation will be required to determine if endangered species are likely to be affected by the preliminary program recommendations. The area around Lake Merced and the coastal region surrounding the proposed beach outlet structure may provide habitat for endangered species. Even if the presence of

endangered species is not known, appropriate habitat for an endangered species, even without confirmation of the presence of that species, can be considered cause for further investigation.

In addition, many of the regions of the Pacific Ocean along the California coast are protected as parts of the NOAA's National Marine Sanctuaries. Activities within a national marine sanctuary are limited by the National Marine Sanctuaries Act and site-specific legislation and regulations. They are regulated by NMFS. The Gulf of the Farallones and the Monterey Bay National Marine Sanctuaries protect a large portion of the ocean along the coast of the San Francisco Peninsula and Marin. The coast and ocean directly offshore from the San Francisco/San Mateo County line currently falls outside of either marine sanctuary. However, the boundaries of the marine sanctuaries are subject to revision and may change during the implementation of the preliminary program. It will be important to track any changes in the sanctuary, since they may influence the permitting requirements for tunnel construction and the proposed outlet structure.

### San Francisco Bay Area Regional Water Quality Control Board

The mission of the SWRCB is to "preserve, enhance and restore the quality of California's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations" (SWRCB, 2005). The RWQCBs conduct the planning, permitting and enforcement activities to meet that mission. The activities for this watershed study lie within the jurisdiction of the RWQCB.

The RWQCB issues three primary types of permit: §401 water quality certifications, NPDES permits, and waste discharge requirements. Under §401 of the Federal Clean Water Act, any activity that is subject to a permit from a Federal agency must be certified by the appropriate State that the activity also meets all State water quality standards. In California, the RWQCB is responsible for issuing these certifications. A §401 certification may be required for both the tunnel and the wetland projects since both may require a permit from the Corps, a Federal agency. Prior to issuing a §401 certification the RWQCB must review a final environmental document prepared under the California Environmental Quality Act (CEQA).

In addition, the RWQCB, with the support of the US EPA, is responsible for granting Clean Water Act NPDES permits. Stormwater runoff in Daly City is currently regulated under the San Mateo countywide municipal NPDES permit. This permit will continue to cover discharges to the storm drain system to the new tunnel. The RWQCB also issues General Construction Activity Stormwater Permits under the NPDES program. These permits are required for any construction activity that disturbs more than one acre of land, or for programs where the project components disturb fewer than five acres of land but more than five acres are disturbed throughout the program. The general permit requires the site owner to notify the State, to prepare and implement a Stormwater Pollution Prevention Plan, and to monitor the effectiveness of the plan. The clearing, excavation, and grading required for the wetland and the tunnel inlet structure will require this permit for any stormwater discharges occurring from the construction of these preliminary program components.

Finally, the RWQCB regulates the discharge of waste that could affect the quality of the waters of the State under the authority of the California Porter-Cologne Water Quality Control Act. The RWQCB issues Waste Discharge Requirements (WDRs) for any activity that generates dredged material, fill or any other discharge that may directly or indirectly impact the "waters of the State". The "waters of the State" are defined more broadly than the "waters of the United States" and include any surface water or groundwater within the boundaries of the State. Generally, any action requiring a §401 Water Quality Certification is exempt from waste discharge requirements. Therefore, if a Corps jurisdictional delineation determines that the Vista Grande canal is part of the "waters of the United States" then a §401certification would be required, however if the canal is not determined to be part of the "waters of the United States", a WDR would need to be obtained from the RWQCB.

## California Department of Fish and Game

The California Department of Fish and Game (CDFG) protects California's fish, wildlife and plant species and their habitat to maximize their ecological value and their value for human enjoyment. Under the Fish and Game Code §1602, any person, State or local government agency, or public utility is required to provide official notification to CDFG before undertaking any activity that will significantly change any river, stream, or lake. This notification is the first step in the process to obtain a Streambed Alteration Agreement, which is required to conduct the proposed work. Modifications subject to this type of agreement include diverting or obstructing flow, changing the streambed, channel or bank, or using material from a streambed for any purpose. Unlike with the permitting requirements for the Corps, any waterway within California, natural or constructed, is part of the jurisdiction of the CDFG.

Because the Vista Grande Wetland will fill the Vista Grande canal and may involve some work on the banks of Lake Merced for installing the cascade at the wetland outlet, the wetland will require a §1602 permit under CDFG. In addition, a permit from ongoing maintenance to remove accumulated sediment will be required. The maintenance permit can be incorporated as part of the Streambed Alteration Agreement and can be issued for periods up to five years at a time. The tunnel and upstream improvements are not expected to require a permit from CDFG.

Prior to issuing a Streambed Alteration Agreement, a final environmental document under CEQA must be submitted. Official documentation from CDFG indicates that a permit application can be submitted and approved but that the final permit will be held until the CEQA documentation is finalized. However, consultation with a representative from CDFG indicated that generally an application is not considered complete until it is CEQA compliant (Grefsrud, 2005). As such, ongoing communication with CDFG will be necessary to ensure that the permitting process goes smoothly.

## California Coastal Commission

The California Coastal Act of 1976 established the California Coastal Commission (CCC) to "protect, conserve, restore, and enhance environmental and human-based resources of the California coast and ocean for environmentally sustainable and prudent use by current and future generations." In addition, the CCC and the Bay Conservation and Development Commission (BCDC)[1] are the two management agencies responsible for administering the Federal Coastal Zone Management Act in California (CCC, 2005). The CCC requires a Coastal Development Permit for any development occurring in the coastal zone. The coastal zone is delineated by official maps available from the CCC and generally includes areas extending from the shoreline inland for anywhere from 500 yards to five miles. The coastal zone around the preliminary program area of the Vista Grande Watershed Study includes the area along the coast and extends inland surrounding Lake Merced. The tunnel outlet structure, the inlet for the John Muir Drive site tunnel alignment, and the wetland all fall within the coastal zone.

The administrative structure of the CCC creates unique connections between State and local governments. The California Coastal Act authorized the creation of local coastal programs (LCP) to help carry out the requirements of the Act. The CCC maintains jurisdiction over development on the immediate shoreline, but the local coastal programs issue coastal development permits for projects that fall within their jurisdiction. If more than one LCP has jurisdiction over a project area, permits must be secured from each one. Daly City, CCSF, and the County of San Mateo all have established Local Coastal Programs. Since the tunnel and the wetland both fall within the coastal zone, permits will be required from Daly City's LCP, CCSF's LCP, and the CCC. A permit may be required from the County of San Mateo's LCP, depending on the alignment of the tunnel relative to the County's jurisdiction.

[1] The Vista Grande Watershed Study program area falls outside of the jurisdiction of the BCDC, which regulates all activities in the San Francisco Bay and up to 100 feet inland of the areas along the bay's shoreline that are subject to tidal action.

For large planning projects, the appropriate permit can be acquired directly from the Coastal Commission through the development of a "Public Works Plan" as authorized by §30605 of the Coastal Act. A "Public Works Plan" is reviewed by the CCC in the same way that a Local Coastal Program is reviewed. The Public Works Plan is certified with the local coastal programs but is issued directly from the CCC. A Public Works Plan allows the program to be approved as a whole and avoids the need for individual permits from each program component from each LCP. This approach may require more preparatory work but would provide a permit for the entire project, would reduce the number of regulatory entities involve, and make the permitting process more efficient.

In addition to issuing Coastal Development Permits, the CCC reviews the §404 permit applications for the Corps and documents prepared under CEQA or NEPA.

### Golden Gate National Recreation Area

The Golden Gate National Recreation Area (GGNRA), as part of the National Park Service (NPS), strives to preserve natural resources for the enjoyment of current and future generations. The GGNRA area extends from Tomales Bay in Marin County along the shore all the way to San Mateo County encompassing 59 miles of bay and ocean shoreline and covers 75,398 acres of land and water. The tunnel outlet structure and two of the proposed tunnel alignments are located on or beneath GGNRA land.

Consultation with representatives from GGNRA indicated that their primary concerns include the water quality, aesthetic, and beach access impacts of the tunnel outlet structure (Ortega, et al., 2005). In addition they are concerned about the impacts to the park as a result of construction activities. Approval of this type of project by the NPS may be challenging. The project will require approval of a permanent easement for the tunnel components and temporary access for construction purposes. Both of these actions fall under the category of "Special Park Uses" which are described in the NPS Management Policies and in Director's Order #53: Special Park Uses (NPS, 2000; NPS, 2001). Construction activities will require a Special Use Permit. According to Director's Order #53, a Special Use Permit can only be issued if the proposed activity will not:

- Cause injury or damage to park resources.
- Be contrary to the purposes for which the park was established.
- Unreasonably impair the atmosphere of peace and tranquility maintained in wilderness, natural, historic or commemorative locations within the park.
- Unreasonably interfere with the interpretive, visitor service, or other program activities, or with the administrative activities of the NPS.
- Substantially impair the operation of public facilities or services of NPS concessioners or contractors.
- Present a clear and present danger to public health and safety.
- Result in significant conflict with other existing uses.

A Special Use Permit can be issued for a period up to, but no longer than, five years. For longer-term projects, such as the permanent installation of the tunnel, a right-of-way permit must be obtained. NPS issues right-of-way agreements for utilities to pass over, under or through NPS property. According to the NPS Management Policies a right-of-way may be issued "only if there is no practicable alternative to such use of NPS lands." It is considered a temporary agreement and does not transfer any interest in the land itself. The fees associated with this type of agreement may be high and the NPS pays special attention to recovering the fair market value for the use of their land.

Since NPS is a Federal Agency, it is required to comply with the National Environmental Policy Act (NEPA). Thus, the appropriate NEPA documentation would be required to obtain these permits.

## California State Parks

The California Department of Parks and Recreation (California State Parks) manages more than 270 park units, which contain the finest and most diverse collection of natural, cultural, and recreational resources to be found within California. Their mission is to "provide for the health, inspiration and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation".

Thornton State Beach in Daly City is part of the California State Parks system. If the final alignment of the Tunnel South of County Line terminates at Thornton State Beach, and easement from California State Parks would be required for the tunnel and the beach outlet structure. This easement could be granted under §5012 of the California Public Resource Code.

Obtaining the appropriate easements and right-of-way permits is may be challenging since granting this type of access is generally disfavored by California State Parks. In order to obtain these approvals a detailed assessment of potential impacts or concerns would need to be conducted and mitigation for these impacts incorporated into the final project design. Specific concerns of California State Parks include adverse impacts to the public's use and enjoyment of the area, adverse visual impacts of the outlet structure, short and long-term impacts to the natural beach and near-shore environment, coastal bluff impacts and water quality concerns.

In addition, California State Parks would require that the project satisfy all GGNRA requirements, since Thornton State Beach may be the subject of a future land transfer between California State Parks and GGNRA.

## California Department of Transportation

A California Department of Transportation (Caltrans) encroachment permit is required for any project that occurs within, under, or over a State highway right-of-way (Caltrans, 2002). Both of the proposed tunnel alignments pass under State Highway 35 so this permit will need to be secured.

## California State Lands Commission

The State acquired sovereign ownership of all tidelands and submerged lands and beds of navigable waterways upon its admission to the United States in 1850. Generally, these sovereign lands include all ungranted tidelands and submerged lands and the beds of navigable rivers, streams, lakes, bays, estuaries, inlets, and straits. In coastal areas, sovereign lands include both tidelands and submerged lands from the shore to three miles in the Pacific Ocean. Tidelands lie between mean high tide and mean low tide, and submerged lands are below mean low tide. The State holds these lands for the benefit of all the people of the State for statewide Public Trust purposes which include waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. The landward boundaries of the State's sovereign interests are generally based upon the extent and location of the subject waterways as they last naturally existed, prior to artificial influences. The California State Lands Commission's authority is defined in the Public Resources Code - Division 6 Public Lands.

A California State Lands Commission land use lease is required for any project "in State-owned areas waterward of the ordinary high water mark as it last existed naturally, before artificial influences, in waterways that are subject to tidal action, or the ordinary low-water mark before artificial influences, in water ways that are not subject to tidal action (California Association of Resource Conservation Districts (CARCD), 2002)". Depending on the placement of the tunnel outlet structure and the final design of the Vista Grande Wetland, a State Lands Commission General Lease – Right-of-Way may be required for one or both of these alternatives. Further investigation is necessary to make this determination. The processing time for this type of lease ranges from one to three years.

### Additional Permitting Requirements

The above descriptions list the primary agencies that will have regulatory influence on the preliminary program components of the Vista Grande Watershed Study. However, further investigation should be conducted during the implementation phase of the Watershed Study to ensure that all permitting requirements are met. Special attention should be given to Executive Order 11990 Protection of Wetlands.

Executive Order 11990 covers any project that is located on Federal land, sponsored by a Federal agency or receiving Federal funding that may affect wetlands. It requires that Federal agencies avoid initiating or assisting projects that involve construction in wetlands unless there is no practicable alternative to the construction and that steps to minimize harm to wetlands are taken.

## 6.3.3 Environmental Documentation

The permitting requirements for the Vista Grande Watershed Study dictate that environmental documentation under both NEPA and CEQA are expected to be required. The required documentation for NEPA and CEQA can be prepared jointly.

### National Environmental Policy Act (NEPA)

NEPA requires Federal agencies to evaluate the impacts of their actions and decisions on the “human environment”. It was established in 1969 in response to public concern over environmental degradation. Its goal is to encourage Federal agencies consider the environment in their decisions and ensure that any environmental impacts resulting from those decisions are disclosed to the public. Compliance with NEPA will likely be required for the proposed tunnel and wetland, since the Corps or GGNRA, both Federal agencies, are expected to have jurisdiction over these preliminary program components

The first step in the NEPA process is to identify whether the proposed action is subject to NEPA requirements. If the proposed action qualifies for a categorical exclusion, the project will not require further NEPA actions. If no categorical exclusion or other exemption applies, an Environmental Assessment (EA) must be prepared. The Environmental Assessment evaluates the impact from the proposed project and determines if it will significantly affect the quality of the environment. If the project has no impacts, or if the impacts are very minor, a Finding of No Significant Impact (FONSI) can be issued and the NEPA process is complete. If there are significant impacts that can be mitigated to less than significant levels by redesigning the proposed project, a Mitigated FONSI can be filed. Otherwise, an Environmental Impact Statement (EIS) must be prepared. While investigation through the NEPA process is necessary to determine what level of documentation will be required, the Vista Grande Watershed Study will likely require the development of a full EIS. The NEPA lead agency is expected to be the Corps with other involved agencies participating as either co-lead agencies or cooperating agencies.

### California Environmental Quality Act (CEQA)

Protecting and enhancing the environment in California is the primary purpose of CEQA. It further seeks to help public agencies identify the environmental impacts of their actions and avoid or mitigate those impacts whenever possible. All public agencies are required to comply with CEQA. For projects where there are multiple agencies involved, as with those described in the Vista Grande Watershed Study, CEQA requires that a lead agency be selected.

Under CEQA the lead agency must complete an environmental review process that documents the impacts of the proposed project, analyzes alternatives to the project and proposes mitigation measures for any “significant” impacts. The environmental review process includes three basic steps. First, the agency must determine if the proposed project is subject to the requirements of CEQA and if any categorical or statutory exemptions apply. If an exemption applies, no further CEQA analysis is required. Otherwise, the agency performs an initial study to identify any potential impacts from the project and determine if those impacts are “significant”. Based on those findings, the agency must then prepare one of three

environmental documents: A Negative Declaration if no “significant” impacts were identified, a Mitigated Negative Declaration if the initial investigation found “significant” impacts but the project was revised to avoid or minimize those impacts, or an Environmental Impact Report (EIR) if there were “significant” impacts. Because both the tunnel and the wetland will be regulated under multiple State and local agencies, CEQA compliance, likely involving the development of an EIR, will be required. The lead agency will likely be Daly City, with the other involved agencies participating as Responsible and Trustee agencies per CEQA guidelines.

### 6.3.4 Regulatory Summary and Recommendations

Table 6-3 includes a summary of the State and Federal regulatory requirements that are expected for the Vista Grande Watershed Study.

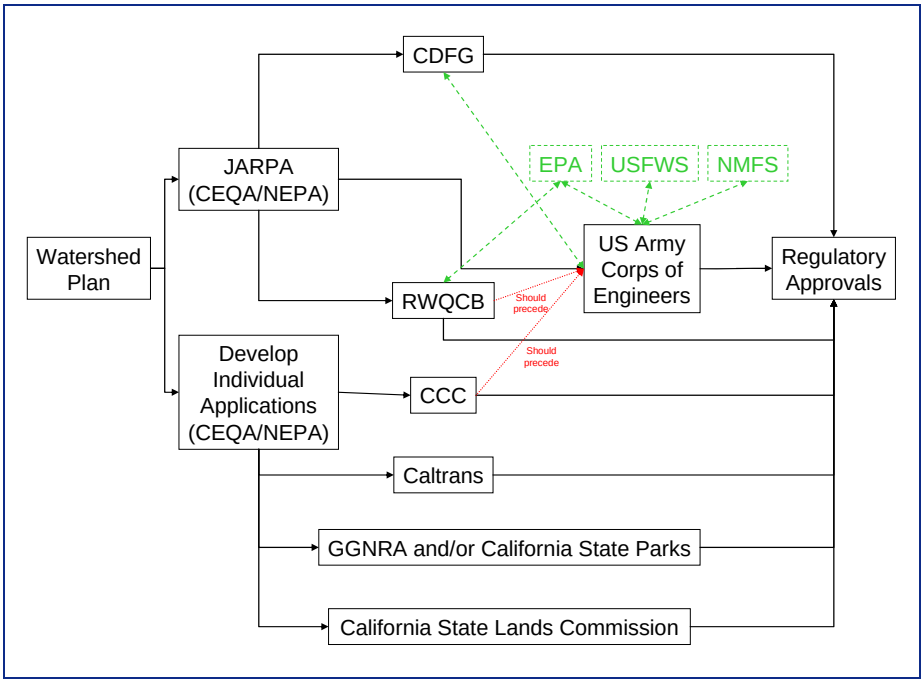
**Table 6-3 Summary of State and Federal Regulatory Requirements**

| Agency | Permit or Requirement | Authority | Project Component Regulated | Time Frame |
|---|---|---|---|---|
| US Army Corps of Engineers | §404 Permit | Clean Water Act | Tunnel, Wetland | 4-6 months – Individual Permit<br>45-60 days -Nationwide Permit |
| | §10 Permit | River and Harbors Act | Tunnel, Wetland | An additional year or more if a biological opinion is required. |
| US Fish and Wildlife Service | §7 Consultation | Endangered Species Act | Tunnel, Wetland | 1-3 years |
| National Marine Fisheries Service | §7 Consultation | Endangered Species Act | Tunnel | 1-3 years |
| San Francisco Regional Water Quality Control Board | §401 Permit -Water Quality Certification | Clean Water Act §401 | Tunnel, Wetland | 60 days after application is deemed complete. Up to one year of additional time may be requested from the Corps. |
| | §402 Permit - NPDES: General Construction Activity Stormwater Permit | Clean Water Act §402 | Tunnel, Wetland, Storm Drain Improvements | Approximately six months |
| | Waste Discharge Requirements (WDRs) | Porter-Cologne Water Quality Control Act | Waived if §401 Permit required, Tunnel Inlet | Approximately three months |
| California Department of Fish and Game | Streambed Alteration Agreement (§1602 permit) | Fish and Game Code §1602 | Wetland | 30 days after application submittal to evaluate completeness; 60 days after application is deemed complete. |
| California Coastal Commission<br>and/or<br>Daly City Local Coastal Programs<br>San Francisco Local Coastal Program | Coastal Development Permit or Public Works Plan | California Coastal Act of 1976; Federal Coastal Zone Management Act | Tunnel, Wetland | Six months to two years |
| California State Parks | Easement / Right-of-Way | California Public Resource Code §5012 | Tunnel | Six months to several years |
| Golden Gate National Recreation Area | Special Use Permit | The National Park Service Organic Act | Tunnel Construction | Six months to several years |
| | Right-of-Way Permit | | Tunnel | Six months to several years |
| California Department of Transportation | Encroachment Permit | California Streets and Highways Code | Tunnel | 60 days after application is deemed complete |
| California State Lands Commission | General Lease – Right-of-Way | California Public Resources Code - Division 6 Public Lands | Tunnel, Wetland | 1-3 years |

In order to ensure compliance with each of the regulatory requirements, a systematic, detailed approach to the application process will be necessary. The first step in the application project will be to prepare all of the materials necessary for each application. Consulting with each of the agencies to ensure understanding of the application process is essential. The San Francisco Bay Area Joint Aquatic Resource Permit Application (JARPA) is a standard application form that can be used for a variety of different projects in the San Francisco Bay Area and submitted to multiple agencies in place of each agency's specific application. JARPA can be used for applications to RWQCB, the Corps, CDFG, EPA, USFWS, NMFS, and California State Lands Commission. Agencies not covered by this permit will require their own application procedure, including CCC, Caltrans, California State Parks, and GGNRA.

The permitting processes for each agency are not independent; agencies rely on each other and have requirements establishing what order permits should be pursued. For example, the Corps requires that an application be filed with the California Coastal Commission prior to submitting an §404 application to the Corp. They do not require that the CCC permit process be completed, just that an application has been filed. Additional communication with the agencies is necessary to determine the details of these dependencies but a preliminary flow chart showing the known relationships is shown in Figure 6-2.

**Figure 6-2 Regulatory Agency Relationships**




Securing the appropriate permits and agreements will be a significant part of implementing the Vista Grande Watershed Study. The permitting process is extensive and will require a significant investment of time and resources in the project. Overall the permitting process is expected to take approximately three years. Advance preparation and coordination with the agencies can help maximize efficiency in this process. Sponsoring a meeting to inform agencies about the project and give them an opportunity to collaborate on the regulatory issues involved would be an ideal method to ensure understanding of the existing requirements. As an alternative, the Corps sponsors monthly interagency meetings where multiple agencies can comment on the project at once. Attendance at one of these meetings may clarify the relationships between the agencies and determine the best approach to the permitting process.

It is essential to start the permitting process early in the implementation period to avoid delays. The critical next steps for this process are as follows:

- Conduct a jurisdictional delineation to determine the jurisdiction of the Corps
- Determine the requirements for preparing a public works plan for the CCC and decide if it is the preferred approach
- Arrange an interagency meeting or attend one that is sponsored by the Corps

## 6.4 Institutional Arrangements

The Vista Grande Watershed Study involves many different organizations each with their own needs and interests. The recommended program will require the long-term cooperation of many of the involved parties. Coordination agreements between the key agencies will need to be established to ensure a long-term commitment to the program. In addition, these arrangements may be necessary to secure funding and regulatory approval for the project components as part of a comprehensive watershed plan. Table 6-4 summarizes the relationships that are involved in implementing the Vista Grande Watershed Study.

**Table 6-4 Summary of Recommended Institutional Arrangements**

| Agencies | Relationship |
|---|---|
| City of Daly City<br>&<br>San Mateo County | Stormwater from the portion of unincorporated San Mateo County that is located within the Vista Grande Drainage Basin contributes to the current capacity problems. An arrangement between the County and Daly City will be necessary to ensure the County participates in the funding and implementation of the tunnel and storm drain improvements. |
| City of Daly City<br>&<br>City and County of San Francisco | Historic conflicts over the flooding at the Vista Grande canal require that these two agencies enter into a MOU that clarifies each city's commitment to the program and establishes a plan for ongoing communication. |
| City of Daly City<br>&<br>Golden Gate National Recreation Area and/or California State Parks | As described in the section 6.3 Regulatory Requirements, the City of Daly City will need to establish a right-of-way agreement with GGNRA and/or California State Parks for the tunnel and its outlet structure depending on the final alignment selected. In addition a Special Use Permit will be required for access through the park area during the construction phase. |
| City of Daly City<br>&<br>Private property owners | An easement for the tunnel alignment will need to be obtained. When the final tunnel alignment is selected, the affected property owners would need to be identified and the appropriate easements secured (e.g. the Olympic Club if the John Muir Drive to Beach alignment is selected). |
| City of Daly City and/or the City and County of San Francisco<br>&<br>The Olympic Club | A portion of the Olympic Club near the wetland may need to be regraded to convey overland runoff into the upstream end of the wetland. Based on the conceptual level design of the Vista Grande Wetland, this grading is expected to be limited to the area immediately surrounding the Vista Grande canal, and is not expected to modify active portions of the golf course or interfere with course play. An agreement with the Olympic Club will need to be established to perform this work or the land will need to be acquired. |

This Study was jointly funded in 2005 by CCSF and Daly City, which continued cooperative effort on resolving issues related to the overflow of stormwater from the Vista Grande canal into Lake Merced. The SFPUC participated as the lead agency for CCSF in cooperation with the SFRPD and the San

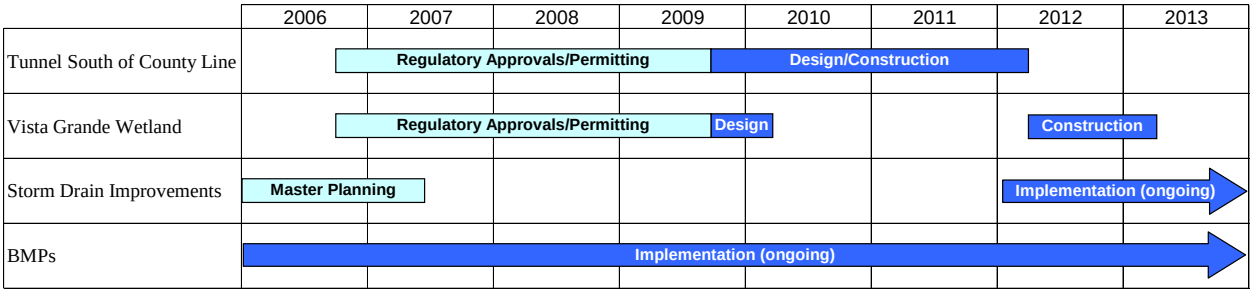
Francisco Department of Public Works. SFPUC's support for this study was prompted by several factors including the need to evaluate flooding issues on a watershed basis, to reduce or eliminate flooding at the Vista Grande canal, and reuse the stormwater for beneficial purposes such as recharging Lake Merced and/or the Westside Groundwater Basin. The SFPUC continues to support project planning that will ultimately lead to implementation of solutions to resolve longstanding flooding problems associated with the Vista Grande watershed. The SFPUC also supports further planning studies needed to define a project that may result in the conversion of the Vista Grande canal to a stormwater treatment wetland, following resolution of the larger stormwater diversion problem that is the focus of this joint study. Proposed drainage solutions and treatment options for addition of a small volume of stormwater to Lake Merced will require detailed environmental review and permitting before proceeding to the implementation phase. This study continues past cooperative efforts between CCSF and Daly City on resolving integrated water resources issues involving recycled water, groundwater, stormwater, and Lake Merced. However, participation of CCSF as a joint sponsor of this report should not be interpreted as a commitment by CCSF to contribute funding for projects outside of its jurisdiction.

## 6.5 Phasing and Schedule

### 6.5.1 Program Phasing

The specific projects that make up the preliminary program build on each other to solve the flooding problems in the Vista Grande watershed. Their dependence on each other places several constraints on the overall phasing of the preliminary program. Although the program components could be conducted independently, developing program components together will improve their effectiveness as a comprehensive watershed-wide solution. The program should be implemented in two primary stages: planning and permitting followed by design and construction, as shown in Figure 6-3. The schedule provided below is designed to give an overview of how the individual preliminary program components could be implemented as an overall watershed program. This schedule would need to be refined based on when projects are selected for implementation and funding is secured.

**Figure 6-3 General Schedule for the Watershed Study**




From a programmatic perspective, the planning and permitting for the tunnel, wetland, and storm drain improvements will be most successful if completed simultaneously. By presenting the preliminary program components as a comprehensive watershed plan with multiple goals and benefits, it will be easier to secure the permits necessary for the tunnel and the wetland. In addition, beginning the planning phase of the storm drain master plan in conjunction with the tunnel planning phase will facilitate the planning of the interface between the tunnel inlet and the rest of the storm drain system. In addition, conducting the planning for the storm drain improvements in the near future will help define the capital improvement project and create a better understanding of funding needs and opportunities. By developing the preliminary program components in conjunction with each other, a more effective, comprehensive upstream solution will be developed.

Construction of the preliminary program components will require specific phasing measures. The Vista Grande Wetland is located on the site of the existing Vista Grande canal, which conveys stormwater to

the existing stormwater tunnel. Until the new tunnel is constructed, and the canal is no longer needed for stormwater conveyance, the canal must remain active. As a result, the wetland cannot be constructed until the tunnel is completely operational.

Upstream improvements that increase downstream flow must also be phased after the completion of the tunnel. The Vista Grande watershed can produce 1,300 cfs of stormwater for the 10-year, 4-hour storm. Currently, only 680 cfs of this runoff makes it through the storm drain system and down to the canal. However, the existing Vista Grande tunnel only has a 170 cfs capacity, resulting in flooding along the Vista Grande canal. Upstream improvements to the storm drain system that would convey additional water down to the canal, increasing the flooding at that site. Therefore, while maintenance activities, small conveyance improvements that are not expected to have a significant impact on downstream flow, and localized detention can be implemented throughout the planning and construction of the tunnel, the majority of the storm drain conveyance improvements must be conducted after the new tunnel is complete so that there is a receptor for the increased flows in the storm drain system.

### 6.5.2 Overall Implementation Schedule for the Vista Grande Watershed Study

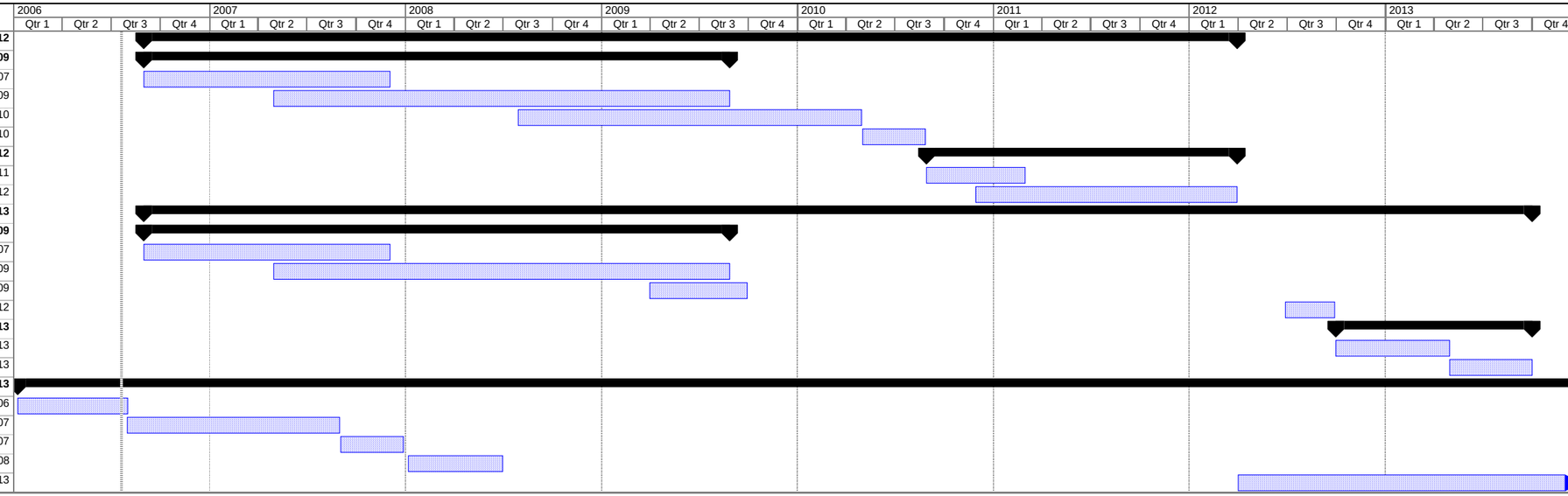
The Vista Grande Watershed Study will be an involved, multi-year process. A more detailed overall schedule for the preliminary program is shown in Figure 6-4. As this schedule shows, implementation can begin immediately with planning and permitting for the tunnel and wetland, flow monitoring and master planning for the storm drain improvements, and ongoing BMPs. The tunnel will take at least six years to implement. Under the proposed schedule the tunnel will be completed in the Spring of 2012. Wetland construction can begin once the tunnel replaces the need for the Vista Grande canal and is expected to take approximately one year, placing its completion in 2013. Flow monitoring and master planning for storm drain improvement can begin immediately and will take approximately two years to complete. After the tunnel is completed in early 2012, conveyance improvements for the storm drain system can begin and should continue to be implemented on an ongoing basis.

The preparation of the permit applications for the tunnel and the wetland are expected to take approximately one year. Once submitted, and complete, the permit review time for each agency ranges from two months to several years. During this same period, the environmental documentation under CEQA and NEPA will be prepared and requests by regulatory agencies for additional supporting materials may be fulfilled. Compliance with CEQA, NEPA, and any additional requests will be required before the final permits can be issued. Near the end of the regulatory process, in mid-2009, the design of the tunnel and the wetland can begin. Although the wetland cannot be constructed until after the tunnel is complete, developing the design early in the process will help develop support for the program and facilitate the ultimate implementation of the wetland.

The schedule provided below is designed to give an overview of how the individual preliminary program components could be implemented as an overall watershed program. This schedule includes only permitting, design and construction phases and is dependent on funding availability. This schedule would need to be refined when projects are selected for implementation and funding is secured.

Figure 6-4 Overall Implemenation Schedule for the Vista Grande Watershed Study

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **Tunnel** | **1456 days** | **Fri 9/1/06** | **Fri 3/30/12** |
| 2 | **Permitting** | **780 days** | **Fri 9/1/06** | **Thu 8/27/09** |
| 3 | Applications | 327 days | Fri 9/1/06 | Mon 12/3/07 |
| 4 | Approval | 608 days | Tue 5/1/07 | Thu 8/27/09 |
| 5 | Design | 458 days | Wed 7/30/08 | Fri 4/30/10 |
| 6 | Bid & Award | 85 days | Mon 5/3/10 | Fri 8/27/10 |
| 7 | **Construction** | **415 days** | **Mon 8/30/10** | **Fri 3/30/12** |
| 8 | Contractor Mobilization | 132 days | Mon 8/30/10 | Tue 3/1/11 |
| 9 | Field Construction | 349 days | Tue 11/30/10 | Fri 3/30/12 |
| 10 | **Wetland** | **1848 days** | **Fri 9/1/06** | **Tue 10/1/13** |
| 11 | **Permitting** | **780 days** | **Fri 9/1/06** | **Thu 8/27/09** |
| 12 | Applications | 327 days | Fri 9/1/06 | Mon 12/3/07 |
| 13 | Approval | 608 days | Tue 5/1/07 | Thu 8/27/09 |
| 14 | Design | 130 days | Wed 4/1/09 | Tue 9/29/09 |
| 15 | Bid & Award | 66 days | Fri 6/29/12 | Fri 9/28/12 |
| 16 | **Construction & Monitoring** | **262 days** | **Mon 10/1/12** | **Tue 10/1/13** |
| 17 | Construction | 152 days | Mon 10/1/12 | Tue 4/30/13 |
| 18 | Wetland Monitoring | 110 days | Wed 5/1/13 | Tue 10/1/13 |
| 19 | **Vista Grande Storm Drain Master Plan** | **2082 days** | **Mon 1/9/06** | **Tue 12/31/13** |
| 20 | Data Collection/Verification | 147 days | Mon 1/9/06 | Tue 8/1/06 |
| 21 | Modeling & Conceptual Alternatives Analysis | 284 days | Tue 8/1/06 | Fri 8/31/07 |
| 22 | Detailed Alternatives Analyses | 85 days | Mon 9/3/07 | Fri 12/28/07 |
| 23 | CIP Development | 126 days | Mon 1/7/08 | Mon 6/30/08 |
| 24 | Implementation of Improvements | 457 days | Mon 4/2/12 | Tue 12/31/13 |




Vista Grande Watershed Study
August 2006

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

## 6.6 Next Steps

As discussed previously, the intent of this Study is to establish a general approach to flood protection within the watershed. Since this is a planning level document, the preliminary alternatives included in the preliminary program have not been selected for implementation and acceptance of this Study by the agencies does not constitute adoption of these alternatives. Rather, it is recommended that the agencies accept this study as a general approach for further investigation to solve flooding in the Vista Grande watershed.

The next steps in developing the preliminary program recommendations identified in this Study include:

- Defining the Recommended Program
- Defining a funding approach and establish a financing plan
- Maintaining coordination between key agencies
- Conducting preliminary design of the Recommended Program components
- Obtaining required permits and regulatory approvals
- Conducting final design of the Recommended Program components
- Constructing the Recommended Program components
- Performing maintenance on the Vista Grande drainage basin until a long-term solution is implemented
- Conduct shoreline restoration at Lake Merced after completion of long-term downstream program components.

Within these next steps, a number of critical path items have been identified in order to streamline the implementation process. These items are described below.

### Continued Development of the Preliminary Program Recommendations

***Storm Drain Improvements***

- Calibrate existing model based on flow monitoring data
- Conduct storm drain modeling to evaluate local storage and define design flow criteria
- Develop a storm drain master plan

***Tunnel South of County Line***

- Conduct site survey and geotechnical investigation
- Evaluate inlet hydraulics and need for interim bypass facilities
- Evaluate the location and conceptual design for the beach outlet structure
- Identify alternative locations and mechanisms for spoils disposal
- Conduct alternatives analysis to refine concepts and define preliminary recommendations
- Conduct CEQA/NEPA analyses and finalize recommendations

***Vista Grande Wetland***

- Conduct water quality monitoring to define seasonal variations in quality with respect to potential constituents of concern

- Quantify dry-weather stormwater flows in the Vista Grande canal
- Conduct alternatives analysis to refine concepts and define preliminary recommendations
- Conduct CEQA/NEPA analyses and finalize recommendations

### Funding

The overall preliminary program is expected to cost from $86,000,000 to $117,000,000. Further investigation of the funding strategies described in Section 6.1 will be essential to identifying and securing the necessary backing to implement the program. Pursuing a variety of funding avenues will maximize the funds available and developing a detailed financing plan will be necessary to make the preliminary program recommendations a reality.

### Coordination Between Agencies

Successful implementation of the Vista Grande Watershed Study will depend on establishing a successful working arrangement between the key agencies. Clearly defining responsibilities and the relationships between the interested parties may be necessary to secure funding and regulatory approval for the program components as part of a comprehensive watershed plan.

### Regulatory Requirements / Permitting

Securing the appropriate permits and regulatory agreements is necessary prior to program implementation. This is expected to be a lengthy and involved process, thus it is essential to begin as soon as possible. Arranging or attending an interagency meeting will jumpstart this process, and will ensure that all of the appropriate regulatory requirements are met. In addition, the agencies should consider preparing a public works plan with the CCC, as described in Section 6.3.2, since a public works plan may make the permitting process more efficient.

### Maintenance

Maintenance of the Vista Grande drainage system, especially the Vista Grande canal and the Vista Grande tunnel, will be essential in minimizing flooding damages until a long-term program is in place. This maintenance should include a pre-storm season walkthrough of the canal and adjacent areas to identify debris and other maintenance activities to be conducted prior to the storm season. Maintenance during storm events could be enhanced by installing a mechanical device to catch and remove debris to maintain flow through the canal and tunnel.

# References

# References

Bay Area Stormwater Management Agencies Association. *Start at the Source: Design Guidance Manual for Stormwater Quality Protection*. Forbes Custom Publishing. 1999.

Boyce, Glenn, PhD, PE, Senior Associate, Jacobs Associates Engineers/Consultants. Electronic and telephone communications. September 2005 through November 2005.

California Association of Resource Conservation Districts (CARCD). *Guide to Watershed Project Permitting*. 2002.

California Coastal Commission. Program Overview. Accessed September 2005. http://www.coastal.ca.gov/whoweare.html.

California Coastal Commission. The California Coastal Act, Questions and Answers. Accessed September 2005. http://www.coastal.ca.gov/qa99.pdf.

California Coastal Records Project. California Coastal Pictures. Accessed September 2005 through November 2005. http://www.californiacoastline.org.

California Department of Health Services. *California Health Laws Related to Recycled Water, Title 22 of the California Code of Regulations*. June 2003.

California Department of Transportation (Caltrans). *Encroachment Permits, Manual for Encroachment Permits on California State* Highways, Seventh Edition. 2002.

California Environmental Resources Evaluation System (CERES). *California Wetlands Information System: How to Get a Wetlands Permit*. February 5, 2002.

California Regional Water Quality Control Board, San Francisco Bay Region. *San Mateo Countywide NPDES Permit #CAS0029921*. July 21, 2004.

California Regional Water Quality Control Board, San Francisco Bay. *Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan)*. June 1995.

Camp Dresser & Mckee (CDM). *East Bay Municipal Utility District Wet Weather Facilities Plan Update, Final Report*. May 1985.

CH2M Hill. *Draft Vista Grande Stormwater Drainage Basin Hydraulic Capacity Evaluation*. August 2002.

CH2M Hill. *Vista Grande Canal-Lake Merced Pilot Storm Water Treatment Project, Technical Memorandum 3*. January 2004.

CH2M Hill. *Vista Grande Diversion Feasibility Evaluation, Technical Memorandum 2*. October 2001.

City/County Association of Governments. *San Mateo Countywide Stormwater Pollution Prevention Program, Guide to Creek & Wetland Project Permitting*. September 24, 1996.

City/County Association of Governments. *San Mateo Countywide Stormwater Pollution Prevention Program, Stormwater Management Plan*. 2004.

City of Daly City, Department of Water and Wastewater Resources. *Stormwater Pollution Prevention Program – First Half-Year Deliverables for 2004-2005*. January 14, 2005.

City of Daly City, Department of Water and Wastewater Resources. *Stormwater Pollution Prevention Program – Second Half-Year Deliverables for 2004-2005*. July 18, 2005.

City/County Association of Governments. *San Mateo Countywide Stormwater Pollution Prevention Program, Fiscal Year 2004/05 Annual Report, July 2004 through June 2005, Volume I of V*. August 31, 2005

CULTEC, Inc. Stormwater Filter Systems. Accessed October 2005. http://www.cultec.com.

D'Avignon, Mark, United States Army Corps of Engineers. Meeting with USACE Staff. October 11, 2005.

Dineen, Spring, PE Associate Civil Engineer, City of North Las Vegas, NV, personal communication, July 18, 2005.

EDAW and Talavera & Richardson. *Initiative to Raise and Maintain Lake Level and Improve Water Quality, Task 3 Technical Memorandum*. Prepared for the SFPUC. September 2004a.

EDAW and Talavera & Richardson. *Initiative to Raise and Maintain Lake Level and Improve Water Quality, Task 4 Technical Memorandum*. Prepared for the SFPUC. September 2004b.

EIP Associates. *Significant Natural Resources Management Plan*. Prepared for San Francisco Recreation and Parks Department, Natural Areas Program. June 2005.

Encyclopedia.com. Plover. Accessed November, 2005. http://www.encyclopedia.com/html/p1/plover.asp.

FishNet 4C, MFG, Inc, Prunuske Chatham Inc., and Pacific Watershed Associates. *Guidelines for Protecting Aquatic Habitat and Salmon Fisheries for County Road Maintenance*. December 2004.

Geo/Resource Consultants, Inc. *Lake Merced Water Resource Planning Study*. May 1993.

Grefsrud, Marsha, California Department of Fish and Game. Meeting with CDFG Staff. October 26, 2005.

Horne, Alex, PhD, University of California-Berkeley, Civil and Environmental Engineering. Personal communications. October 2005 through November 2005.

Interstate Technology & Regulatory Council, Wetlands Team. *Technical and Regulatory Guidance Document of Constructed Treatment Wetlands*. December 2003.

Jacobs Associates Engineers/Consultants. *Basis for Conceptual Costs Estimates Project Memorandum*. October 18, 2005.

Kennedy/Jenks Engineers. *Vista Grande Storm Sewer Project Draft Report*. November 1983.

Kern, Chris and YinLan Zhang, California Coastal Commission. Meeting with Coastal Commission Staff. October 12, 2005.

Lindeburg, Michael, PE. *Civil Engineering Reference Manual, 9th Edition*. Professional Publications Inc. 2003.

McComas, Jesyln. California State Lands Commission. Email communication. July 17, 2006.

National Park Service (NPS). *Director's Order #53: Special Park Uses*. April 4, 2000. http://www.nps.gov/refdesk/DOrders/DOrder53.html.

National Park Service. Golden Gate National Recreation Area website. Accessed 2005. http://www.nps.gov/goga.

National Park Service. *NPS Management Policies*. 2001.

North San Mateo County Sanitation District. *Lake Merced Pilot Stormwater Enhancement Project, Preliminary Water Quality Screening Results*. Prepared by EOA Inc. 2005.

Ortega, Steve, Nancy Hornor, Karen Cantwell, Tamara Williams, Chris Powell and Michelle Rios, National Park Service. Meeting with GGNRA Staff. November 17, 2005.

Peterson, Dean, County of San Mateo's Environmental Health Services Division. Meeting with Health Division Staff. October 12, 2005.

Presidio Trust, The. *Presidio Water Recycling Project, Environmental Assessment*. March 2002.

Portland Online, City of Portland Oregon. Combined Sewer Overflow Projects. Accessed November 2005. http://www.portlandonline.com/cso.

RMC Water and Environment. 90% Design Cost Estimates for Watsonville. Internal document. October, 2005.

RMC Water and Environment. *Zone 7 Draft Stream Management Master Plan*. 2005.

San Francisco Bay Area Joint Aquatic Resource Permit Application (JARPA). *Joint Aquatic Resource Permit Application: Instructions, Drawings Submittal Information, Useful Definitions, and Agencies/Fees*. August 2004.

San Francisco Public Utilities Commission (SFPUC). *Draft Recycled Water Master Plan*. September 2005.

San Francisco Recreation and Park Department (SFRPD). *Significant Natural Areas Management Plan, Public Draft*. 2005.

Santa Clara Valley Transportation Authority (VTA). *Subway Overview Fact Sheet, BART Extension to Milpitas, San Jose and Santa Clara*. April 2002.

Spencer, Eugene, et al. *Heavy Construction Cost Data, 19th Annual Edition*. RSMeans Construction Publishers and Consultants. 2004.

State Water Resources Control Board (SWRCB). Website. Accessed 2005. http://www.swrcb.ca.gov.

US Army Corps of Engineers, San Francisco District. Website. Accessed 2005. http://www.spn.usace.army.mil.

US Army Corps of Engineers, San Francisco District. Construction Equipment Ownership and Operating Expense Schedule, Region VII. July 2005.

US Environmental Protection Agency (EPA). *Clean Water Act, Section 303(d)*. 2002.

US Environmental Protection Agency (EPA). *Getting in Step: A Guide for Conducting Watershed Outreach Campaigns*. December 2003.

Weintraub, June, and Lorraine Anderson, City and County of San Francisco Department of Public Health, Environmental Health Section. Meeting with Department of Public Health Staff. November 4, 2005.

West, John, Vic Pal, Keith Lichten, Habte Kifle and Susan Gladstone, Regional Water Quality Control Board. Meeting with RWQCB Staff. October 12, 2005

Wikipedia Online Encyclopedia. Tunnel Boring Machine. November 2005. http://en.wikipedia.org/wiki/Tunnel_boring_machine

Woodward-Clyde. *Richmond Transport Tunnel Project Summary*. 1995.

Yates, Gus, PG, CHG. *Groundwater Conditions along Proposed New Vista Grande Stormwater Tunnels Memorandum*. October 5, 2005.

Yates, Gus, PG, CHG. *Groundwater Conditions along Proposed New Vista Grande Stormwater Tunnels Memorandum*. November 16, 2005.

Yates, Gus, PG, CHG. Electronic and telephone communications. September 2005 through November 2005.

Yates, Gus, PG, CHG. *Preliminary Evaluation of Groundwater Recharge Benefits from Proposed Stormwater Detention Basins in Daly City*. May 15, 2005.

# Appendices

# Appendix A - Vista Grande Watershed Peak Stormwater Discharge for Various Design Storms

The Vista Grande watershed peak discharges calculated for storms with 10-year to 100-year return period have been calculated using the Rational Method.

| Drainage Area | Area (acres) | C-value[d] | Volume of Rainfall Over Basin (Inches)[a] | | | | Peak rainfall Intensity [b] | | | | Rainfall Runoff [c] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 10-yr Event (in) | 25-yr Event (in) | 50-yr Event (in) | 100-yr Event (in) | 10-yr Event (in/hr) | 25-yr Event (in/hr) | 50-yr Event (in/hr) | 100-yr Event (in/hr) | 10-yr Event (ft3/sec) | 25-yr Event (ft3/sec) | 50-yr Event (ft3/sec) | 100-yr Event (ft3/sec) |
| 24" Sub-drainage Basin | 110 | 0.75 | 1.80 | 2.00 | 2.25 | 2.50 | 1.13 | 1.25 | 1.41 | 1.56 | 93 | 103 | 116 | 129 |
| 60" Sub-drainage Basin | 393 | 0.6 | 1.80 | 2.00 | 2.25 | 2.50 | 1.13 | 1.25 | 1.41 | 1.56 | 258 | 287 | 322 | 358 |
| 6'x7' Sub-drainage Basin | 1170 | 0.75 | 1.80 | 2.00 | 2.25 | 2.50 | 1.13 | 1.25 | 1.41 | 1.56 | 987 | 1,097 | 1,234 | 1,371 |
| Total | 1673 | | | | | | | | | | 1,338 | 1,487 | 1,672 | 1,858 |

Notes:

a. National Weather Service Precipitation Frequency Publication: NOAA Atlas 2, Volume XI. California, Part 5 North 6hr precipitation maps. Event intensities were estimated from the 6-hr precipitation isopoluvials for the 10-year, 25-year, 50-year and 100-year event.

b. From Figure 4.2, Kennedy Jenks Report; I= V/(0.4x T) with V: volume of rainfall over basin, in inches; and T: storm duration.

c. Calculated using the Rational Method for peak discharge. $Q_p=CIA_d$ (cfs).

d. From civil Engineering Reference Manual, Appendix 20.A

# Appendix B - July 2005 Stakeholder Workshop Attendance List

**Vista Grande Watershed Study**
**Public Workshop #1 - 07-27-05**

| Name | Title | Organization |
|---|---|---|
| Annette Hipona | President | Original Daly City Protective Association |
| Bob Maddow | Attorney | Olympic Club |
| Bob Murray | | Hillside Home Owners |
| Cary Chien | Field Rep | Speaker Pro Tem Leland Yee |
| Celine Monget | Project Engineer | RMC Water & Environment |
| Chandra | | San Francisco Public Utilties Commission |
| David Burruto | | For Assembly Member Leland Yee |
| Frank Filice | SFDPW | City and County of San Francisco Department of Public Works |
| Greg Bartow | Groundwater Program Manager | San Francisco Public Utilties Commission |
| Gus Yates | Hydrologist | Consultant to City of Daly City and San Francisco Public Utilties Commission |
| James Chia | Assistant City Engineer | City and County of San Francisco Department of Public Works |
| John Plummer | | Friends Of Lake Merced |
| Jonathan Langt | | San Francisco Public Utilties Commission |
| Maia Fleming Singer | Scientist | Alex Horne Associates |
| Mario Avendano | Superintendent | City and County of San Francisco Rec/Park |
| Mark Poppel | Civil Engineer Associate/Daly City | City of Daly City Department of Public Works |
| Mike Casteel | Microbiologist | San Francisco Public Utilties Commission |
| Patrick Sweetland | Director | City of Daly City Department of Water and Wastewater Resources |
| Randy Raines | Project Manager /President | RMC Water & Environment |
| Randy Zebell | President | California Native Plant Society |
| Robert Ovadia | Senior Civil Engineer | City of Daly City Department of Public Works |
| Roxanne Stachon | Senior Project Manager | RMC Water & Environment |
| Roy Cordero | Assistant Director DC Dept. of PW | City of Daly City Department of Public Works |
| Suzanne Gautier | | San Francisco Public Utilties Commission |
| Teresa Devincenzi | Resident | City of Daly City |
| Vaughn Jones<br>Gloriann Jones | President | Skyline-Palisades Association |
| William Choutka | G.M. | Westlake Village |

# Appendix C - Upstream Detention Storage Alternative Supporting Technical Information

# Regional Detention Storage Costs

# Supporting Technical Information

Regional detention basin cost estimates in Chapter 4 were developed based on review of several construction cost estimates for similar storage basins around the Bay Area. Reviewed cost estimates were adjusted to the October 2005 ENR CCI of 8404 for the City and County of San Francisco. Based on the review, a unit cost of $3.00 per gallon was established for the regional detention basin construction cost estimates for the Vista Grande Watershed Study. The sampled Bay Area storage cost estimates included the following projects:

| Storage Description | Storage Volume (MG) | Construction Cost Estimate[1] | Unit Cost ($/gal) |
|---|---|---|---|
| Watsonville Clearwell<br><br>Partially buried, cast-in-place concrete storage tank. Includes groundwater drainage system. 90% design level cost estimate. Non-urban construction. June 2005 ENR CCI of 8282. (RMC Water and Environment, 2005) | 0.5 | $800,000 | $1.60 |
| San Francisco Recycled Water Clearwell<br><br>Partially buried, concrete storage tank. Planning level cost estimates for urban construction. March 2005 ENR CCI of 8227. (SFPUC, 2005) | 5.0 | $15,400,000 | $3.08 |
| EBMUD Wet Weather Facilities Storage Basin[2]<br><br>Storage basin with pumping equipment on Alameda Island. 1985 ENR CCI of 5100. (CDM, 1985) | 3.0 | $11,200,000 | $3.73 |
| Presidio Water Recycling Project<br><br>Underground storage in the Presidio, a part of the Golden Gate National Recreation Area. 2002 ENR CCI of 7660. (The Presidio Trust, 2002) | 0.5 | $9,100,000 | $18.20 |

Footnotes:

1. Construction cost estimate includes project contingencies but does not include implementation costs such as engineering, permitting, or environmental compliance.
2. The EBMUD cost estimate from 1985 may not account for more restrictive permitting, mitigation, or restoration requirements.

# MEMORANDUM

**Gus Yates, RG, CHg, Consulting Hydrologist • 1809 California Street, Berkeley, CA 94703**
**tel/fax 510-849-4412 • gusyates@earthlink.net**

**Date:** May 15, 2005
**To:** Roxanne Stachon, RMC, Inc.
**From:** Gus Yates, consulting hydrologist
**Cc:**
**Subject:** Preliminary Evaluation of Groundwater Recharge Benefits from Proposed Stormwater Detention Basins in Daly City

Preliminary Evaluation

Additional stormwater detention basins in Daly City offers the dual benefits of decreased peak flood flows and increased groundwater recharg. This memorandum describes the results of simulated operations for seven prospective stormwater detention ponds using a daily time step over a 34-year simulation period. The purpose of the simulations was to estimate the average annual groundwater recharge benefit and the sensitivity of that benefit to selected key parameters such as the permeability of the pond bottom and the rate at which water is actively pumped out of the basin following a storm event.

The average annual groundwater recharge benefit for the seven ponds is on the order of 580 acre-feet per year (or 190 million gallons). This is equivalent to approximately 14% of the annual amount of groundwater pumped by Daly City for municipal supply purposes.

## Pond, Rainfall and Soils Data

Seven potential pond locations have been identified within the overall watershed area of Daly City's Vista Grande stormwater drainage system. These are locations where site conditions appear favorable for pond construction or previous stormwater management simulations have identified a need for additional storage capacity. The locations are shown in Figure 1, and some of the basic dimensions of the ponds and their respective watershed areas are listed in Table 1. The proposed pond capacities range from 0.9 to 35.7 million gallons (mgal), and the watershed areas range from 29 to 1,025 acres. Some of the watershed areas overlap, but this analysis treats them all independently. The ratio of watershed area to pond capacity affects pond storage operations significantly and varies by a factor of 8 among the proposed ponds.

Table 2 lists several global parameters needed to simulate pond operations. An empirical rainfall-runoff coefficient was calculated using data from a temporary rainfall and runoff gaging program for Vista Grande Canal implemented between December 1998 and April 1999 (TRS, Inc. 1999). A regression of daily runoff versus daily rainfall for 17 rain days produced a quite linear relationship with a slope of 0.45 and a Y intercept of zero, as shown in Figure 2. The regression coefficient (r-squared) was 0.93.

It was assumed that inflow to the ponds would be a lateral diversion from a major storm drain by means of a connecting pipe with a limited conveyance capacity. Design work has not advanced to the point of specifying these pipe capacities. A capacity of 100 cubic feet per second (cfs) was selected for this analysis, which was sufficiently large that it did not significantly constrain the recharge benefit.

Groundwater recharge accrues from seepage through the bottom of the pond. However, pond geometry has not yet been specified. For the purposes of this preliminary analysis, ponds were assumed to be 8 feet deep and have vertical side walls. Percolation was assumed to occur only through the bottom of the pond, and the basal area was obtained by dividing pond volume by pond depth. The resulting basal areas are listed in Table 1.

The nearest rain gage with a long historical record of daily rainfall is at San Francisco airport. Daily data were obtained for October 1959 through September 2003 (water years 1960-2003). These daily values were

multiplied by 1.06 which is the ratio of average annual rainfall in the Vista Grande watershed to average annual rainfall at the airport, according to an isohyetal map developed by Phillips and others (1993).

Soil permeability data were obtained from the soil survey for San Mateo County (Natural Resource Conservation Service, 19__). Soils in Daly City are loams that are not as permeable as the sandy soils present in San Francisco's Sunset District a few miles to the north. The most common permeability rates for soils in the Vista Grande watershed are 0.2-0.6 inches per hour (in/hr).

# Operations Model

A spreadsheet operations model was developed that simulates the operation of a single stormwater detention pond on a daily basis during water years 1960-2003. The model simulates runoff, diversion into the stormwater pond, percolation out the bottom of the pond, pond storage, and active pumping from the pond back into the stormwater main to accelerate draining of the pond. Average annual groundwater recharge was calculated from the daily percolation volumes.

Stormwater runoff in Daly City is rapid, with peaks that develop and pass within the span of an hour or two. Daily data smoothes these peaks and tends to overestimate the amount of water that can be diverted into the stormwater pond (assuming a limited conveyance capacity between the stormwater main and the pond). The model includes an adjustment to estimate the "capturable" fraction of daily runoff. Rainfall recorded at 15-minute intervals for 17 rainy days during water year 1999 were converted to runoff rates in cfs for each pond, given the watershed area and runoff coefficient. The rainfall intensity corresponding to the maximum diversion rate into the pond was identified and the percentage of daily rainfall volume that occurred at rates greater than this maximum was considered not capturable. This percentage varied considerably from storm to storm and pond to pond but was almost always greater than 90 percent for the assumed 100-cfs diversion capacity. Accordingly, a multiplier of 0.9 was applied to the rainfall data to omit the water that would not be capturable.

In the model, diversions from the storm drain into the pond are limited by the available flow in the storm drain, the capacity of the connecting pipe, and the vacant storage capacity in the pond. Percolation out of the pond is limited by the percolation rate (assumed to be constant) and the current storage volume of the pond. Finally, the amount of water pumped out of the pond each day is limited by the current storage volume and the pump capacity. After calculating each of these flows for a given day, the model updates the pond storage volume and proceeds to the next day.

An illustration of simulation results is presented in Figure 3, which shows hydrographs of daily storage in the Franklin School pond during six selected wet seasons. This particular simulation assumed a percolation rate of 0.2 in/hr and a pump-out capacity sufficient to empty the pond in 1 week assuming no further rainfall (898 gpm). Figure 4 is a bar graph showing the annual volume of groundwater recharge from the pond during the simulation period.

# Sensitivity of Recharge Benefit to Watershed Area/Pond Capacity Ratio

The size of the detention pond relative to its tributary watershed area affects the percentage of runoff that can be captured, on a daily and average annual basis. For example, the pond with the largest ratio of watershed area to pond capacity is the I-280 cloverleaf pond, which was capable of percolating only 22 percent of runoff on an average annual basis. At the opposite extreme, the middle pond on Lake Merced Golf Club was capable of percolating 59% of runoff.

# Sensitivity of Recharge Benefit to Percolation Rate

The percolation rate through the bottom of the pond strongly affects the average annual recharge benefit and the size of the pump required to empty the pond within a specified number of days. These relationships are shown in Table 3. Part A of the table shows that the pump capacity required to empty a full pond in 1 week

Preliminary Evaluation

(in the absence of rainfall during that period) drops off steeply with increasing percolation rate. In fact, with a percolation rate of 0.6 in/hr, seepage alone will drain an 8-foot-deep pond in 7 days. With percolation rates of 0.2 or 0.4 in/hr, seepage would drain the pond in 20 or 10 days, respectively.

The recharge benefit decreases with decreasing percolation rate because a larger percentage of pond water is removed by pumping rather than percolation. A three-fold decrease in percolation rate decreases average annual percolation by approximately a factor of 3. The graph at the bottom of the table illustrates these tradeoffs using the Franklin School pond as an example.

## Sensitivity of Recharge Benefit to Pump-Out Rate

Pumps were assumed to be needed in order to evacuate the storage capacity of the ponds before the arrival of another rain storm. A one-week evacuation time was assumed as the default target for the simulations described above. The adequacy of this rate was explored by checking to see how full the pond was on the day before each of the ten largest rainfall events during the simulation period. Table 4 lists the previous-day simulated storage for each event for a range of assumed pump-out rates. The events are ranked from largest to smallest and the previous-day storage of the pond is expressed as a percentage of pond capacity. The values shown use the Westlake shopping center pond as an example, with pump-out rates ranging from 0.5 to 20 cfs. For comparison, the pumping rate needed to empty this pond in 1 week is 5.1 cfs (2,300 gpm). With a pumping rate of only 0.5 cfs, the pond would have been empty the day before only two of the ten storm events and would have been more than half full the day before five of the events. Increasing the pump-out rate decreases the previous-day storage. With a pump-out rate of 5 cfs, the pond is empty immediately before six of the ten events, but for one event it would still be 86% full.

A closer inspection of the rainfall timeseries for these large events revealed that extremely high daily rainfall amounts sometimes occur in close succession. For example, the second-largest daily rainfall total during the simulation period (4.07 inches on January 21, 1967) was immediately preceded by the 30$^{th}$ largest rainfall total (1.91 inches on January 20, 1967). Similarly, the fifth largest rainfall total (2.62 inches on October 13, 1962) occurred only two days after the ninth largest rainfall total (2.38 inches on October 11, 1962). Obviously, very large pumping plants would be required to vacate the pond capacity between such closely-spaced storm events.

Increasing the pump-out rate inevitably decreases the groundwater recharge benefit. In the example shown in Table 4, average annual recharge with a pump-out rate of 10 cfs is only half the amount of recharge with a pump-out rate of 0.5 cfs.

## Conclusions and Recommendations

The following conclusions can be drawn from this analysis:

! The groundwater recharge benefits of percolation from stormwater detention ponds could potentially amount to a modest but significant percentage of Daly City's annual groundwater use. Using reasonable assumptions regarding hydrologic conditions and design parameters, the seven ponds considered in this analysis might contribute 14% of the groundwater use.

! The average annual recharge amount is affected by a number of variables, most notably the ratio of watershed area to pond capacity, the percolation rate and the pond pump-out rate.

! The rate at which pond storage needs to be evacuated following a rainfall event should be considered in the overall context of the storm drain system and the targets for flood management. Simulation of selected major events using a system-wide model and 15-minute time steps would help determine the optimal pump-out rate

Preliminary Evaluation

given the higher costs and lower recharge benefits associated with increased pumping capacity.

! Groundwater recharge benefits are quite sensitive to the percolation rate through the bottom of the ponds. Geotechnical investigations should be completed at proposed sites to improve the estimate of vertical permeability of near-surface alluvial materials. The rate at which percolation rates would decrease due to clogging of the pond bed should be estimated based on published results for similar areas and measurements of soil texture and the suspended sediment content of Daly City runoff. In the present analysis, the normal decline in permeability was roughly acknowledged by assuming an average permeability toward the low end of the range published in the soil survey.

## References

Natural Resource Conservation Service. 19__. Soil survey of San Mateo County. U. S. Department of Agriculture. Washington, D.C.

Phillips, S.P., S.N. Hamlin and E.B. Yates. 1993. Geohydrology, water quality, and estimation of ground-water recharge in San Francisco, California, 1987-92. Water-Resources Investigations Report 93-4019. U.S. Geological Survey. Sacramento, CA.

TRS, Inc. 1999. Vista Grande flow monitoring study. Prepared for the City of Daly City, CA.

Preliminary Evaluation

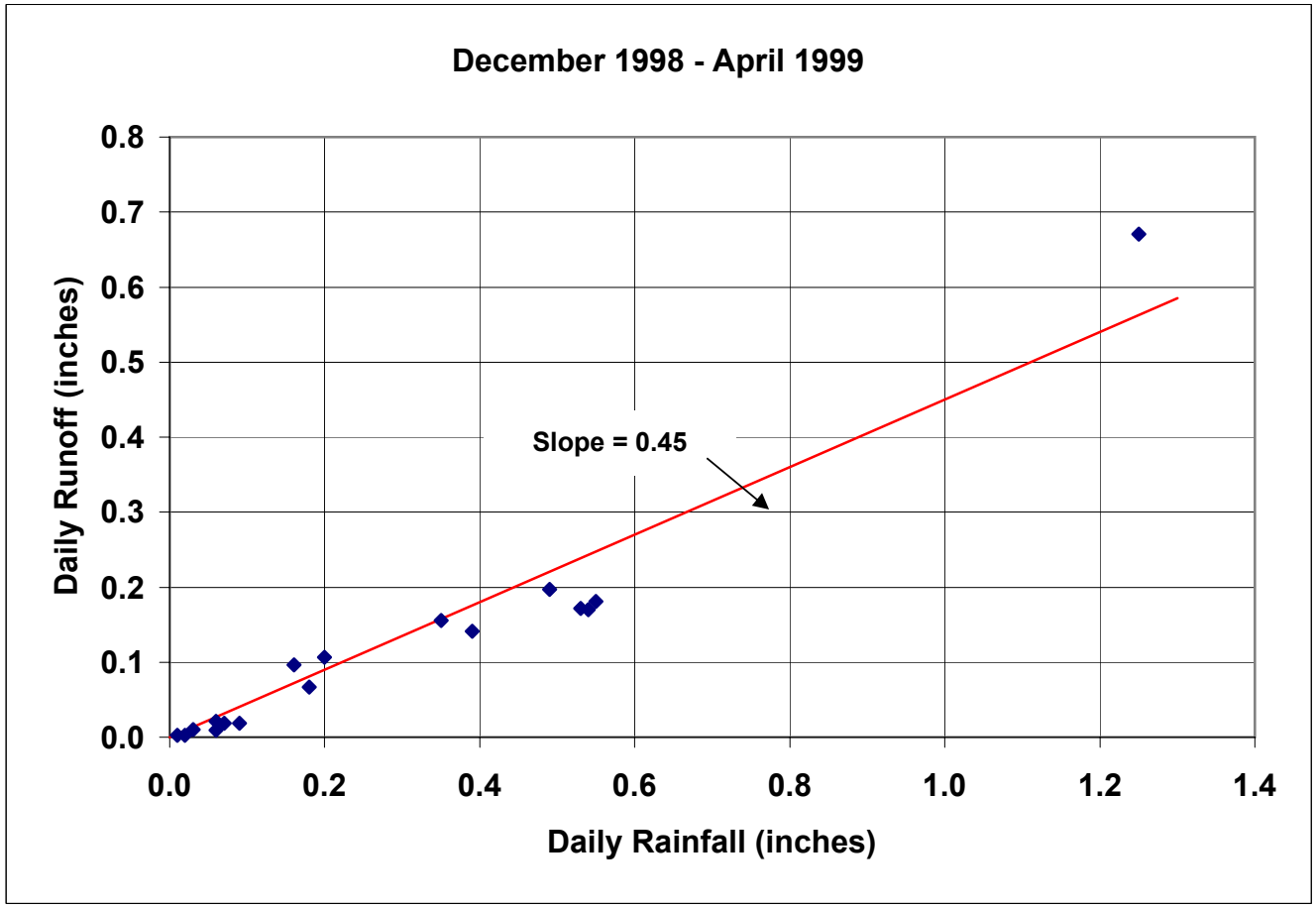



**Figure 2. Relationship of Daily Runoff to Daily Rainfall in the Vista Grande Watershed**

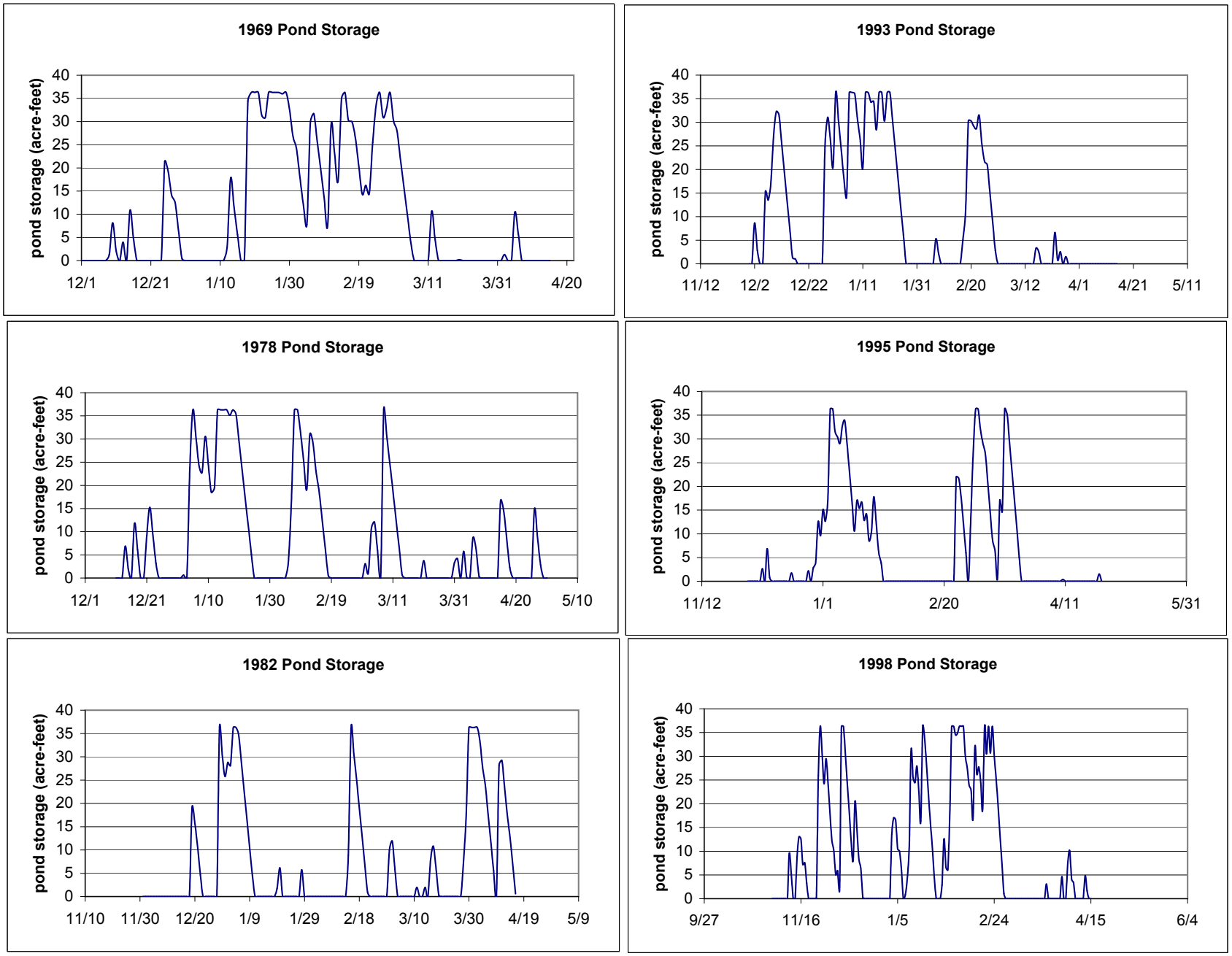



**Figure 3. Simulated Daily Storage in the Franklin School Pond during Six Selected Wet Seasons**

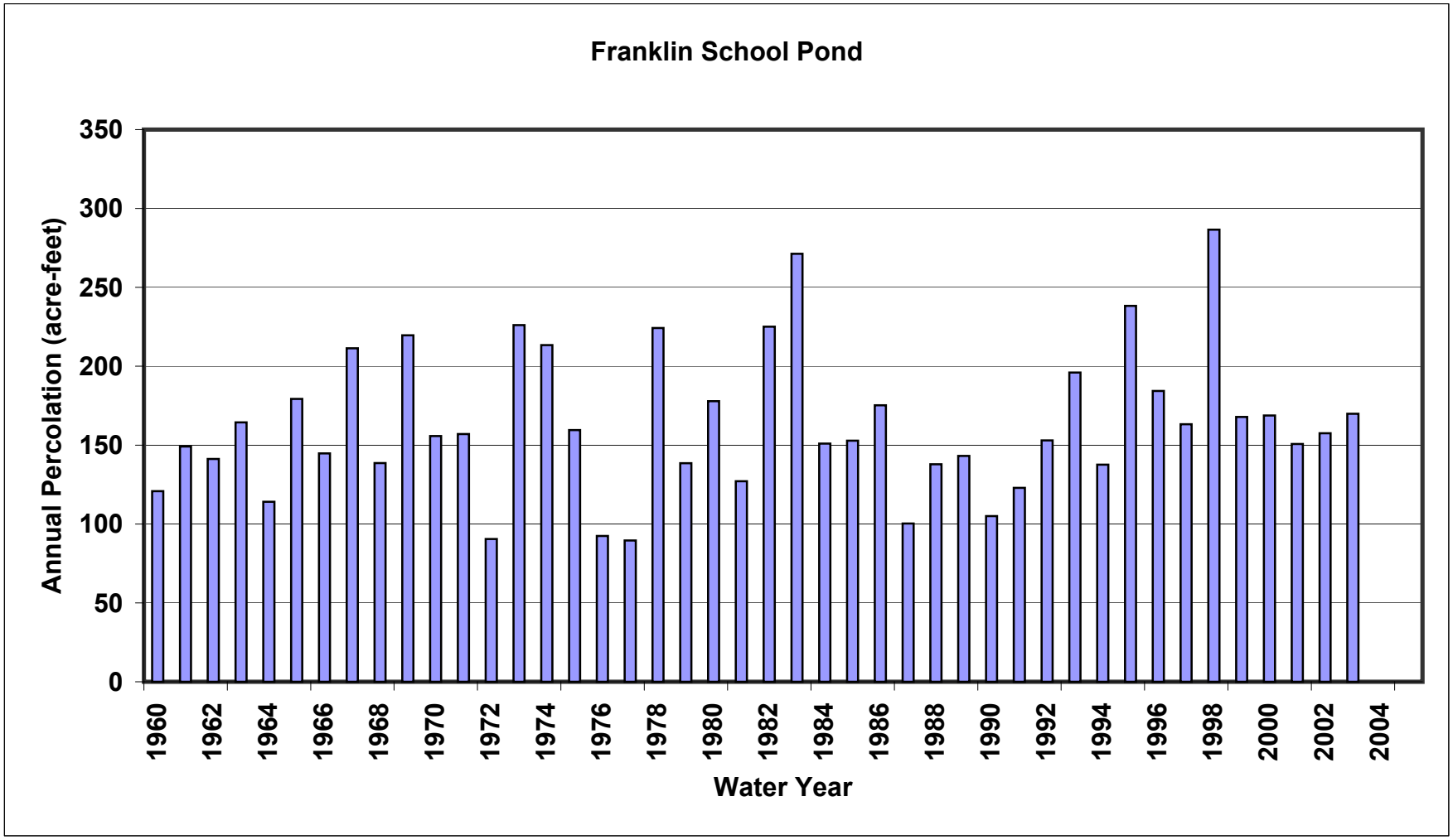



**Figure 4. Annual Simulated Percolation from the Franklin School Pond during 1960-2003**

**Table 1. Dimensions and Recharge Benefits of Seven Potential Stormwater Percolation Ponds in Daly City**

| Pond Parameter | I-280 cloverleaf | Westlake shopping center | Franklin School | Lake Merced Golf Club | | | City Hall | Total |
|---|---|---|---|---|---|---|---|---|
| | | | | North | Middle | South | | |
| Watershed area (acres) | 168 | 1025 | 622 | 59 | 29 | 39 | 108 | n.a. |
| Pond area (square feet)[1] | | | | | | | | |
| Square feet | 26,736 | 596,550 | 230,599 | 15,039 | 36,762 | 20,052 | 108,900 | 1,034,639 |
| Acres | 0.61 | 13.69 | 5.29 | 0.35 | 0.84 | 0.46 | 2.50 | 24 |
| Pond capacity | | | | | | | | |
| Acre-feet | 4.9 | 109.6 | 42.4 | 2.8 | 6.8 | 3.7 | 20.0 | 190 |
| Million gallons | 1.6 | 35.7 | 13.8 | 0.9 | 2.2 | 1.2 | 6.5 | 62 |
| Watershed area/ pond capacity ratio[2] | 34.2 | 9.4 | 14.7 | 21.4 | 4.3 | 10.6 | 5.4 | n.a. |
| Approximate average annual recharge benefit[3] | | | | | | | | |
| Acre-feet | 26 | 316 | 160 | 12 | 12 | 12 | 41 | 579 |
| Million gallons | 8.5 | 103.0 | 52.1 | 3.9 | 3.9 | 3.9 | 13.4 | 189 |
| Percent of current groundwater use | 0.7% | 7.9% | 4.0% | 0.3% | 0.3% | 0.3% | 1.0% | 14.5% |

Notes:

[1] Pond basal area assumes 8-foot pond depth and vertical pond walls.

[2] Ratio of watershed area in acres to pond capacity in acre-feet

[3] Average annual percolation through the pond bottom during water years 1960-2003 under the global parameter assumptions in Table 2.

**Table 2. Global Parameters for Simulation of Pond Operation**

| Parameter | Value |
|---|---|
| Mulitplier to convert rainfall at airport to rainfall at Daly City: | 1.06 |
| Mulitplier to convert daily rainfall to "capturable" hourly rainfall: | 0.9 |
| Runoff coefficient: | 0.43 |
| Maximum diversion rate into pond (cfs): | 100 |
| Pond depth (feet): | 8 |

**Table 3. Effect of Percolation Rate on Required Pump Capacity and Average Annual Recharge Benefit**

**A. Pumping Rate Needed to Empty Pond in 1 Week (gpm)**

| Percolation rate (in/hr) | I-280 cloverleaf | Westlake shopping center | Franklin School | Lake Merced Golf Club | | | City Hall |
|---|---|---|---|---|---|---|---|
| | | | | North | Middle | South | |
| 0.2 | 103 | 2,302 | 898 | 58 | 144 | 76 | 422 |
| 0.4 | 48 | 1,064 | 413 | 27 | 67 | 36 | 193 |
| 0.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**B. Average Annual Groundwater Recharge Corresponding to Above Pumping Rate (acre-feet)**

| Percolation rate (in/hr) | I-280 cloverleaf | Westlake shopping center | Franklin School | Lake Merced Golf Club | | | City Hall |
|---|---|---|---|---|---|---|---|
| | | | | North | Middle | South | |
| 0.2 | 26 | 316 | 160 | 12 | 12 | 12 | 41 |
| 0.4 | 50 | 542 | 291 | 23 | 18 | 20 | 63 |
| 0.6 | 82 | 981 | 499 | 39 | 38 | 36 | 127 |

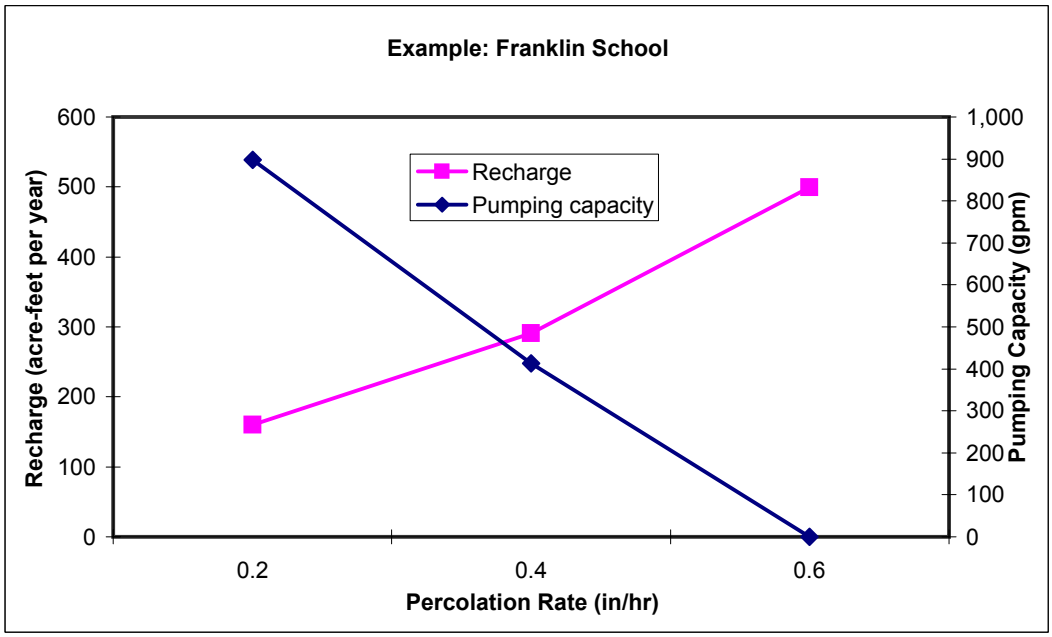


**Table 4. Effect of Pond Pump-Out Capacity on Westlake Pond Storage Volume the Day Before a Major Rainfall Event**
(Units are percent of pond storage capacity)

| Ranked Daily Rainfall at SF Airport | | | Pump-Out Rate (cfs) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Date | Rain (in) | 0.5 | 1 | 2 | 3 | 4 | 5 | 10 | 20 |
| 1 | 01/04/82 | 5.59 | 74% | 68% | 58% | 47% | 36% | 25% | 0% | 0% |
| 2 | 01/21/67 | 4.07 | 55% | 54% | 52% | 51% | 49% | 47% | 38% | 20% |
| 3 | 12/11/95 | 3.16 | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 4 | 02/02/98 | 2.92 | 91% | 77% | 27% | 18% | 14% | 12% | 3% | 0% |
| 5 | 10/13/62 | 2.62 | 94% | 93% | 91% | 90% | 88% | 86% | 77% | 56% |
| 6 | 01/20/64 | 2.49 | 7% | 5% | 2% | 0% | 0% | 0% | 0% | 0% |
| 7 | 12/13/02 | 2.47 | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 8 | 11/30/73 | 2.39 | 30% | 7% | 0% | 0% | 0% | 0% | 0% | 0% |
| 9 | 10/11/62 | 2.38 | 5% | 4% | 3% | 1% | 0% | 0% | 0% | 0% |
| 10 | 01/06/93 | 2.34 | 56% | 48% | 32% | 15% | 0% | 0% | 0% | 0% |
| Average annual recharge (ac-ft): | | | 550 | 499 | 426 | 376 | 343 | 319 | 263 | 241 |

Notes:

The rainfall events shown are the ten largest daily rainfall totals at San Francisco Airport during water years 1960-2003.

The assumed percolation rate was 0.2 in/hr; other parameters are as shown in Tables 1 and 2.

# Appendix D - Evaluation of Interim Solutions

# Appendix D Interim Solutions

## D.1 Introduction

The implementation of long-term improvements is projected to take 5 to 8 years. To reduce the number of years of flooding impacts, the partner agencies requested the assessment of possible interim solutions that could be implemented sooner. The primary goals of interim solutions would be to address immediate safety concerns caused by roadway flooding and to prevent erosion of the banks of Lake Merced where overflows occur. A successful interim solution would solve these problems cost effectively, be compatible with long term solutions, and be capable of implementation in a relatively short time period.

Three interim solution alternatives were developed and evaluated: a Diversion to Impound Lake, a Diversion to South Lake, and armoring the banks of South Lake with Rip Rap. The evaluation of these alternatives, which are presented below, includes the following: a description of proposed facilities, hydraulic analysis, permitting and regulatory requirements, implementation schedule, project cost, and benefits and limitations. Based on these factors, a conclusion and recommended course of action are presented at the end of this section.

*Safety concerns and erosion problems are evident.*

**Figure D-1 Flooding on John Muir Drive from Vista Grande canal**

### D.1.1 Interim Solutions Design Assumptions

To effectively develop and evaluate alternatives for interim solutions, design hydraulic criteria had to be established. These criteria were derived from previous studies, as presented in this chapter.

Based on data from these studies, storm water flow to Vista Grande canal under existing conditions during a 10-year design storm is approximately 680 cfs, and the capacity of Vista Grande Tunnel is approximately 170 cfs. Under these conditions, 510 cfs overflows to Lake Merced uncontrolled by overtopping John Muir Drive. Interim solutions were therefore developed to allow 170 cfs to flow through Vista Grande canal and divert 510 cfs to Lake Merced in a controlled manner.

## D.1.2 Alternative 1 – Diversion to Impound Lake

**Figure D-2 Overview of Alternative 1, Diversion to Impound Lake**

### *Description*

Alternative 1, Diversion to Impound Lake, would divert flow in excess of the tunnel capacity to Impound Lake via a concrete weir structure installed in Vista Grande canal, four 48-inch diameter pipes under John Muir drive and a concrete outfall at Impound Lake. The banks of Impound Lake would be lined with rip rap below the outlet structure to the normal lake level to prevent erosion. After implementation of a long term solution, the rip rap would be removed and the banks would be restored. Figure D-3 through Figure D-5 are schematic diagrams of the facilities for this alternative.

**Figure D-3 Section View of Alternative 1**

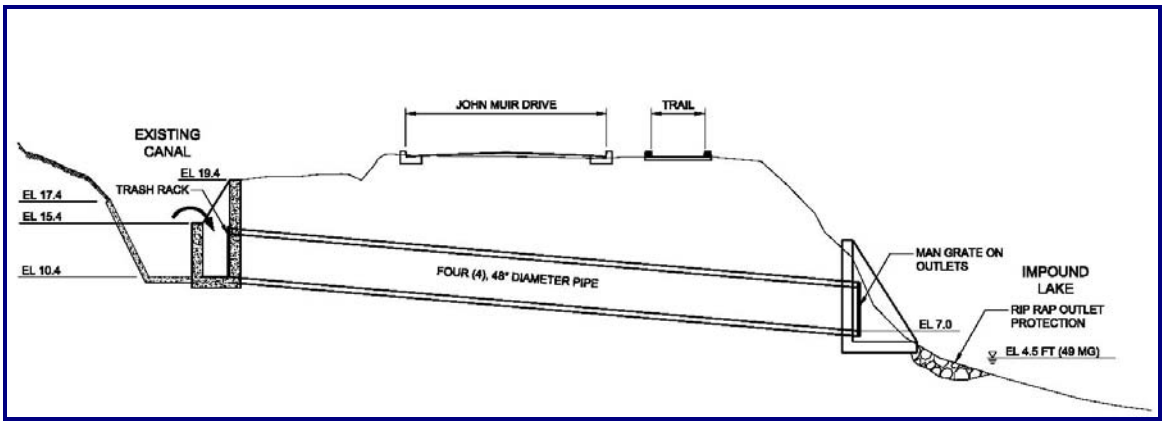


**Figure D-4 Weir Structure**

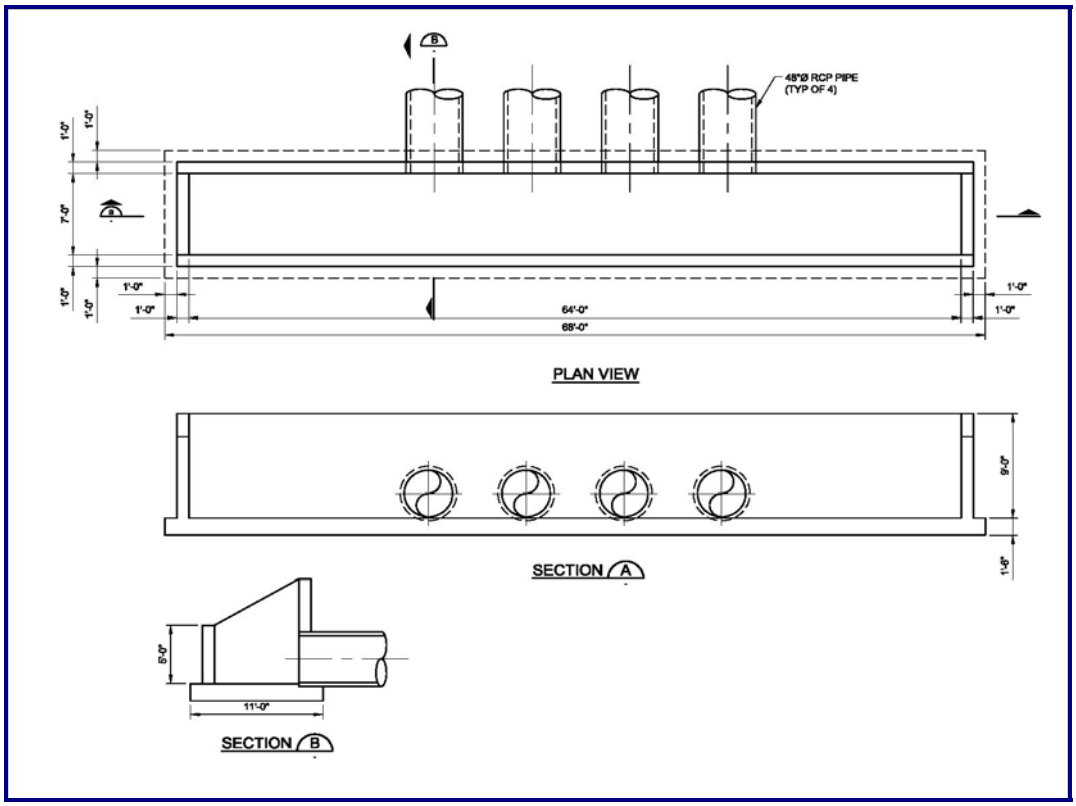
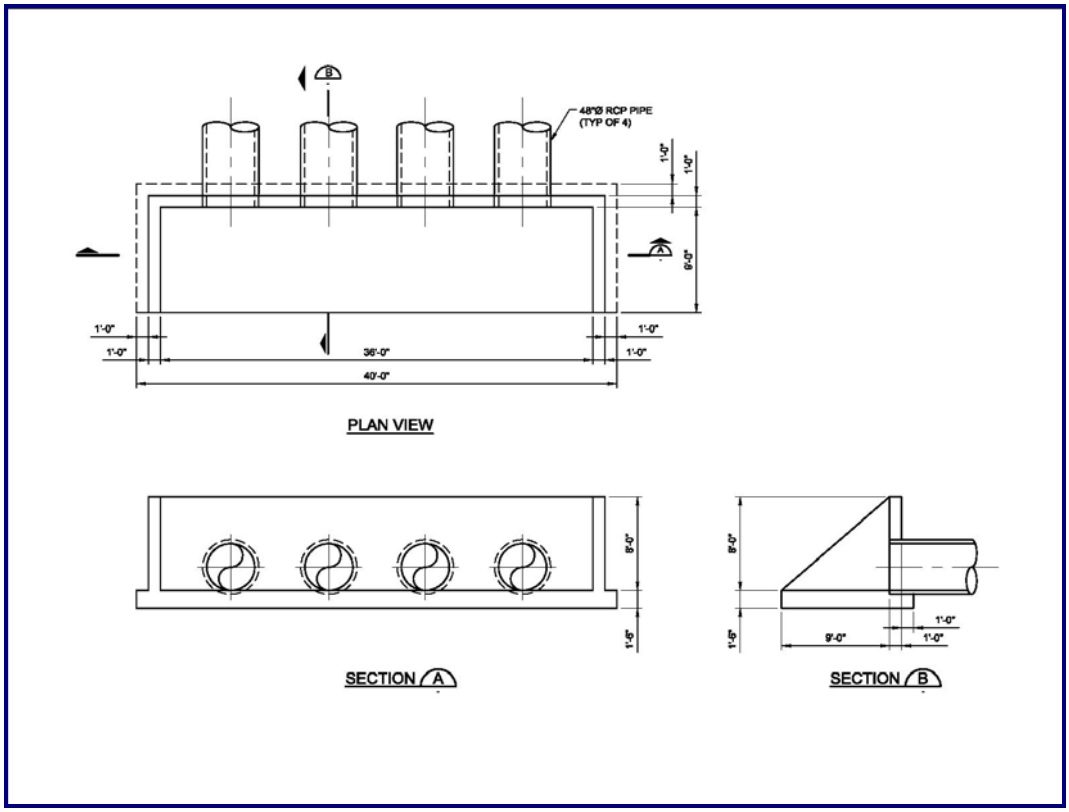



**Figure D-5 Outlet Structure**



## Hydraulic Analysis

The weir elevation on the structure in the canal would be installed at a level equal to the water depth necessary for the canal to convey 170 cfs. Setting the weir at this level will lower the hydraulic grade line in the canal as much as possible, while still allowing 170 cfs to flow to the tunnel. The weir would be set at an elevation of approximately 15.4 feet., which would allow a depth in the canal of 5 feet before overflowing. With a weir length of 64 feet, 2 feet of water over the crest of the weir is required to pass 510 cfs. The elevation of the top of existing concrete in the canal where the structure would be installed would be approximately 17.4 feet, which is equal to the water elevation in the canal required for 510 cfs to pass over the weir. An additional 5 (±) feet of freeboard would be available from the top of concrete to the elevation of the roadway. Four 48-inch pipes installed at 1.75% slope would carry 510 cfs from the weir structure, under John Muir Drive to Impound Lake flowing approximately 60% full.

## Permitting and Regulatory Requirements

Each Interim Solution Option is expected to trigger regulatory involvement from several state and federal agencies. Table D-3 summarizes the permitting requirements that have been identified for the proposed interim solutions.

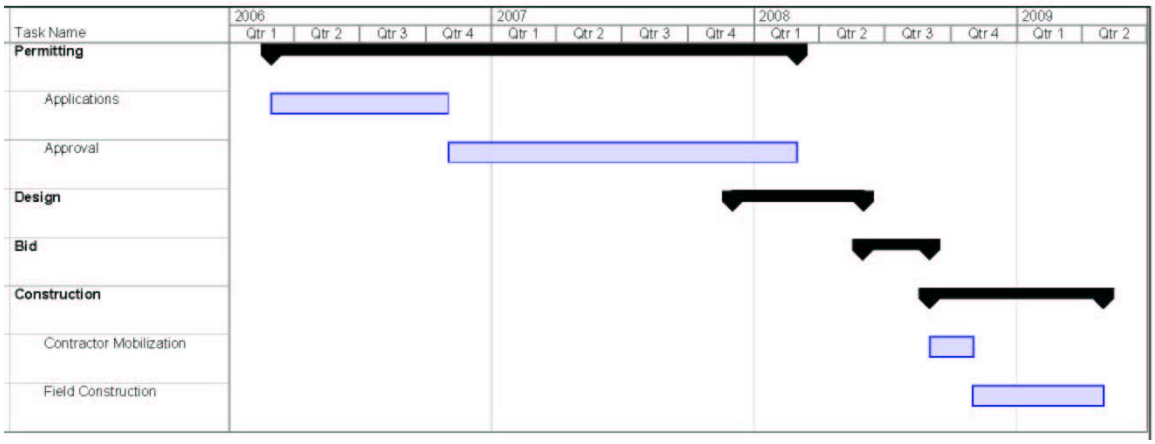
**Table D-1 Summary of Permit Requirements Interim Solutions**

| Agency | Permit or Requirement | Authority | Cause for Permitting Action | Time Frame |
|---|---|---|---|---|
| US Army Corps of Engineers (the Corps) | §404 Permit<br><br>§10 Permit | Clean Water Act<br><br>River and Harbors Act | Lake Merced is a part of the "waters of the United States". The status of the Vista Grande canal is unclear but it may also be considered a part of the "waters of the United States". The Diversion to Impound Lake and the Diversion to South Lake would require modifications to the canal, and all three interim solutions would require the installation of erosion control devices on the banks of Impound Lake, triggering a permit from the Corps. | 4-6 months – Individual Permit<br>45-60 days - Nationwide Permit<br><br>An additional year or more if a biological opinion is required |
| US Fish and Wildlife Service | §7 Consultation | Endangered Species Act | The area around the Vista Grande canal may contain the appropriate habitat for endangered species. The Corps will consult with USFWS during the permit process. If endangered species or their habitat are believed to be affected, USFWS will prepare a biological opinion under a §7 Consultation. | 1-3 years |
| San Francisco Regional Water Quality Control Board (RWQCB) | §401 Permit - Water Quality Certification | Clean Water Act §401 | Under §401 of the Clean Water Act, any activity subject to a permit from a federal agency must be by the appropriate state that the activity meets all state water quality standards. Since all of the interim solutions would likely require a permit from the Corps a §401permit would be required. | 60 days after application is deemed complete. Up to one year of additional time may be requested from the Corps. |
| | §402 Permit - NPDES: General Construction Activity Storm Water Permit | Clean Water Act §402 | Required for any construction activity that disturbs more than five acres of land, or if the overall program disturbs more than five acres of land. While each of the proposed interim solutions would not disturb more than five acres of land, these interim solutions could be permitted as part of the overall watershed study. If this was the case, a General Construction Activity Storm Water Permit would be required. | Approximately six months |

| | | | | |
|---|---|---|---|---|
| California Department of Fish and Game (CDFG) | Streambed Alteration Agreement (§1602 permit) | Fish and Game Code §1602 | Required before undertaking any activity that will significantly change any river, stream, or lake. The jurisdiction of CFG includes the Vista Grande canal and Lake Merced so any of the proposed interim solutions would require a streambed alteration agreement. | 30 days after application submittal to evaluate completeness; 60 days after application is deemed complete. |
| California Coastal Commission (CCC) and/or Local Coastal Programs (LCPs) | Coastal Development Permit or Public Works Plan | California Coastal Act of 1976; Federal Coastal Zone Management Act | Required for any development in the coastal zone. The coastal zone begins at the shoreline and extends from 500 yards to 5 miles inland. The coastal zone extends around Lake Merced and includes the Vista Grande canal Area. | Six months to two years |

Since all three of the interim solution options allow untreated storm water to continue to flow directly into Lake Merced, they will be most easily permitted if they are presented as part of a long-term program that will eliminate the discharge of untreated storm water to Lake Merced. As shown in Table D-3, the permitting requirements for any of the interim solutions are extensive.

## *Implementation Schedule*




The schedule includes time necessary for preparing permit applications, obtaining permit approval, design, bidding and construction. Design should begin approximately three quarters of the way through permit approval because regulatory agencies generally require a portion of design to be complete before granting final approval. The remaining tasks are dependent upon the previous tasks being complete before they can begin.

Assuming permitting begins in February 2006, this schedule would result in four rainy seasons of potential flooding (2005, 2006, 2007 and 2008) with construction complete in summer of 2009. Permitting would require an estimated 2 years, including time to prepare permit applications and gain approval. Design is expected to take 6 months, bidding 3 months and 8 months for construction.

## Project Cost

The estimated cost to implement Alternative 1 is about$2,144,000. Table D-2 is a cost breakdown for this alternative. The cost estimate includes environmental compliance, mitigation of environmental

impacts, and design and permitting and construction costs. Construction cost includes removing rip rap and restoring the banks of Impound Lake after implementation of a long term solution. A 30% contingency has been added to the construction cost and is typical for conceptual design level cost estimates. Operation and maintenance costs are not included in the cost estimate.

**Table D-2 Impound Lake Diversion Alternative Cost Estimate**

| Item | Unit | Unit Cost | No. Units | Total |
|---|---|---|---|---|
| Weir Structure | LS | $ 113,390 | 1 | $ 113,390 |
| Outlet Structure | LS | $ 57,500 | 1 | $ 57,500 |
| 48" RCP | LF | $ 476,350 | 1 | $ 476,350 |
| Road Restoration | LS | $ 89,040 | 1 | $ 89,040 |
| Bank Restoration | LS | $ 69,200 | 1 | $ 69,200 |
| Mobilization/Demobilization, Bonds and Insurance (10%) | LS | $ 80,550 | 1 | $ 80,550 |
| Temporary Erosion Control (2%) | LS | $ 16,110 | 1 | $ 16,110 |
| Traffic Control (1%) | LS | $ 8,050 | 1 | $ 8,050 |
| Construction Engineering (5%) | LS | $ 40,270 | 1 | $ 40,270 |
| Subtotal | | | | $ 950,460 |
| Contingency (30%) | LS | $ 285,140 | 1 | $ 285,140 |
| Construction Cost Estimate | | | | $ 1,235,600 |
| Environmental Compliance | LS | $ 500,000 | 1 | $ 500,000 |
| Mitigation | AC | $ 250,000 | 0.15 | $ 37,500 |
| Engineering and Permitting (30%) | LS | $ 370,680 | 1 | $ 370,680 |
| **Total Capital Cost Estimate** | | | | **$ 2,143,780** |

## Benefits and Limitations

Alternative 1, Impound Lake Diversion, addresses safety concerns and bank erosion issues by preventing the flooding of John Muir Drive during a 10-year storm event. This alternative requires a relatively low capital cost (significantly lower than Alternative 2) and the loss of habitat of about .04 acres is considerably lower than the other two alternatives. Assuming mitigation requirements of 3:1, this alternative would require about 0.15 acres of mitigation.

This alternative would take approximately 3 to 3½ years to implement, which would mean at least four rainy seasons without protection or addressing safety concerns. There would be a loss of a small amount of habitat at Impound Lake, but there is documentation, (SFRPD, 2005) that the habitat at Impound Lake is of higher value than the habitat at South Lake. The impacts of discharging storm water with higher than ambient levels of coliform, nutrients and some metals and other pollutants will need to be addressed in the permitting/environmental compliance process. This alternative is not compatible with the long term solutions and therefore would be abandoned when a long term solution is implemented.

### D.1.3 Alternative 2 – Diversion to South Lake

**Figure D-6 Overview of Alternative 2, Diversion to South Lake**

#### *Description*

Alternative 2, Diversion to South Lake, would divert flow in excess of the tunnel capacity to South Lake via a concrete overflow structure installed in Vista Grande canal, 27 rows of 2 feet x 5 feet box culverts under John Muir Drive and a concrete outlet structure at South Lake. To avoid conflict between the proposed box culverts and an existing 10 feet x 24 feet combined sewer box, John Muir Drive would have to be raised between one and 2.5 feet for a length of approximately 440 feet. The banks of South Lake below the outlet structure would be lined with rip rap to the normal lake level to prevent erosion. Figure D-7 through Figure D-9 are schematic diagrams of the required facilities for this alternative.

**Figure D-7 Section View of Alternative 2**

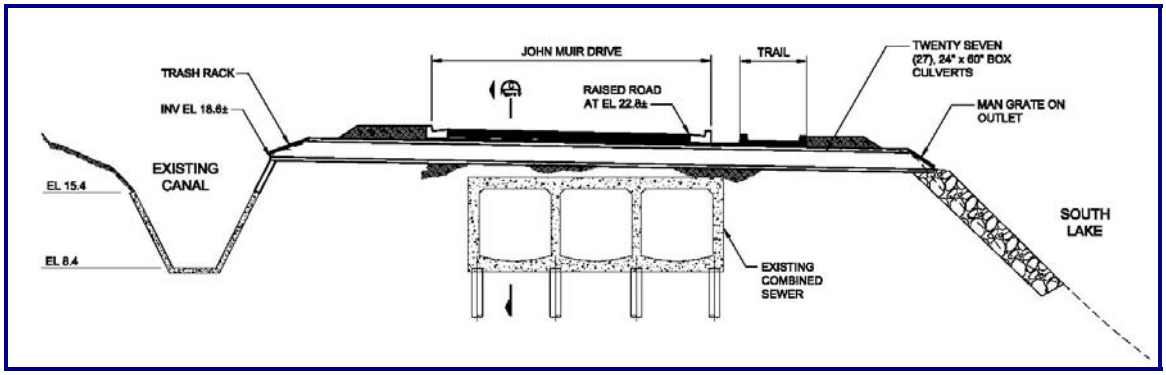


**Figure D-8 Overflow and outlet structure**

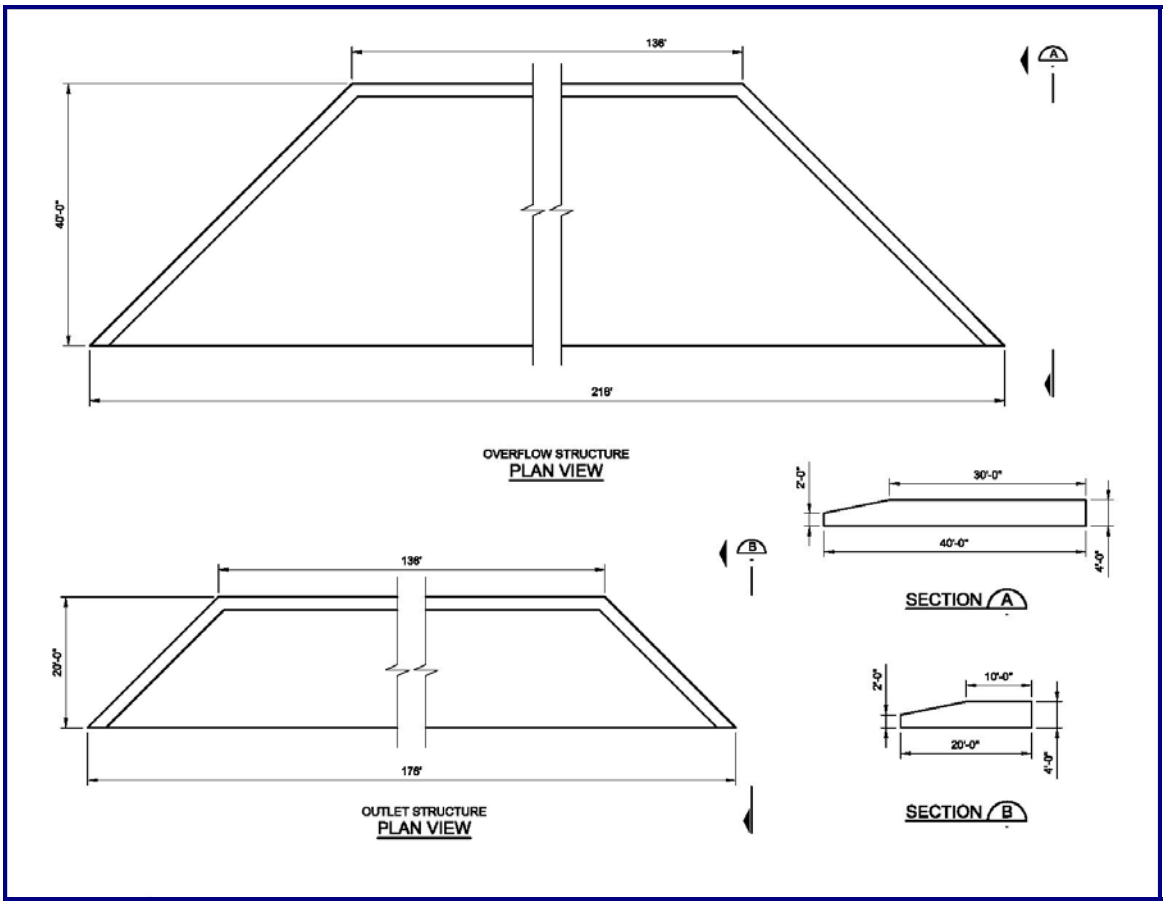
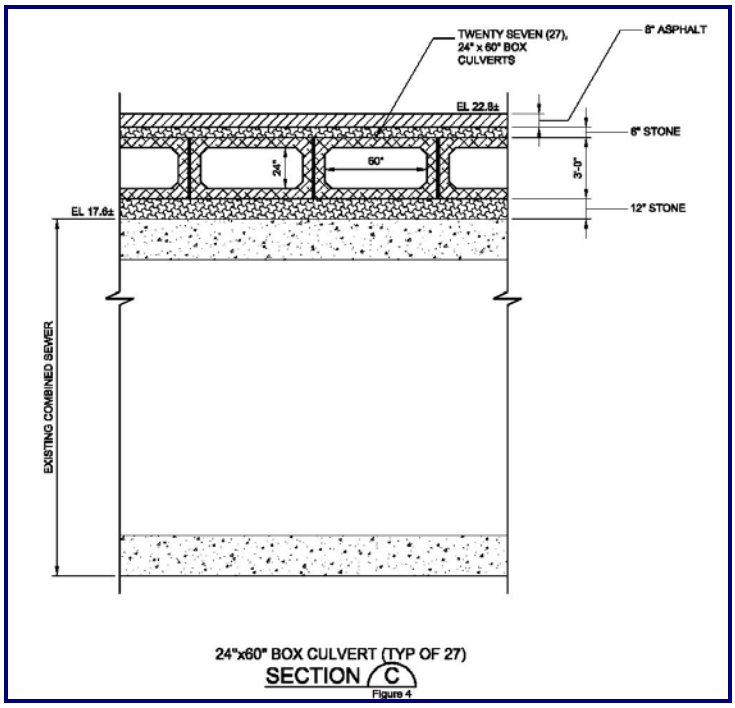



**Figure D-9 Section view through the existing combined sewer and proposed box culverts.**



### Hydraulic Analysis

It is assumed that a maximum of 170 cfs will be conveyed through the canal regardless of water depth because of the capacity restriction of the downstream tunnel. If the proposed overflow structure is installed at an elevation higher than the minimum water level required in the channel to carry 170 cfs (assuming no downstream restrictions) and low enough to keep the water level below the roadway during a 10-year storm event, then roadway flooding will be eliminated.

The elevation of the overflow structure in the canal would be set at approximately 18.6 feet, which is the lowest possible elevation that would allow installation of the box culverts while avoiding the existing combined sewer box. The level of the existing road at its lowest point (the natural overflow location) is approximately 20.5 feet. When the water level (hydraulic grade line) in the canal rises above 18.6 feet, flow in excess of 170 cfs would be diverted through the outlet structure to South Lake via the box culverts. In order to carry 510 cfs, the water depth in the box culverts would be about one foot. At this depth, the hydraulic grade line would be 19.6 feet, which is below the elevation of the road's lowest point; therefore, the roadway would not flood.

In order to be effective, this alternative should be installed at the natural overflow location (lowest point in the roadway), because if it is installed at another location where the roadway is higher, there is a possibility that the road would still flood at the natural overflow location.

### Permitting and Regulatory Requirements

Each Interim Solution Option is expected to trigger regulatory involvement from several state and federal agencies. Table D-3 summarizes the permitting requirements that have been identified for the proposed interim solutions.

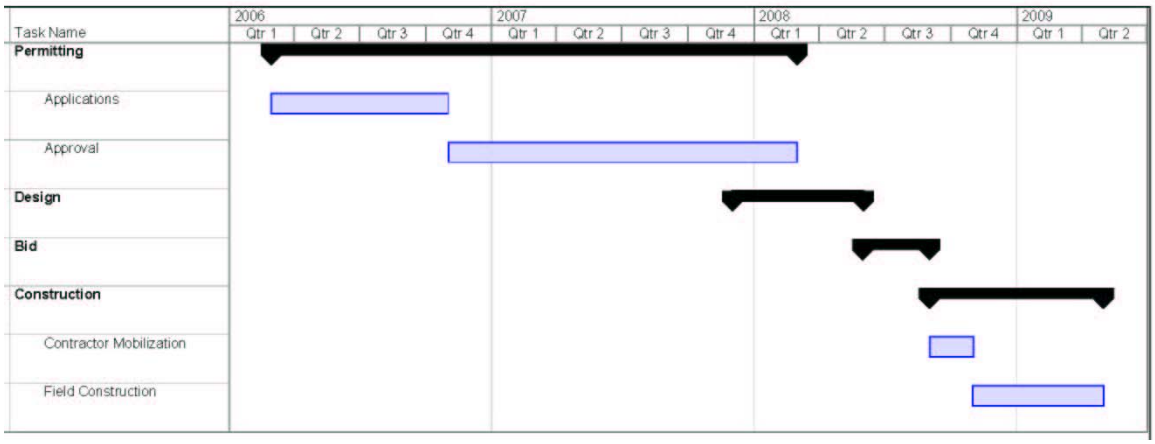
**Table D-3 Summary of Permit Requirements Interim Solutions**

| Agency | Permit or Requirement | Authority | Cause for Permitting Action | Time Frame |
|---|---|---|---|---|
| US Army Corps of Engineers (the Corps) | §404 Permit<br><br>§10 Permit | Clean Water Act<br><br>River and Harbors Act | Lake Merced is a part of the "waters of the United States". The status of the Vista Grande canal is unclear but it may also be considered a part of the "waters of the United States". The Diversion to Impound Lake and the Diversion to South Lake would require modifications to the canal, and all three interim solutions would require the installation of erosion control devices on the banks of Impound Lake, triggering a permit from the Corps. | 4-6 months – Individual Permit<br>45-60 days - Nationwide Permit<br><br>An additional year or more if a biological opinion is required |
| US Fish and Wildlife Service | §7 Consultation | Endangered Species Act | The area around the Vista Grande canal may contain the appropriate habitat for endangered species. The Corps will consult with USFWS during the permit process. If endangered species or their habitat are believed to be affected, USFWS will prepare a biological opinion under a §7 Consultation. | 1-3 years |
| San Francisco Regional Water Quality Control Board (RWQCB) | §401 Permit - Water Quality Certification | Clean Water Act §401 | Under §401 of the Clean Water Act, any activity subject to a permit from a federal agency must be by the appropriate state that the activity meets all state water quality standards. Since all of the interim solutions would likely require a permit from the Corps a §401permit would be required. | 60 days after application is deemed complete. Up to one year of additional time may be requested from the Corps. |
| | §402 Permit - NPDES: General Construction Activity Storm Water Permit | Clean Water Act §402 | Required for any construction activity that disturbs more than five acres of land, or if the overall program disturbs more than five acres of land. While each of the proposed interim solutions would not disturb more than five acres of land, these interim solutions could be permitted as part of the overall watershed study. If this was the case, a General Construction Activity Storm Water Permit would be required. | Approximately six months |

| | | | | |
|---|---|---|---|---|
| California Department of Fish and Game (CDFG) | Streambed Alteration Agreement (§1602 permit) | Fish and Game Code §1602 | Required before undertaking any activity that will significantly change any river, stream, or lake. The jurisdiction of CFG includes the Vista Grande canal and Lake Merced so any of the proposed interim solutions would require a streambed alteration agreement. | 30 days after application submittal to evaluate completeness; 60 days after application is deemed complete. |
| California Coastal Commission (CCC) and/or Local Coastal Programs (LCPs) | Coastal Development Permit or Public Works Plan | California Coastal Act of 1976; Federal Coastal Zone Management Act | Required for any development in the coastal zone. The coastal zone begins at the shoreline and extends from 500 yards to 5 miles inland. The coastal zone extends around Lake Merced and includes the Vista Grande canal Area. | Six months to two years |

Since all three of the interim solution options allow untreated storm water to continue to flow directly into Lake Merced, they will be most easily permitted if they are presented as part of a long-term program that will eliminate the discharge of untreated storm water to Lake Merced. As shown in Table D-3, the permitting requirements for any of the interim solutions are extensive.

## *Implementation Schedule*




The schedule for Alternative 2 is identical to the schedule for Alternative 1 because the projects are similar. The implementation schedule includes time necessary for preparing permit applications, obtaining permit approval, design, bidding and construction. Design should begin approximately three quarters of the way through permit approval because regulatory agencies generally require a portion of the design to be complete before granting final permit approval. The remaining tasks are dependent upon the previous tasks being complete before they can begin.

Assuming permitting begins in February 2006, this schedule would result in four rainy seasons of potential flooding (2005, 2006, 2007 and 2008) with construction complete in summer 2009. Permitting would require an estimated 2 years, including time to prepare permit applications and gain approval. Design is expected to take 6 months, bidding 3 months and 8 months for construction.

## Project Cost

The estimated cost to implement Alternative 2 is about $10,716,000. Table D-4 below is a cost breakdown for this alternative. The cost estimate includes environmental compliance, mitigation of environmental impacts, and design and permitting and construction costs. Construction cost includes removing rip rap and restoring the bank of South Lake after implementation of a long term solution. A 30% contingency has been added to the construction cost and is typical for conceptual design level cost estimates. Operation and maintenance costs are not included in the cost estimate.

**Table D-4 South Lake Diversion Alternative Cost Estimate**

| Item | Unit | Unit Cost | No. Units | Total |
|---|---|---|---|---|
| Wingwall/Overflow Structure | LS | $ 397,600 | 1 | $ 397,600 |
| Outlet Structure | LS | $ 209,900 | 1 | $ 209,900 |
| 5'x2' Box Culverts | LS | $1,675,070 | 1 | $ 1,675,070 |
| Road Restoration | LS | $1,432,200 | 1 | $ 1,432,200 |
| Bank Restoration | LS | $1,032,000 | 1 | $ 1,032,000 |
| Mobilization/Demobilization, Bonds and Insurance (10%) | LS | $ 474,680 | 1 | $ 474,680 |
| Temporary Erosion Control (2%) | LS | $ 94,940 | 1 | $ 94,940 |
| Traffic Control (1%) | LS | $ 47,470 | 1 | $ 47,470 |
| Construction Engineering (5%) | LS | $ 237,340 | 1 | $ 237,340 |
| Subtotal | | | | $ 5,601,200 |
| Contingency (30%) | LS | $1,680,360 | 1 | $ 1,680,360 |
| Construction Cost Estimate | | | | $ 7,281,560 |
| Environmental Compliance | LS | $ 500,000 | 1 | $ 500,000 |
| Mitigation | AC | $ 250,000 | 3 | $ 750,000 |
| Engineering and Permitting (30%) | LS | $2,184,470 | 1 | $ 2,184,470 |
| Total Capital Cost Estimate | | | | $ 10,716,030 |

## Benefits and Limitations

Alternative 2, South Lake Diversion would address safety concerns and bank erosion issues by preventing flooding of John Muir Drive during a 10-year storm event. This option would essentially allow water to go where it naturally goes today, but it would flow under the road in a controlled manner rather than over the road.

The limitations of this alternative are significant. First, it would take 3 to 3 ½ years to implement this alternative, which means at least four rainy seasons without protecting the roadway or the banks, and without addressing public safety concerns. Second, the capital cost is very high and the facility would be abandoned when long term solutions are in place. Finally, loss of habitat would be approximately 0.92 acres, which is a significant impact considering the quality of habitat surrounding Lake Merced. Mitigation would be required at a 3:1 ratio, or approximately 3 acres. As with all interim solutions, the impacts of discharging storm water with higher than ambient levels of coliform, nutrients and some metals and other pollutants will need to be addressed in the permitting/environmental compliance process.

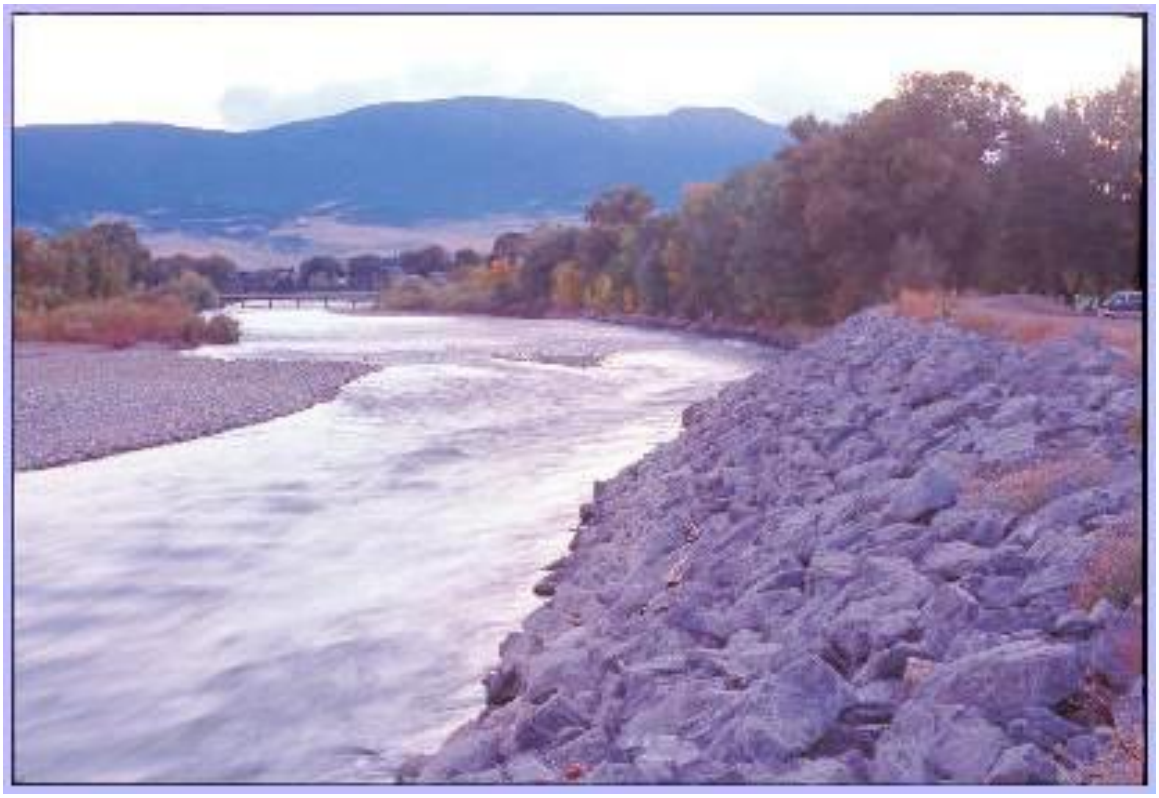
### D.1.4 Alternative 3 – Rip Rap at South Lake

**Figure D-10** ***Overview of Alternative 3, Rip Rap at South Lake***

#### *Description*

Alternative 3, Rip Rap at South Lake would consist of armoring the banks of South Lake with rip rap where overflows presently occur. The width of rip rap would be approximately 300 feet along John Muir Drive and extend from the roadway to normal lake level. After implementation of a long term solution, the rip rap would be removed and the banks would be restored. Figure D-11 shows an installation of rip rap similar to what would be proposed under this alternative.

**Figure D-11 Typical rip rap installation to protect the banks of a waterway.**



## Hydraulic Analysis

Preliminary hydraulic analysis based on the existing roadway profile indicates that the flow path when John Muir Drive is flooded during a 10-year storm event is approximately 300 feet wide. Rip rap would be installed on the banks of South Lake for the width of the flow path. Storm water would overtop the roadway and flow to the lake as it does currently.

## Permitting and Regulatory Requirements

Each Interim Solution Option is expected to trigger regulatory involvement from several state and federal agencies. Table D-3 summarizes the permitting requirements that have been identified for the proposed interim solutions.

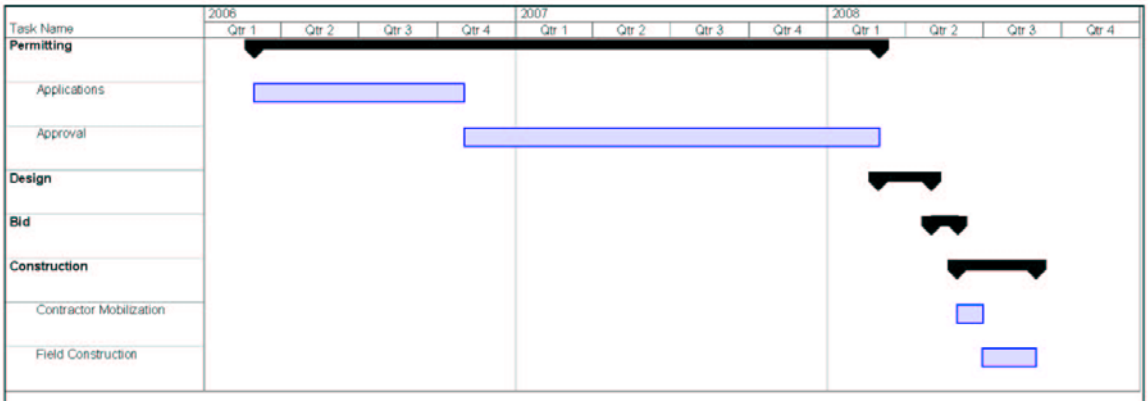
**Table D-5 Summary of Permit Requirements Interim Solutions**

| Agency | Permit or Requirement | Authority | Cause for Permitting Action | Time Frame |
|---|---|---|---|---|
| US Army Corps of Engineers (the Corps) | §404 Permit<br><br>§10 Permit | Clean Water Act<br><br>River and Harbors Act | Lake Merced is a part of the "waters of the United States". The status of the Vista Grande canal is unclear but it may also be considered a part of the "waters of the United States". The Diversion to Impound Lake and the Diversion to South Lake would require modifications to the canal, and all three interim solutions would require the installation of erosion control devices on the banks of Impound Lake, triggering a permit from the Corps. | 4-6 months – Individual Permit<br>45-60 days - Nationwide Permit<br><br>An additional year or more if a biological opinion is required |
| US Fish and Wildlife Service | §7 Consultation | Endangered Species Act | The area around the Vista Grande canal may contain the appropriate habitat for endangered species. The Corps will consult with USFWS during the permit process. If endangered species or their habitat are believed to be affected, USFWS will prepare a biological opinion under a §7 Consultation. | 1-3 years |
| San Francisco Regional Water Quality Control Board (RWQCB) | §401 Permit - Water Quality Certification | Clean Water Act §401 | Under §401 of the Clean Water Act, any activity subject to a permit from a federal agency must be by the appropriate state that the activity meets all state water quality standards. Since all of the interim solutions would likely require a permit from the Corps a §401permit would be required. | 60 days after application is deemed complete. Up to one year of additional time may be requested from the Corps. |
| | §402 Permit - NPDES: General Construction Activity Storm Water Permit | Clean Water Act §402 | Required for any construction activity that disturbs more than five acres of land, or if the overall program disturbs more than five acres of land. While each of the proposed interim solutions would not disturb more than five acres of land, these interim solutions could be permitted as part of the overall watershed study. If this was the case, a General Construction Activity Storm Water Permit would be required. | Approximately six months |

| | | | | |
|---|---|---|---|---|
| California Department of Fish and Game (CDFG) | Streambed Alteration Agreement (§1602 permit) | Fish and Game Code §1602 | Required before undertaking any activity that will significantly change any river, stream, or lake. The jurisdiction of CFG includes the Vista Grande canal and Lake Merced so any of the proposed interim solutions would require a streambed alteration agreement. | 30 days after application submittal to evaluate completeness; 60 days after application is deemed complete. |
| California Coastal Commission (CCC) and/or Local Coastal Programs (LCPs) | Coastal Development Permit or Public Works Plan | California Coastal Act of 1976; Federal Coastal Zone Management Act | Required for any development in the coastal zone. The coastal zone begins at the shoreline and extends from 500 yards to 5 miles inland. The coastal zone extends around Lake Merced and includes the Vista Grande canal Area. | Six months to two years |

Since all three of the interim solution options allow untreated storm water to continue to flow directly into Lake Merced, they will be most easily permitted if they are presented as part of a long-term program that will eliminate the discharge of untreated storm water to Lake Merced. As shown in Table D-3, the permitting requirements for any of the interim solutions are extensive.

## Implementation Schedule




The schedule above includes time necessary for preparing permit applications, obtaining permit approval, design, bidding and construction. All of these tasks rely upon the task ahead of them being complete before they can begin. Design for this project should not begin until permit approval has been granted because the design is simple and straightforward. Permitting should be accomplishable without formal design drawings and there is no reason to begin design until it is certain that the project can be built.

Assuming permitting begins in February 2006, this schedule would result in three seasons of potential flooding (2005, 2006, and 2007) with construction being complete in summer 2008. Permitting would require an estimated 2 years including time to prepare permit applications and gain approval. Design is expected to take 2 months, bidding 1 months and 3 months for construction.

## Project Cost

The estimated cost to implement Alternative 3 is about $3,571,000. Table D-6 is a cost breakdown for this alternative. The cost estimate includes environmental compliance, mitigation of environmental impacts, design and permitting and construction costs. Construction cost includes removing rip rap and restoring the bank of South Lake after implementation of a long term solution. A 30% contingency has

been added to the construction cost and is typical for conceptual design level cost estimates. Operation and maintenance costs are not included in the cost estimate.

**Table D-6 Rip Rap at South Lake Cost Estimate**

| Item | Unit | Unit Cost | No. Units | Total |
|---|---|---|---|---|
| Grading | LS | $ 20,000 | 1 | $ 20,000 |
| Rip Rap Placement | SY | $ 148 | 6667 | $ 986,720 |
| Bank Shaping and Plantings | SF | $ 2 | 4000 | $ 8,000 |
| Mobilization/Demobilization, Bonds and Insurance (10%) | LS | $ 100,670 | 1 | $ 100,670 |
| Temporary Erosion Control (2%) | LS | $ 20,130 | 1 | $ 20,130 |
| Traffic Control (1%) | LS | $ 10,070 | 1 | $ 10,070 |
| Construction Engineering (5%) | LS | $ 50,340 | 1 | $ 50,340 |
| Subtotal | | | | **$ 1,195,930** |
| Contingency (30%) | LS | $ 358,780 | 1 | $ 358,780 |
| Construction Cost Estimate | | | | **$ 1,554,710** |
| Environmental Compliance | LS | $ 500,000 | 1 | $ 500,000 |
| Mitigation | AC | $ 250,000 | 4.2 | $ 1,050,000 |
| Engineering and Permitting (30%) | LS | $ 466,410 | 1 | $ 466,410 |
| **Total Capital Cost Estimate** | | | | **$ 3,571,120** |

## *Benefits and Limitations*

Installing rip rap at South Lake addresses bank erosion issues related to flooding of John Muir Drive by protecting the soil from being washed away during an overflow. The cost of the project is in the same range as Alternative 1 and is significantly lower than Alternative 2. The implementation period for this alternative is projected to be one year shorter than both Alternatives 1 and 2, but would still require three years to implement.

A significant limitation with this alternative is that it does not address safety concerns associated with flooding of the roadway. The roadway will flood, as it does presently, during a 10-year storm event, posing a safety risk to motorists and pedestrians. This alternative would also require the largest loss of habitat of the three alternatives. A total of 1.38 acres of habitat would be lost, which would require 4.2 acres of mitigation at a 3:1 ratio. As previously mentioned, the impacts of discharging storm water with higher than ambient levels of coliform, nutrients and some metals and other pollutants will need to be addressed in the permitting/environmental compliance process.

# Appendix E - Tunnel South of County Line Supporting Technical Information

# Tunnel South of County Line

# Supporting Technical Information

This appendix contains technical information developed as part of the Tunnel South of County Line alternative. The following information is included in this appendix:

1. Hydrogeology Memorandum, October 5, 2005 – Gus Yates, PG, CHG, developed a memorandum summarizing the available hydrogeology information in regards to the project area. Included in this memorandum were figures detailing groundwater well locations and groundwater model results projecting groundwater surface elevations in March and September of 2003.
2. Hydrogeology Memorandum, November 16, 2005 – Gus Yates provided a second memorandum characterizing the groundwater conditions along the two alignment alternatives. Included in this memorandum were profile drawings of groundwater elevations along each alignment. These drawings were modified and are included as figures in Section 4.2.
3. Basis for Conceptual Costs Estimates Memorandum, October 18, 2005 – Glenn Boyce, PhD, PE, lead the Jacobs Associates project team in developing planning level cost estimates for tunnel Alternatives 1 and 2. The memorandum describes cost assumptions and the work included per each estimate. Also included in the memorandum are detailed cost estimate summaries for each tunnel alternative. The cost estimates prepared by Jacobs Associates served as the basis for the cost estimates presented in Section 5.2. Note that the cost estimates prepared by Jacobs Associates did not include implementation costs or costs for other necessary construction work, such as potential storm drain improvements.
4. John Daly Alignment (Tunnel Alternative 3), Alternate Retrieval Location: Option B, March 9, 2006 – A third tunnel alternative, the John Daly Alignment, was investigated at the request of the City of Daly City. Details for Alternative 3 are presented in the Vista Grande Watershed Study, however an alternate retrieval shaft and inlet location were also investigated. The Option B memo presents details associated with this alternate location.
5. Basis for Conceptual Costs Estimates Memorandum, John Daly Alignment (Alternative 3), January 6, 2006 – Jacobs Associates developed planning level cost estimates for tunnel Alternative 3. The memorandum describes cost assumptions and the work included per the estimate and a detailed cost estimate summary. The cost estimate was developed assuming the use of retrieval Option B and served as the basis for the cost estimates presented in Section 5.2. Note that the cost estimates prepared by Jacobs Associates did not include implementation costs or costs for other necessary construction work, such as potential storm drain improvements.

# MEMORANDUM

Gus Yates, PG, CHg, Consulting Hydrologist • 1809 California Street, Berkeley, CA 94703
tel/fax 510-849-4412 • gusyates@earthlink.net

DATE: 5 October 2005
TO: Kevin Smith, RMC
FROM: Gus Yates, Consulting Hydrologist
SUBJECT: Groundwater Conditions along Proposed New Vista Grande Stormwater Tunnels

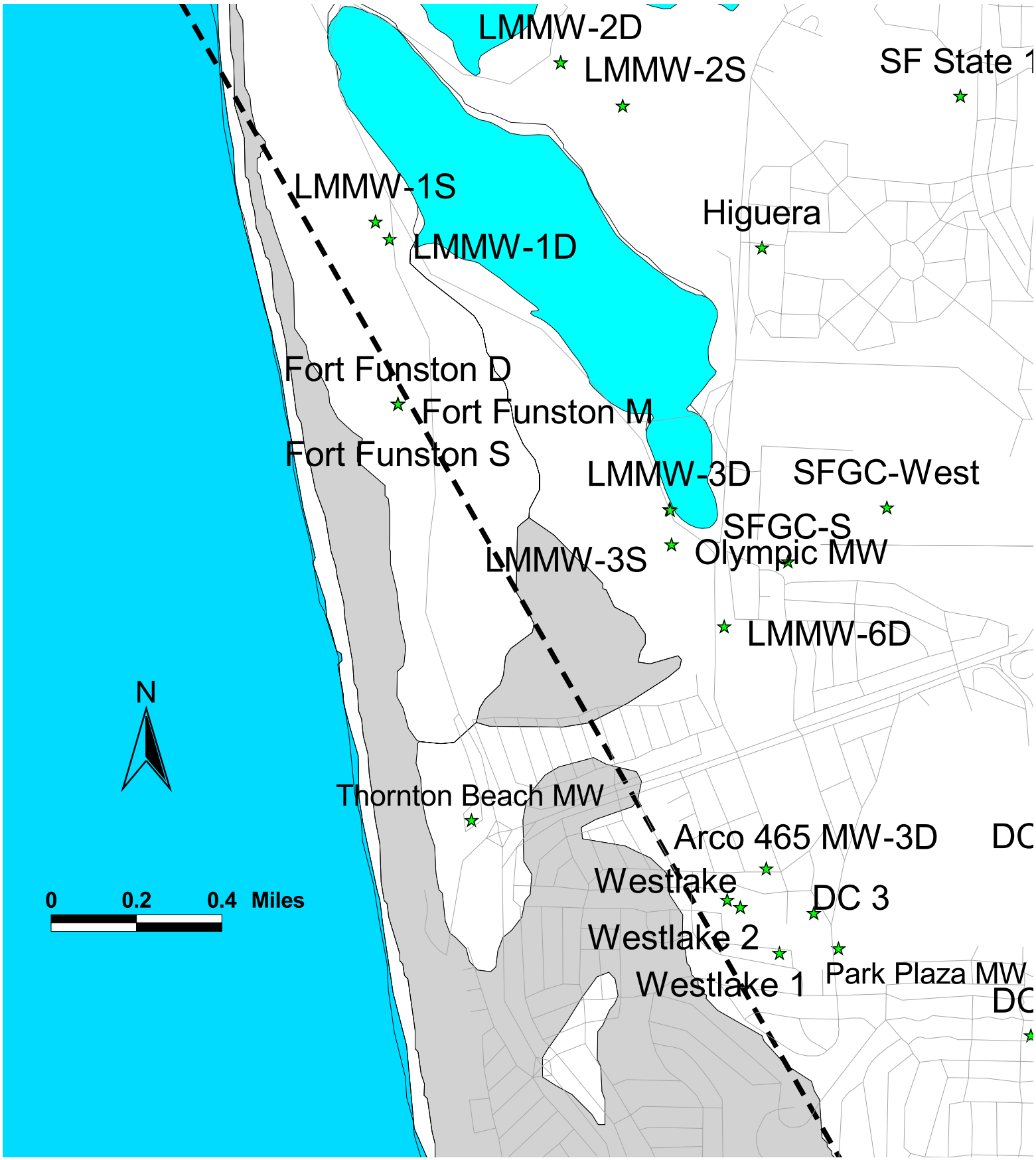
At your request, I am sending some preliminary information regarding groundwater conditions along the proposed alignments for the new Vista Grande stormwater tunnel. Some of the items I am transmitting by e-mail, the rest by surface mail.

A few comments on the materials:

- Well location map (pdf). This figure shows the locations of the wells for which I am also including hydrographs (plus other wells in the vicinity of the Olympic Golf Club). The Serra Fault is shown on the figure as a heavy, black dashed line.
- Hydrographs of measured and simulated groundwater elevations in those wells, in feet above sea level (NGVD 1929) (two pdf files). You'll want to pay attention to shallow wells corresponding to model layer 1, since the tunnel would be in that layer.
- At the east end of the tunnel (near Lake Merced Blvd), groundwater gradients are downward and southward. Near Impound Lake (hydrograph for monitoring well LMMW 3S), groundwater elevation is 6-8 feet above sea level. At the Daly City WWTP, groundwater elevation in a deeper monitoring well (LMMW 6D) is 30-40 feet below sea level.
- Two monitoring wells are present farther west, near Skyline Boulevard. The Fort Funston well cluster is located about 0.5 mile north of the tunnel alignments. The shallow well at this location has water levels about 9 feet above sea level. This well was redeveloped in 2002, and older data are not reliable. The Thornton Beach well cluster is located at the intersection of Skyline Boulevard and John Daly Boulevard, about 0.4 mile south of the tunnel alignments. The shallow well at that location has a water level about 82 feet above sea level.
- Two contour maps of simulated water levels in model layer 1 (the topmost layer) are also enclosed, one for March 2003 and one for September 2003 (two pdf files). The model is still undergoing development, but the general pattern of simulated water levels in this area will likely remain about the same. Generally, it shows that the Serra Fault (zig-zag red line) separates an area of relatively flat groundwater elevations (on the northeast side of the fault) from a ridge of elevated groundwater levels on the southwest side. The southwest side of the fault consists of a tilted and possibly folded block of primarily Merced Formation. This deformation results in low horizontal hydraulic conductivity, which is why the Thornton Beach well has such a high water level. The contours suggest that the water level near the tunnel

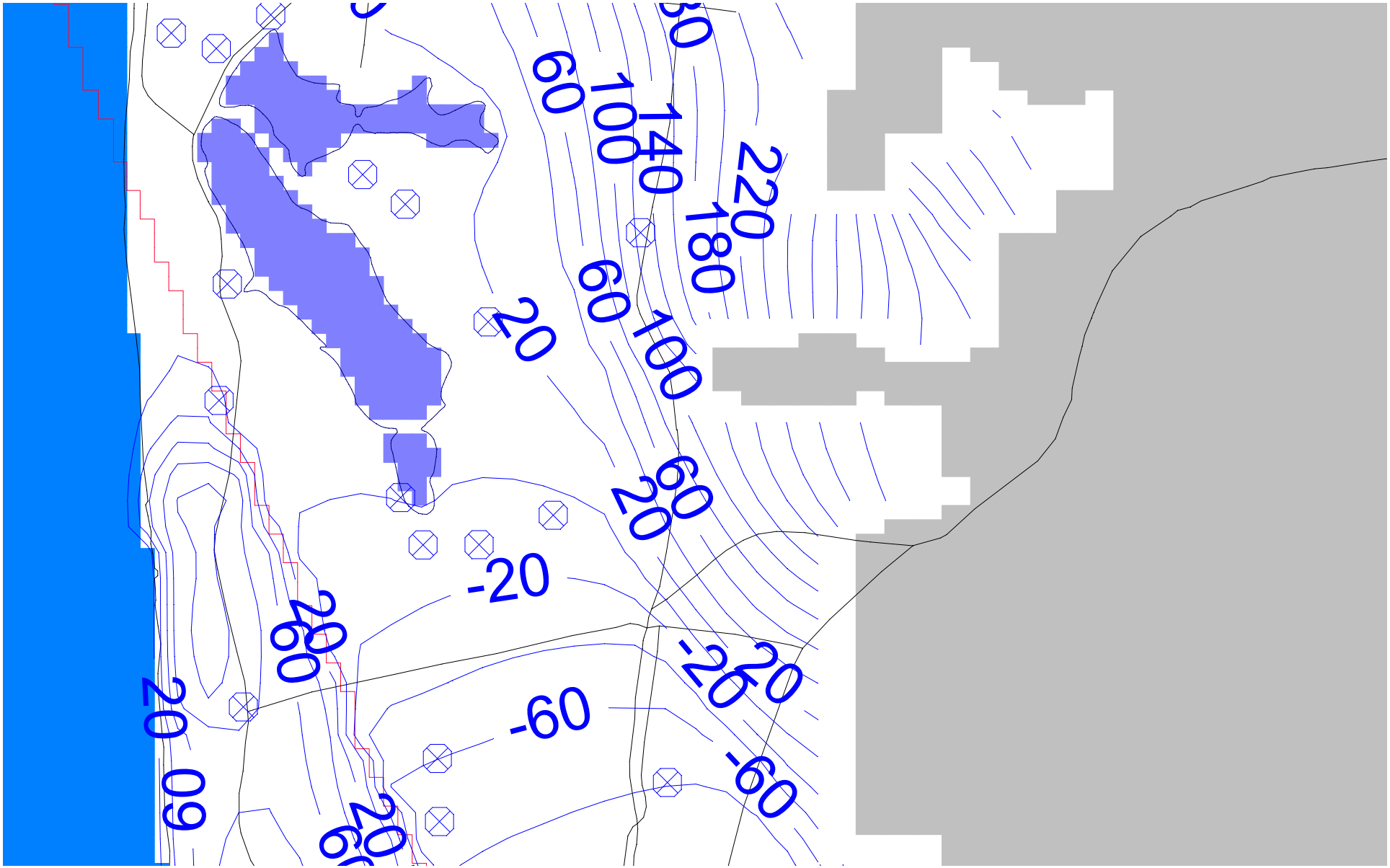
alignments would peak at about 100 feet above sea level in spring and 75 feet above sea level in fall. Actually, I would expect less seasonal variation than indicated here, because of the thick unsaturated zone that attenuates recharge pulses.

- The upshot of all of this is that the east end of the tunnel might be above the water table, but farther to the west it will definitely be below the water table. This transition might not occur until the tunneling reaches the Serra Fault, but it is possible that the water table slopes more uniformly along the alignment and would be encountered in the excavation between the fault and Lake Merced Blvd.
- I am sending various references regarding the Merced Formation and the Serra Fault that may be of use to the geotechnical consultants for the tunneling operation:
    - Drew Kennedy's 2002 masters thesis is the most recent work in the area. Fortunately, I have it as a pdf and will send it on a CD. The key thing to keep in mind is that the Serra Fault appears to be active at a slip rate exceeding 1 mm/yr in this area. The fault is buried but is expressed near the surface as a "vergent" (overturned) fold. The tunnel design should allow for vertical movement on the fault and probably also adjacent deformation.
    - Jennifer Barr's 1999 master's thesis on the Serra Fault (paper copy). She was the first to present the overturned fold hypothesis.
    - Two of numerous articles by Ed Clifton and Ralph Hunter (USGS) on the geology of the Merced Formation as exposed in the cliffs along Ocean Beach (paper copy).
- All of these geologic reports show a large mapped landslide on the bluff face at the ocean end of the tunnel alignment. Presumably, this will have implications for tunel engineering.
- The datum conversion chart from the March 2002 hydrogeologic conceptualization report by Luhdorff and Scalmanini Consulting Engineers (paper copy)

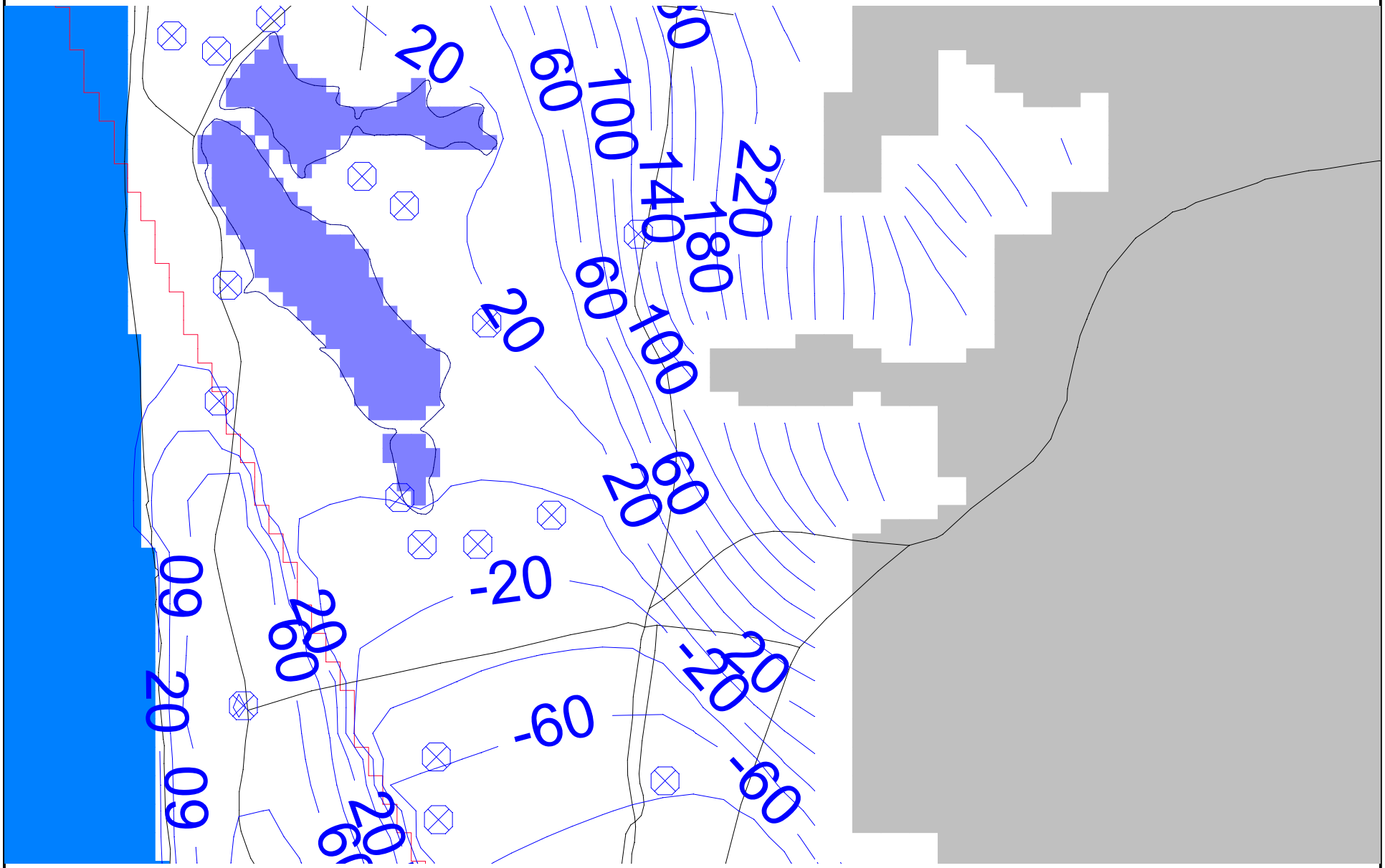



Locations of Wells with Water-Level Data

# Westside Basin Groundwater Model (Draft) Simulation Layer 1 Groundwater Elevation, March 2003



**Westside Basin Groundwater Model (Draft) Simulation Layer 1 Groundwater Elevation, Sept. 2003**



# MEMORANDUM

**Gus Yates, PG, CHg, Consulting Hydrologist • 1809 California Street, Berkeley, CA 94703**
**tel/fax 510-849-4412 • gusyates@earthlink.net**

DATE: 16 November 2005
TO: Kevin Smith, RMC
FROM: Gus Yates, Consulting Hydrologist
SUBJECT: Groundwater Profiles along Proposed New Vista Grande Stormwater Tunnels

I superimposed my estimate of the water table elevation on the profile drawings for the two proposed Vista Grande tunnel alignments (see attached). Please have your graphics department add the following label to the Y axis of the profiles: "Elevation in Feet above San Francisco Datum (-8.62 feet NGVD 1929)". All of my data and modeling use the NGVD 1929 sea level datum, and those values can be converted to the SF datum by subtracting 8.62 feet. This includes the hydrographs and water-level contour maps that accompanied my October 5, 2005 memorandum. For the present exercise, I shifted the water table profiles downward on the cross section diagrams to correspond to the San Francisco datum. With multiple firms and individuals working on this project, it is essential to indicate the datum for all elevation information, or there will be a substantial risk of error in the design and construction process.

The water table profile lines are a bit uneven because I was using the Adobe Acrobat freehand pencil tool, which allows no editing of the line once it is drawn. However, the profiles are consistent with the following geologic and groundwater data:

- There is a large water-level drop across the Serra Fault, which crosses the two profiles about one-third of the way between Skyline Boulevard and the eastern ends of the profiles.

- Simulations with a regional groundwater model suggest that the water table profile is quite flat east of the fault and forms a high mound west of the fault, dropping steeply to a seepage face near the toe of the beach bluff cliffs.

- The closest monitoring wells used to calibrate the model are the Thornton Beach monitoring well cluster, the Fort Funston monioring well cluster, LMMW-1S, LMMW-3S and -3D, and LMMW-6D. My October 5 memorandum included a map showing the locations of the wells and fault.

- The Thornton Beach and Fort Funston wells are west of the fault and substantiate the considerable water table mounding that occurs in the deformed Merced Formation beds west of the fault. Interpolating between the well locations with the assistance of the groundwater model suggests a water table elevation of 60-65 feet (NGVD 1929) at the crest of the mound.

- East of the fault, the regional water table slopes southward toward a major pumping depression in the Westlake area. Shallow clay layers that support the shallow aquifer become discontinuous somewhere between Impound Lake and John Daly Boulevard. As the clays become discontinuous, the downward slope steepens and the water table plunges to an elevation of approximately 100 feet below sea level (NGVD 1929) in the Westlake area. The exact shape of the water table as it slopes southward is poorly known. However, the water table is certainly lower at the eastern end of tunnel profile 2 (Senior Center) than at the eastern end of tunnel profile 1 (John Muir Drive). On the profiles, it appears that the tunnel inverts would be above the water table elevation at the eastern ends of both profiles, but only by a couple of feet for profile 1.

- My profiles show the water table rising only very gradually between the east ends of the profiles and the Serra Fault. No monitoring wells are available in this interval, and it is quite possible that the water table rises more steeply.

- The Serra Fault is more deeply buried and appears to have less offset along this northern segment compared to its more obvious surface exposures in the San Bruno area. Two recent masters theses have investigated this segment of the fault (Barr 1999, Kennedy 2002) and characterize it as a blind (buried) thrust fault expressed at the surface as steep "vergent" folds. The effect of folding on the water table profile would likely be spread out more broadly than the effect of a fault plane. This suggests that the groundwater model simulates too abrupt a water-level drop across the fault, and that the water table might slope more uniformly from the crest of the mound eastward toward the eastern ends of the profiles.

- My general conclusions are that the tunneling operation might be above the water table at the eastern end (with a higher probability of dry conditions for the southern alignment), but that it would encounter the water table at most about halfway to the coast, and possibly sooner.

JACOBS ASSOCIATES

Engineers/Consultants

# PROJECT MEMORANDUM

**To:** Glenn M. Boyce

**From:** Paul W. Dutton and John M. Stolz

**Date:** October 18, 2005

**Job No.:** 3957 Vista Grande Tunnel

**Subject:** Basis for Conceptual Cost Estimates

---

The purpose of this memorandum is to set forth the basis for developing the subject conceptual cost estimates.

Estimates were prepared for two alternatives:

1. Alternate 1 – Intake Structure at Intersection of John Muir Drive and Lake Merced Blvd. This alternate is estimated to cost $39.5M and require an 18-month construction period.
2. Alternate 2 – Intake Structure in Parking Lot of Westpark Community Center. This alternate is estimated to cost $43.5 M and require a 21-month construction period.

Estimated costs represent the current expected low bid for construction, and include a 30 percent allowance for contingency. This relatively high amount of contingency is intended to reflect the low level of project definition, the current bidding climate in the underground construction industry, and the recent volatility in material prices for such items as steel and cement. The estimates do not include the following:

- Escalation; however the estimates include a memo entry for escalation calculated to the time of expenditure.
- Design and construction management fees.
- Right-of-way and land acquisition.
- Cost for preparing an Environmental Impact Report and obtaining permits.
- Other costs that may be incurred by the City of Daly City and San Francisco PUC, including any allowances for change orders executed during construction.

The cost estimates were prepared using all available information, with judicial assessments where no information was available, and comprise production-type cost estimating methods:

- Current prevailing labor rates were taken from California Department of Industrial Relations and are fully burdened rates, including payroll taxes and insurance, and worker's compensation and commercial general liability insurance.

- Equipment rates were developed using the current US Army Corps of Engineers *Construction Equipment Ownership and Operating Expense Schedule (Region VII)*, published in 2003 for the western states.
- Material and subcontract costs are based on current market prices. Quotes were obtained for large items such as bolted, gasketed tunnel segments.

Work common to both Alternatives involved construction of the following:

- A 32-foot diameter Access Shaft sized to permit subsequent tunneling, and construction of a permanent inlet structure.
- A 15-foot ID tunnel, 4,750- and 4,900- linear foot long for Alternates 1 and 2, respectively. Since the water table is expected to be above the tunnel, construction was based on the use of an Earth Pressure Balance Tunnel Machine so that the alignment would not require dewatering. The tunnel was estimated to be supported using bolted, gasketed precast concrete segments, thereby eliminating the need for a final cast-in-place concrete lining. Tunnel muck (i.e., spoils) was estimated to be disposed of on local beaches (within 10 miles) as remediation material with no associated dump fees.
- An Outlet Structure. Due to the lack of beach access, construction was estimated to be staged entirely from within the tunnel. The concrete structure was estimated to be founded on mini-piles, socketed into the rock face, and equipped with a steel grate and sand pocket.
- A cast-in-place concrete Inlet Structure.

Alternate 1 includes a temporary diversion structure to handle up to 680 cfs of flows into the canal along John Muir Drive for the entire contract period.

Alternate 2 includes the following additional work:

- Construction of a 550-foot-long microtunnel between the new Inlet Structure and a tie-in point to a 60-inch storm drain located on Cliffside Dr. This work includes construction of an access shaft over the tie-in location used to recover the microtunneling machine and affect the tie-in.
- Construction of approximately 300 linear feet of box culvert connecting a tie-in with the existing 7 foot by 6 foot box culvert along Lake Merced Blvd and the new Inlet Structure.

Not included in the Alternate 2 cost estimate is the cost of a small pump station to pump any flows collecting in the existing canal back to the Westpark Community Center.

**Jacobs Associates ♦ Engineers/Consultants**
**San Francisco ♦ Los Angeles ♦ San Diego ♦ Seattle ♦ Portland**

| Project | Client | Job No. | Estimator | Rev | Date |
|---|---|---|---|---|---|
| **Vista Grande Tunnel** | **RMC** | **3957.0** | **PD/JS** | **0** | **10/11/2005** |

**Conceptual Cost Estimate - Alternate 1 Tunnel Portal at Corner of John Muir and Lake Merced Blvd.**

## SUMMARY OPINION OF PROBABLE CONSTRUCTION BID WITH OWNER CONTINGENCY

| No. | Item or Group Item Description | Item Quantity/Unit | Item Unit Cost | Status | Item Cost |
|---|---|---|---|---|---|
| 001 | Clear/Grub Inlet Structure Site | LS | | | $5,000 |
| 002 | Excavate/Support Access Shaft/Diversion Str | LS | | | $391,208 |
| 003 | Pregrout Shaft Portal | 1,200 cf | $27.86 /cf | | $33,431 |
| 004 | Fit out Shaft Tunneling Plant | LS | | | $41,491 |
| 005 | Assemble EPBM and Backup | LS | | | $237,746 |
| 006 | Excavate/Support Tunnel | 4,750 lf | $3,262 /lf | | $15,496,775 |
| 007 | Disassemble EPBM / Backup through Tunnel | LS | | | $334,334 |
| 008 | Construct Outlet Structure | 277 cy | $1,312 /cy | | $363,329 |
| 009 | Remove Tunnel Services | LS | | | $33,654 |
| 010 | Construct Inlet Structure | 480 cy | $559 /cy | | $268,136 |
| 011 | Backfill Temp. Diversion and Effect Tie-in | LS | | | $59,361 |
| 012 | Restore Site | LS | | | $7,500 |
| | | | **Subtotal Direct Cost** | | **$17,271,964** |
| 013 | Equipment Ownership/Mobilization | | 19.3% of cost | | $5,872,643 |
| 014 | General Mobilization | Total 3.6% of unescalated cost | 2.8% of cost | | $847,859 |
| 015 | Demobilization | | 0.9% of cost | | $260,600 |
| 016 | General Plant Operation and Maintenance | 13.5 mo | $11,539 /mo | | $155,775 |
| 017 | Weekend Maintenance | 53 day | $3,827 /day | | $202,847 |
| 018 | Field Supervision | 18.3 mo | $102,672 /mo | | $1,878,904 |
| 019 | Overhead Maintenance and Service | 18.3 mo | $17,179 /mo | | $314,371 |
| 020 | Bonds, Insurance, and Taxes not in General Mob | | 1.0% of cost | | $309,725 |
| 021 | Markup | | 9.8% of cost | | $2,980,889 |
| 022 | Financing Charges | | 1.0% of cost | | $309,143 |
| | | | **Subtotal Indirect Cost** | | **$13,132,756** |
| 023 | Escalation-excluded from estimate | $4,560,501 (3.7% composite annual rate) | | | - |
| **February 2009 NTP: 18.3 month duration** | | | **Opinion of Probable Construction Bid** | | **$30,404,721** |

| Cost Componant | Labor | Equipment | Material | Subcontract | Total |
|---|---|---|---|---|---|
| Direct Cost | $3,666,231 | $884,647 | $11,972,170 | $748,916 | $17,271,964 |
| Indirect Cost | $2,130,225 | $5,222,159 | $5,702,673 | $77,700 | $13,132,756 |
| Escalation-excluded from estimate | - | - | - | - | - |
| **Summary Breakdown by Cost Type** | **$5,796,456** | **$6,106,806** | **$17,674,843** | **$826,616** | **$30,404,721** |

| | | | |
|---|---|---|---|
| Owner Contingency | Project definition | 30% of bid | $9,121,416 |
| | **Subtotal Owner Contingency** | **30% of bid** | **$9,121,416** |
| | **Opinion of Probable Construction Bid with Owner Contingency** | | **$39,526,137** |

**Jacobs Associates ♦ Engineers/Consultants**
**San Francisco ♦ Los Angeles ♦ San Diego ♦ Seattle ♦ Portland**

| Project | Client | Job No. | Estimator | Rev | Date |
|---|---|---|---|---|---|
| **Vista Grande Tunnel** | **RMC** | **3957.0** | **PD/JS** | **0** | **10/18/2005** |

**Conceptual Cost Estimate - Alternate 2 Shaft Construction Near Senior Center.**

## SUMMARY OPINION OF PROBABLE CONSTRUCTION BID WITH OWNER CONTINGENCY

| No. | Item or Group Item Description | Item Quantity/Unit | Item Unit Cost | Status | Item Cost |
|---|---|---|---|---|---|
| 001 | Site Preparation at Inlet Structure Location | 1 LS | $15,000 /LS | | $15,000 |
| 002 | Excavate/Support Access Shaft | LS | | | $137,994 |
| 003 | Pregrout Shaft Portal | 1,200 cf | $27.86 /cf | | $33,431 |
| 004 | Fit out Shaft Tunneling Plant | LS | | | $41,491 |
| 005 | Assemble EPBM and Backup | LS | | | $237,746 |
| 006 | Excavate/Support Tunnel | 4,900 lf | $3,292 /lf | | $16,128,854 |
| 007 | Disassemble EPBM / Backup through Tunnel | LS | | | $334,334 |
| 008 | Construct Outlet Structure | 277 cy | $1,312 /cy | | $363,329 |
| 009 | Construct Drop Shaft on Cliffside Drive | 1 LS | $185,000 /LS | | $185,000 |
| 010 | Micro tunnel to Cliffside Receiving Shaft | 550 lf | $2,145 /lf | | $1,179,660 |
| 011 | Remove Tunnel Services | LS | | | $33,654 |
| 012 | Construct Inlet Structure | 480 cy | $559 /cy | | $268,136 |
| 013 | Erect New Box Culvert - Tie In System | 300 lf | $1,615 /lf | | $484,466 |
| 014 | Restore Site | LS | | | $7,500 |
| | | | **Subtotal Direct Cost** | | **$19,450,595** |
| 015 | Equipment Ownership/Mobilization | | 17.9% of cost | | $5,993,640 |
| 016 | General Mobilization | Total 3.2% of unescalated cost | 2.5% of cost | | $842,237 |
| 017 | Demobilization | | 0.7% of cost | | $238,900 |
| 018 | General Plant Operation and Maintenance | 15.5 mo | $11,556 /mo | | $179,125 |
| 019 | Weekend Maintenance | 52 day | $3,831 /day | | $199,208 |
| 020 | Field Supervision | 21.0 mo | $100,273 /mo | | $2,105,726 |
| 021 | Overhead Maintenance and Service | 21.0 mo | $16,368 /mo | | $343,725 |
| 022 | Bonds, Insurance, and Taxes not in General Mob | | 1.1% of cost | | $370,551 |
| 023 | Markup | | 10.1% of cost | | $3,367,369 |
| 024 | Financing Charges | | 1.0% of cost | | $336,019 |
| | | | **Subtotal Indirect Cost** | | **$13,976,501** |
| 025 | Escalation-excluded from estimate | $5,183,451 (3.8% composite annual rate) | | | - |
| **February 2009 NTP: 21 month duration** | | | **Opinion of Probable Construction Bid** | | **$33,427,096** |

| Cost Componant | Labor | Equipment | Material | Subcontract | Total |
|---|---|---|---|---|---|
| Direct Cost | $3,947,648 | $962,072 | $12,419,090 | $2,121,785 | $19,450,595 |
| Indirect Cost | $2,345,914 | $5,326,590 | $6,219,897 | $84,100 | $13,976,501 |
| Escalation-excluded from estimate | - | - | - | - | - |
| **Summary Breakdown by Cost Type** | **$6,293,562** | **$6,288,663** | **$18,638,986** | **$2,205,885** | **$33,427,096** |

| | | | |
|---|---|---|---|
| Owner Contingency | Project definition | 30% of bid | $10,028,129 |
| | **Subtotal Owner Contingency** | **30% of bid** | **$10,028,129** |
| | **Opinion of Probable Construction Bid with Owner Contingency** | | **$43,455,225** |

# Vista Grande Watershed Study

Prepared by: Kevin Smith

Reviewed by: Randy Raines, Roxanne Stachon

Date: March 9, 2006

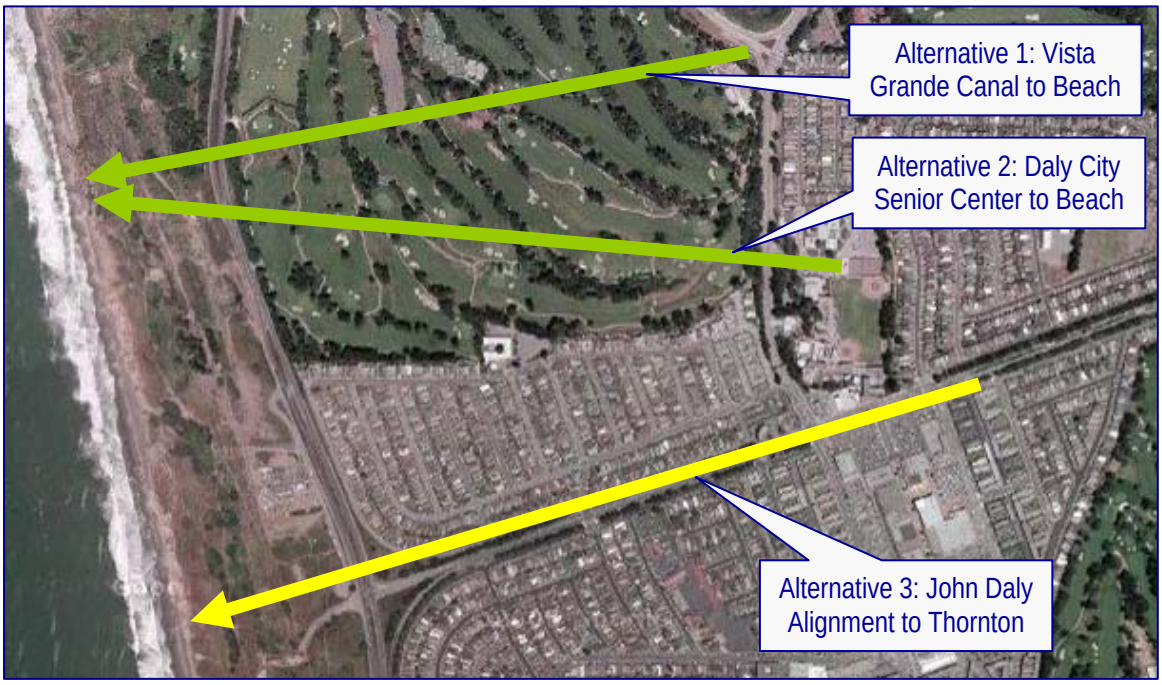
Subject: **John Daly Alignment (Tunnel Alternative 3)**
**Alternate Retrieval Location – Option B**

## 1 Background

The John Daly Alignment (JDA) is being considered, along with two other tunnel alternatives, for the downstream flood protection component of the Vista Grande Watershed Study. The JDA tunnel would convey stormwater from a location near the Westlake Shopping Center to a beach discharge structure in Thornton State Beach. Details regarding the JDA alternative are presented in the Vista Grande Watershed Study. This memo presents details developed for an alternate retrieval location for the JDA alternative, located at South Mayfair Avenue at Lake Merced Boulevard and known as Option B. A retrieval location is the site where a construction shaft is excavated and the tunnel boring machine is retrieved. It is the location of the upstream inlet structure for the tunnel.

Figure 1 shows the JDA alternative and the two other alignment alternatives considered in the Study.

**Figure 1: John Daly Alignment Tunnel Alternative**




The development of the JDA Option B was based on the same hydrologic, hydraulic, and groundwater assumptions presented in the Vista Grande Watershed Study. The JDA Option B would require the same facilities and construction requirements as described for the JDA alternative in the Vista Grande

Watershed Study except in regards to the retrieval location. These details include the following major components:

- Primary construction site located near the termination of John Daly Boulevard at Skyline Boulevard, between Daly City's Thornton Beach Vista and the horse stables to the north. A 215-ft deep, 32-ft diameter access shaft sized to permit subsequent tunneling, in two directions with limited disturbance to the general public.
- The 15-ft I.D. tunnel would be mined in two sections. The first section would be mined with a tunneling shield and would extend from the access shaft to the ocean shore. The second portion of the tunnel would extend from the access shaft the retrieval shaft location.
- Construction of the tunnel utilizes an Earth Pressure Balance Tunnel Machine (EPBM), which can operate below the water table so that dewatering is not required.

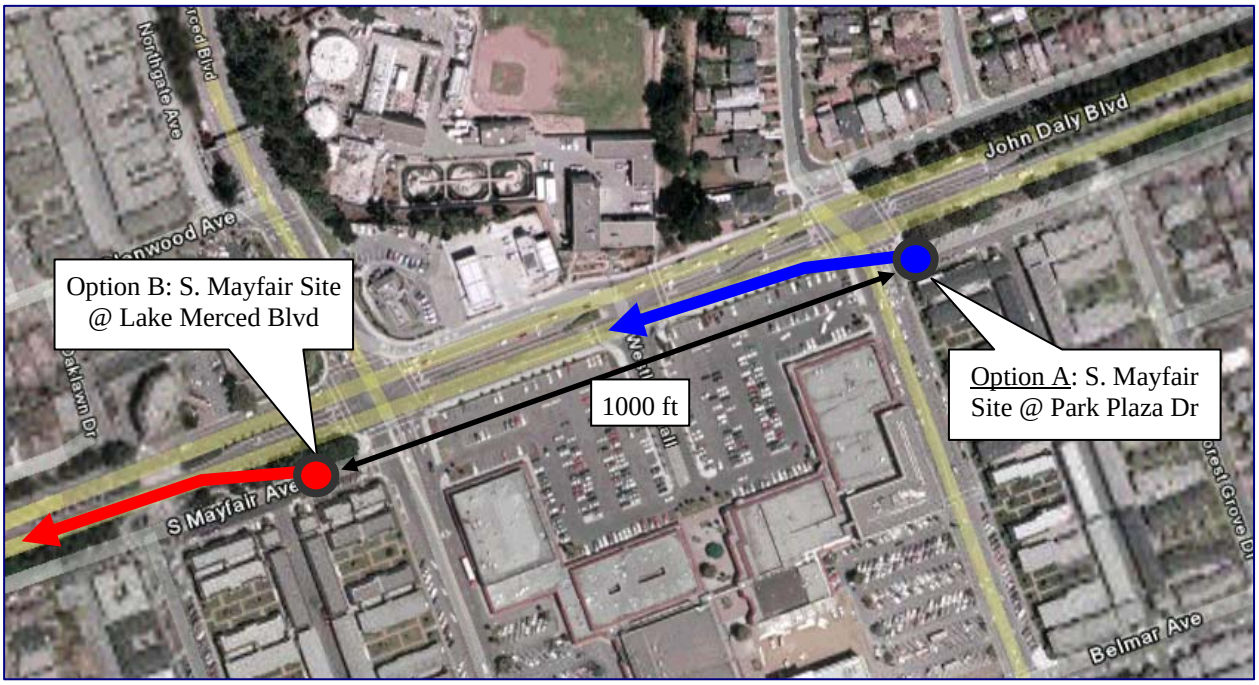
# 2 JDA Option B Facility Details

## 2.1 Retrieval Location

The EPBM would begin excavating the tunnel at the primary construction site and travel upstream toward the EPBM retrieval location. The retrieval location for the EPBM and the upstream inlet of the JDA tunnel alternative would be located near the Westpark Shopping Center. Through field visits and discussions with Daly City staff, two alternate retrieval locations were selected: South Mayfair Avenue at Park Plaza Drive (presented in the Vista Grande Watershed Study) and South Mayfair Avenue at Lake Merced Boulevard (Option B). Figure 2 illustrates the two potential sites. Construction work for Option B would include the following:

- An 80-ft deep, 25-ft diameter retrieval shaft sized to allow recovery of the EPBM. The retrieval shaft would be located at South Mayfair Avenue at Lake Merced Boulevard.
- Construction of a cast-in-place concrete inlet structure
- Restoration of the site after construction is completed
- Storm drain connections, detailed in the following section

**Figure 2: Retrieval Locations**

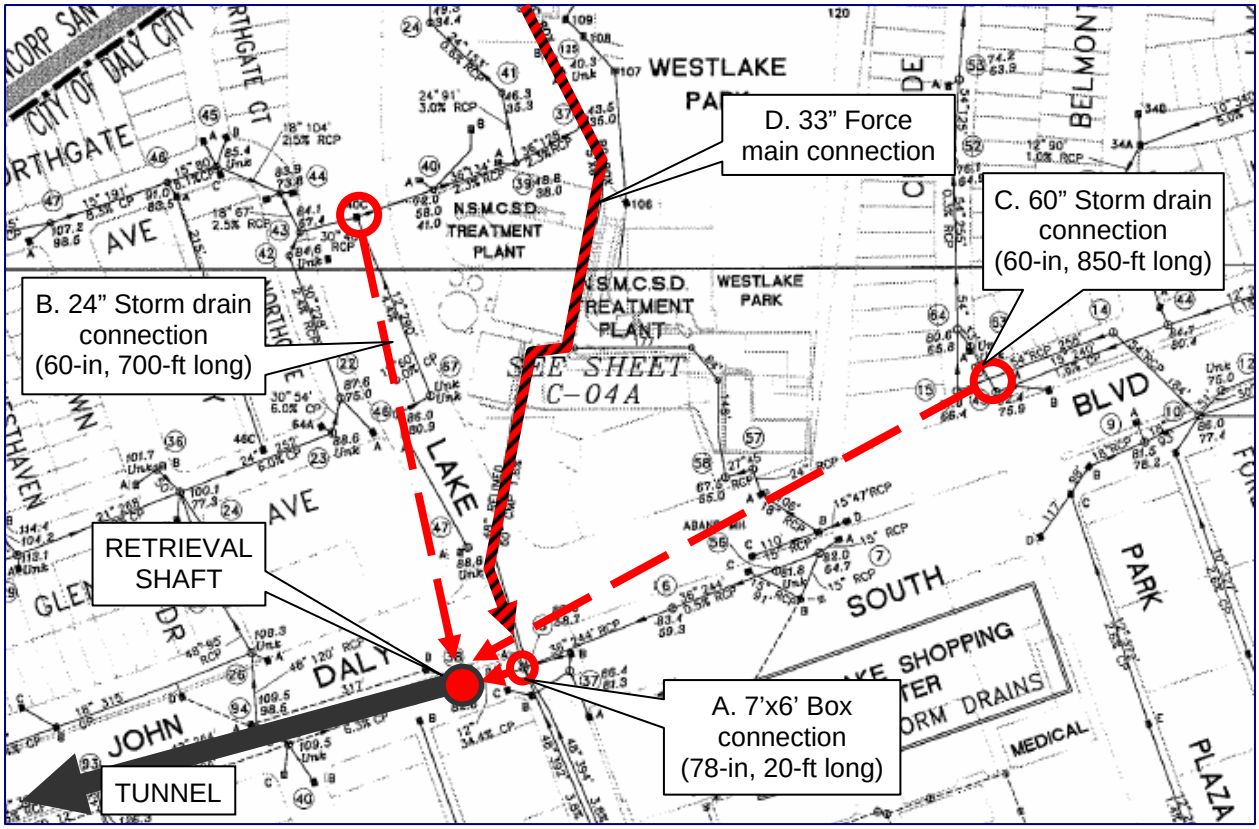



## 2.2 Storm Drain Connections

Extensive storm drain connections are required for Option B. Daly City's three storm drain sub-basins (Glenwood Avenue, Lake Merced Boulevard, and Cliffside Drive trunk lines) would have to be connected to the retrieval shaft location. As illustrated in Figure 3, storm drain connections for Option B would require the following:

A. Construction of approximately 20 ft of RCP pipe-jacked tunnel, connecting an existing manhole (7-ft x 6-ft storm drain) in Lake Merced Boulevard to the new inlet structure.
B. Construction of a 700-foot long, 60-inch I.D. micro-tunnel connecting the new inlet structure with the 24-inch storm drain at an existing manhole. This work includes construction of an access shaft at the connection location to recover the micro-tunneling machine and install a tie-in structure.
C. Construction of an 850-foot long, 60-inch I.D. micro-tunnel connecting the new inlet structure with the 60-inch storm drains at an existing manhole. This work includes construction of an access shaft at the connection location to recover the micro-tunneling machine and install a tie-in structure. Both micro-tunnel connections were assumed to use the same micro-tunnel size for construction cost savings. The size of both micro-tunnels would be refined during the design process based on the findings of the upstream storm drain improvements program included in the Vista Grande Watershed Study.
D. Installation of a pump station and 33" force main to convey stormwater collected in the sub-basins downstream of the connection points. This "remainder" flow would flow toward the existing Vista Grande canal but then be pumped back to the tunnel connection shaft. The pump station would be located underground near the Vista Grande canal and the force main would be installed in the existing 7-ft x 6-ft box storm drain.

**Figure 3: Storm drain Connections to JDA Tunnel Retrieval Site Option B**




## 2.3 Cost Estimates

Planning level costs estimates for the JDA Option B with the retrieval site at South Mayfair Avenue and Lake Merced Boulevard would be approximately $77 million ($98 million escalated to 2010). Option B would cost approximately $4.5 million less than the JDA alternative presented in the Vista Grande Watershed Study. The cost difference is due to the following two reasons:

- Option B reduces the total length of the tunnel by 1000-ft. However, additional micro-tunneling to connect the 60-inch storm drain sub-basin would be required.
- Option B requires only one 80-ft deep excavation pit. The JDA alternative presented in the Vista Grande Watershed Study requires two: one to retrieve the EFBM and another to connect the 24-inch and 7-ft x 6-ft box storm drains to the tunnel. A second drop structure and inlet structure are also required.

Other project details, such as the outlet structure, operation and maintenance, project benefits, environmental impacts, and implementation schedule are assumed to be the same as the details for the JDA alternative presented in the Vista Grande Watershed Study.

JACOBS ASSOCIATES

Engineers/Consultants

# PROJECT MEMORANDUM

**To:** Glenn M. Boyce

**From:** Paul W. Dutton and John M. Stolz

**Date:** January 6, 2006

**Job No.:** 3957 Vista Grande Tunnel

**Subject:** Basis for Conceptual Cost Estimate – Alternate 3

---

The purpose of this memorandum is to set forth the basis for developing the third conceptual cost estimate for the Vista Grande Tunnel. This third estimate was prepared in addition to the estimates for Alternates 1 and 2, prepared in October 2005:

1. Alternate 1 – Intake Structure at Intersection of John Muir Dr. and Lake Merced Blvd. This alternate is estimated to cost $39.5M and require an 18 month construction period.
2. Alternate 2 – Intake Structure in Parking Lot of Westpark Community Center. This alternate is estimated to cost $43.5 M and require a 21 month construction period.
3. Alternate 3 – Intake Structure along South Mayfair Avenue just to the west of the Westlake Shopping Center. Most of the construction activity for this Alternate would be centered around an access shaft located at the Horse Ranch near the intersection of John Daly Boulevard and Skyline Drive. This alternate is estimated to cost $53.3M and require a 14 month construction period.

Estimated costs represent the current expected low bid for construction, and include a 30 percent allowance for contingency. This relatively high amount of contingency is intended to reflect the low level of project definition, the current bidding climate in the underground construction industry, and the recent volatility in material prices for such items as steel and cement. The estimates do not include the following:

- Escalation; however the estimates include a memo entry for escalation calculated to the time of expenditure.
- Design and construction management fees.
- Right-of-way and land acquisition.
- Cost for preparing an Environmental Impact Report and obtaining permits.
- Other costs which may be incurred by the City of Daly City and San Francisco PUC, including any allowances for change orders executed during construction.

465 California Street, Suite 1000 ♦ San Francisco, CA 94104-1824 ♦ Phone: 415/434-1822 ♦ Fax: 415/956-8502

This cost estimate was prepared using all available information, utilizing production-type cost estimating methods.

- Current prevailing labor rates were taken from California Department of Industrial Relations and are fully burdened rates, including payroll taxes and insurance, and worker's compensation and commercial general liability insurance.
- Equipment rates were developed using the current US Army Corps of Engineers *Construction Equipment Ownership and Operating Expense Schedule (Region VII)*, published in 2003 for the western states.
- Material and subcontract costs are based on current market prices. Quotes were obtained for large items such as bolted, gasketed tunnel segments.

Work involved in this construction Alternative includes the following:

- A 215 ft deep, 32 ft diameter Access Shaft sized to permit subsequent tunneling, in two directions with limited disturbance to the general public.
- An 82 ft deep, 25 ft diameter Retrieval Shaft sized to allow recovery of the EPBM and construction of an intake structure.
- A 15 ft I.D. tunnel, mined in two sections. The first section is mined with a tunneling shield and extends 1200 linear feet from the Access Shaft at the horse ranch to the ocean shore. The second portion of the tunnel extends from the Access Shaft to the Retrieval Shaft constructed at a location along South Mayfair Ave just west of the Westlake Shopping Center, a distance of approximately 3200 lf. Since the water table is expected to be above the tunnel, construction of the 3200 lf reach is based on the use of an Earth Pressure Balance Tunnel Machine (EPBM) so that this alignment would not require dewatering. The entire length of 4,400 lf tunnel was estimated to be supported using bolted, gasketed precast concrete segments, thereby eliminating the need for a final cast-in-place concrete lining. Tunnel muck (i.e., spoils) was estimated to be disposed of on local beaches (within 10 miles) as remediation material with no associated dump fees.
- An Outlet Structure. Due to the lack of beach access, construction is estimated to be staged entirely from within the tunnel. The concrete structure is estimated to be founded on mini-piles, socketed into the rock face, and equipped with a steel grate and sand pocket.
- A cast-in-place concrete Inlet Structure.
- Construction of two 48 inch I.D. micro-tunnels totaling 1550 lf connecting the new Inlet Structure with two tie-in points at existing manholes. This work includes construction of an access shaft at each of the tie-in locations which is used to recover the micro-tunneling machine. A new tie-in structure will be constructed in the shaft.
- Construction of approximately 20 lf of RCP pipe-jacked tunnel, connecting the existing Manhole-3 in Lake Merced Blvd to the new Inlet Structure.

The estimated cost of Alternate 2 without contingency is $33.3M while Alternate 3 has a before contingency cost of $41M. This $7.7M increase is due to the following:

- $2.8M additional equipment costs including a second tunneling shield and a second crane.
- $1.4M for a 215 ft deep Access Shaft.
- The Retrieval Shaft in Alt. 3 is $0.7M more than the Access Shaft in Alt. 2.
- $2.4M added Micro-tunneling costs.

The shaft at the Horse Ranch has been finished for permanent access to the tunnel should it be needed in the future for maintenance.

*I:\3957 VISTA GRANDE (SUB TO RMC) (OWNER DALY CITY AND SFPUC)\COST ESTIMATES\ESTIMATES 1-2006\MEMO RE CONCEPTUAL COST ESTIMATE ASSUMPTIONS - ALT 3.DOC*

**Jacobs Associates ♦ Engineers/Consultants**
**San Francisco ♦ Los Angeles ♦ San Diego ♦ Seattle ♦ Portland**

| Project | Client | Job No. | Estimator | Rev | Date |
|---|---|---|---|---|---|
| **Vista Grande Tunnel** | **RMC** | **3957.0** | **Dutton** | **0** | **1/6/2006** |

**Conceptual Cost Estimate - Alternate 3 Shaft Construction at Horse Ranch, Alignment Along John Daly Blvd.**

## SUMMARY OPINION OF PROBABLE CONSTRUCTION BID WITH OWNER CONTINGENCY

| No. | Item or Group Item Description | Item Quantity/Unit | Item Unit Cost | Status | Item Cost |
|---|---|---|---|---|---|
| 001 | Site Preparation at Horse Ranch Location | 1 ls | $15,000 /ls | | $15,000 |
| 002 | Pre-Excavation Grout Access Shaft | 13,316 cf | $20.86 /cf | | $277,736 |
| 003 | Excavate/Support Access Shaft | 215 vf | $5,461 /vf | | $1,174,104 |
| 004 | Fit out Shaft Tunneling Plant | 1 ls | $79,580 /ls | | $79,580 |
| 005 | Assemble Excavation Shield and Backup | 1 ls | $152,260 /ls | | $152,260 |
| 006 | Excavate/Support Tunnel with Shield | 1,200 lf | $3,648 /lf | | $4,377,045 |
| 007 | Construct Outlet Structure | 277 cy | $1,269 /cy | | $351,618 |
| 008 | Assemble EPBM and Backup | 1 ls | $475,462 /ls | | $475,462 |
| 009 | Excavate/Support Tunnel with EPBM | 3,200 lf | $3,256 /lf | | $10,419,881 |
| 010 | Site Preparation at Mayfair Ave. Location | 1 ls | $15,000 /ls | | $15,000 |
| 011 | Pre-Ex Grout Retrieval Shaft | 6,372 cf | $66.88 /cf | | $426,183 |
| 012 | Excavate/Support Retrieval Shaft | 82 vf | $4,842 /vf | | $397,053 |
| 013 | 78" RCP Connection to MH-3 | 20 lf | $8,890 /lf | | $177,799 |
| 014 | Micro-tunnel Additional Tie-ins | 1,550 lf | $1,954 /lf | | $3,028,290 |
| 015 | MicroTBM Retrieval Shafts and Drop Structures | 1 ls | $370,000 /ls | | $370,000 |
| 016 | Disassemble and Retrieve EPBM | 1 ls | $179,733 /ls | | $179,733 |
| 017 | Construct Drop Structure in Retrieval Shaft | 1 ls | $365,391 /ls | | $365,391 |
| 018 | Remove Tunnel Services | 1 ls | $47,722 /ls | | $47,722 |
| 019 | Permanent Access and Backfill Temp Shaft | 4,348 cy | $228 /cy | | $991,267 |
| 020 | Site Restoration - Mayfair Ave. | 1 ls | $50,000 /ls | | $50,000 |
| 021 | Site Restoration - Horse Ranch | 1 ls | $7,500 /ls | | $7,500 |
| | | | **Subtotal Direct Cost** | | **$23,378,623** |
| 022 | Equipment Ownership/Mobilization | | 20.6% of cost | | $8,462,681 |
| 023 | General Mobilization | Total 4.6% of unescalated cost | 3.0% of cost | | $1,240,259 |
| 024 | Demobilization | | 1.6% of cost | | $649,750 |
| 025 | General Plant Operation and Maintenance | 11.5 mo | $12,142 /mo | | $139,638 |
| 026 | Weekend Maintenance | 21 day | $3,613 /day | | $75,881 |
| 027 | Field Supervision | 13.8 mo | $136,370 /mo | | $1,881,905 |
| 028 | Overhead Maintenance and Service | 13.8 mo | $20,715 /mo | | $285,867 |
| 029 | Bonds, Insurance, and Taxes not in General Mob | | 0.8% of cost | | $318,851 |
| 030 | Markup | | 10.4% of cost | | $4,274,798 |
| 031 | Financing Charges | | 0.8% of cost | | $332,750 |
| | | | **Subtotal Indirect Cost** | | **$17,662,379** |
| 032 | Escalation-excluded from estimate | $5,694,655 (3.8% composite annual rate) | | | - |
| **February 2009 NTP: 13.8 month duration** | | | **Opinion of Probable Construction Bid** | | **$41,041,002** |

| Cost Componant | Labor | Equipment | Material | Subcontract | Total |
|---|---|---|---|---|---|
| Direct Cost | $5,558,114 | $1,370,463 | $11,780,055 | $4,669,991 | $23,378,623 |
| Indirect Cost | $2,036,324 | $7,431,781 | $8,088,474 | $105,800 | $17,662,379 |
| Escalation-excluded from estimate | - | - | - | - | - |
| **Summary Breakdown by Cost Type** | **$7,594,438** | **$8,802,244** | **$19,868,529** | **$4,775,791** | **$41,041,002** |

| | | | |
|---|---|---|---|
| Owner Contingency | Project definition | 30% of bid | $12,312,301 |
| | **Subtotal Owner Contingency** | **30% of bid** | **$12,312,301** |
| | **Opinion of Probable Construction Bid with Owner Contingency** | | **$53,353,303** |

# Appendix F - Cost Estimate and Schematics for Vista Grande Wetland Alternative B

# Vista Grande Wetland

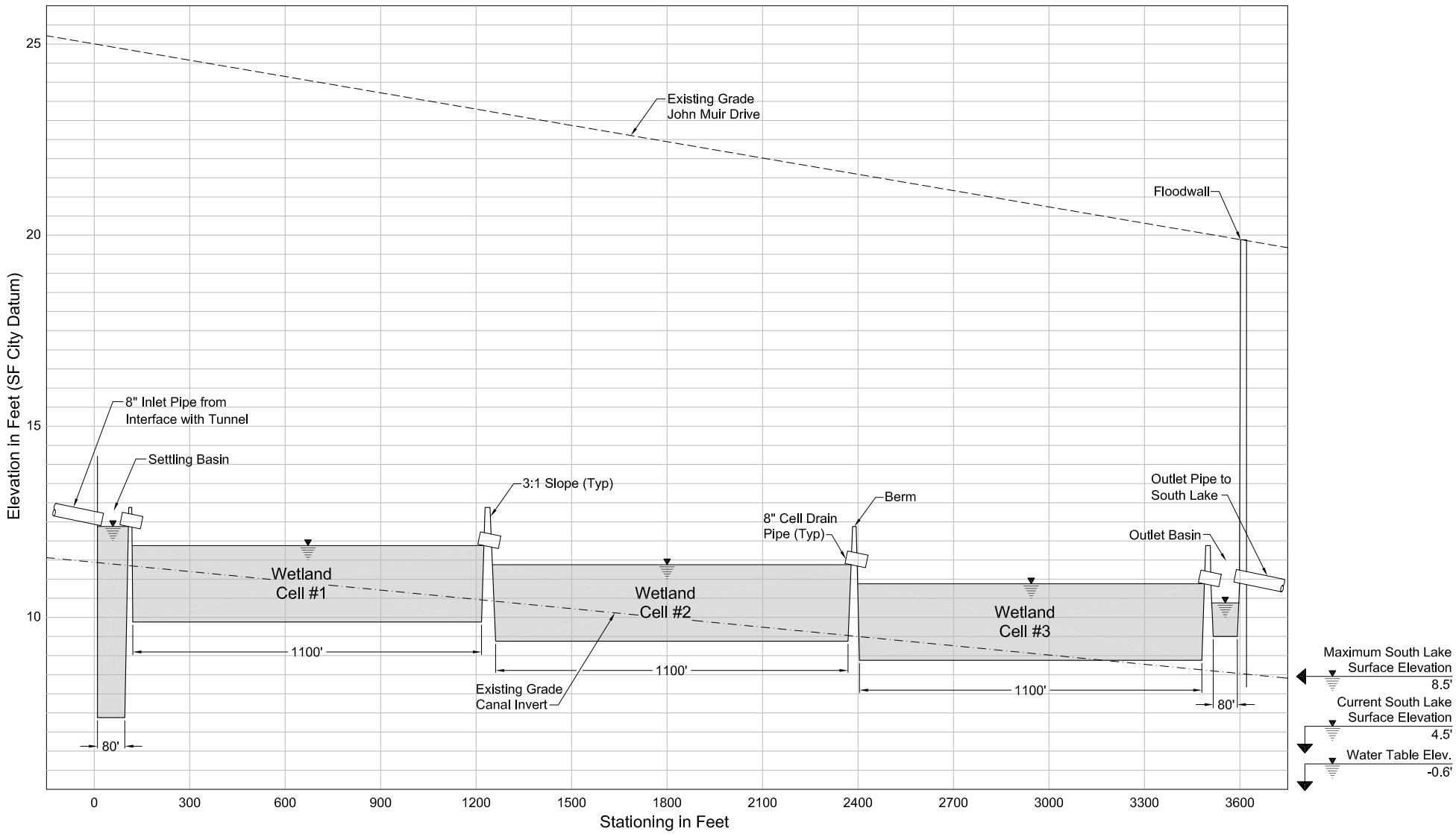
# Supporting Technical Information

This appendix contains technical information developed for Alternative B, an alternate layout for the Vista Grande Wetland. The following information is included in this appendix:

1. The preliminary capital cost estimate for Alternative B.
2. Profile view of Alternative B, which shows the depth, invert elevation and water levels for this alternative.
3. Cross-sections of Alternative B at station 0+00 and 35+00

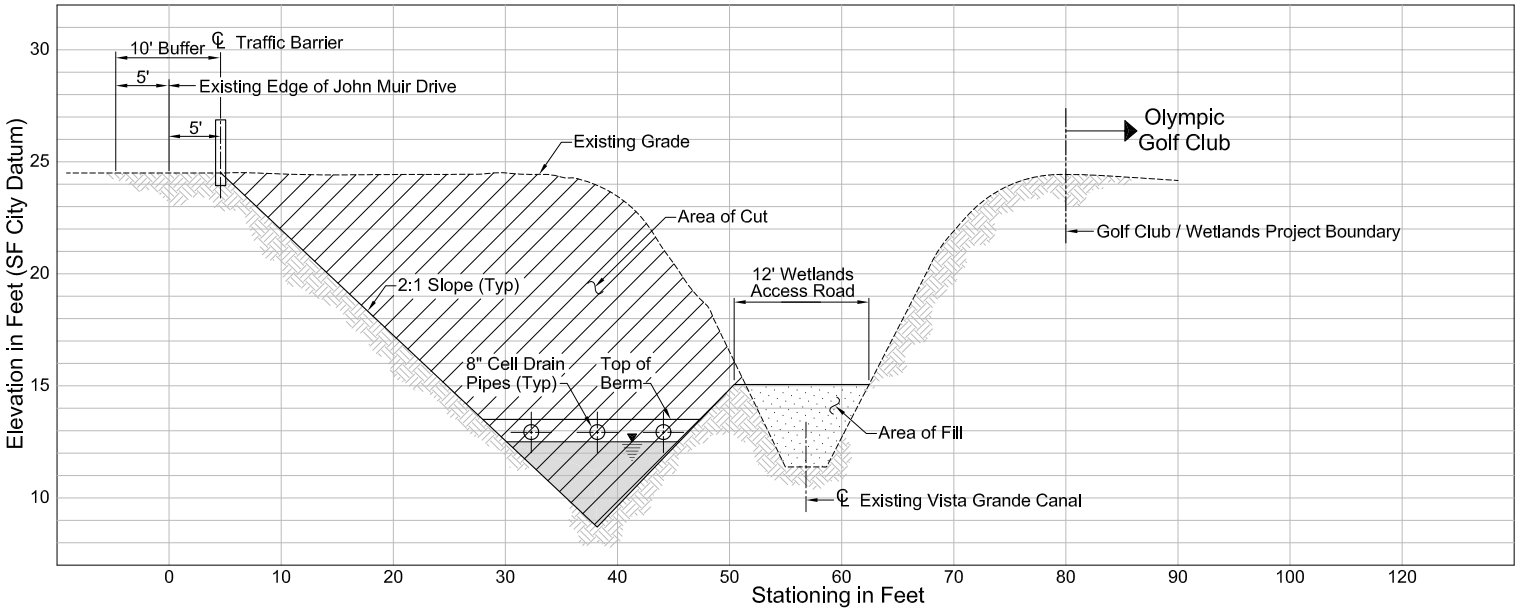
## Preliminary Cost Estimate for Vista Grande Wetland Alternative B

| Description | Units | Unit Cost | Quantity | Total Cost |
|---|---|---|---|---|
| SITE PREPARATION / MOBILIZATION | | | | |
| Clear and grub brush including stumps | acre | $10,000 | 6.5 | $65,000 |
| Removal of heritage oaks | - | - | - | $50,000 |
| Relocate Olympic GC Sewer Pipeline | lf | $96 | 3600 | $346,000 |
| Relocate 30" Sewer Pipeline | lf | $360 | 3600 | $1,296,000 |
| Demolition 18" Sewer Pipeline | lf | $20 | 3600 | $72,000 |
| Relocate Above-ground Structures | Allowance | $500,000 | - | $500,000 |
| Mobilization/Demobilization | each | 10% | - | $757,000 |
| CONSTRUCTION | | | | |
| Mass excavation and hauling | cy | $38 | $110,000 | $4,180,000 |
| Grading, compacting, and transporting fill | day | $10,000 | 10 | $100,000 |
| Traffic Barrier | lf | $50.50 | 3,600 | $182,000 |
| Embankment Construction | cy | $32 | 1,300 | $42,000 |
| Roadways / trains (maintenance access) | sf | $5 | 48,000 | $240,000 |
| Inlet structure | Allowance | - | 1 | $50,000 |
| Flow Control Facilities | Allowance | - | 1 | $50,000 |
| Outlet Basin | Allowance | - | 1 | $50,000 |
| Floodwall at Outlet Basin | sq. ft | $90 | 975 | $88,000 |
| Standard Piping | lf | $40 | 850 | $34,000 |
| Wetlands planting - propagation / harvesting / installation | acre | $30,000 | 2.3 | $68,000 |
| Replanting during wetland establishment | acre | $30,000 | 2.3 | $68,000 |
| Landscaping | acre | $30,000 | 3.0 | $90,000 |
| **Subtotal:** | | | | **$8,326,000** |
| Contingency (30%): | | | | $2,498,000 |
| **Construction Cost Estimate:** | | | | **$10,823,000** |
| Implementation (30% Allowance): | | | | $3,247,000 |
| Environmental Compliance: | | | | $500,000 |
| **Total Capital Cost Estimate** | | | | **$14,570,000** |

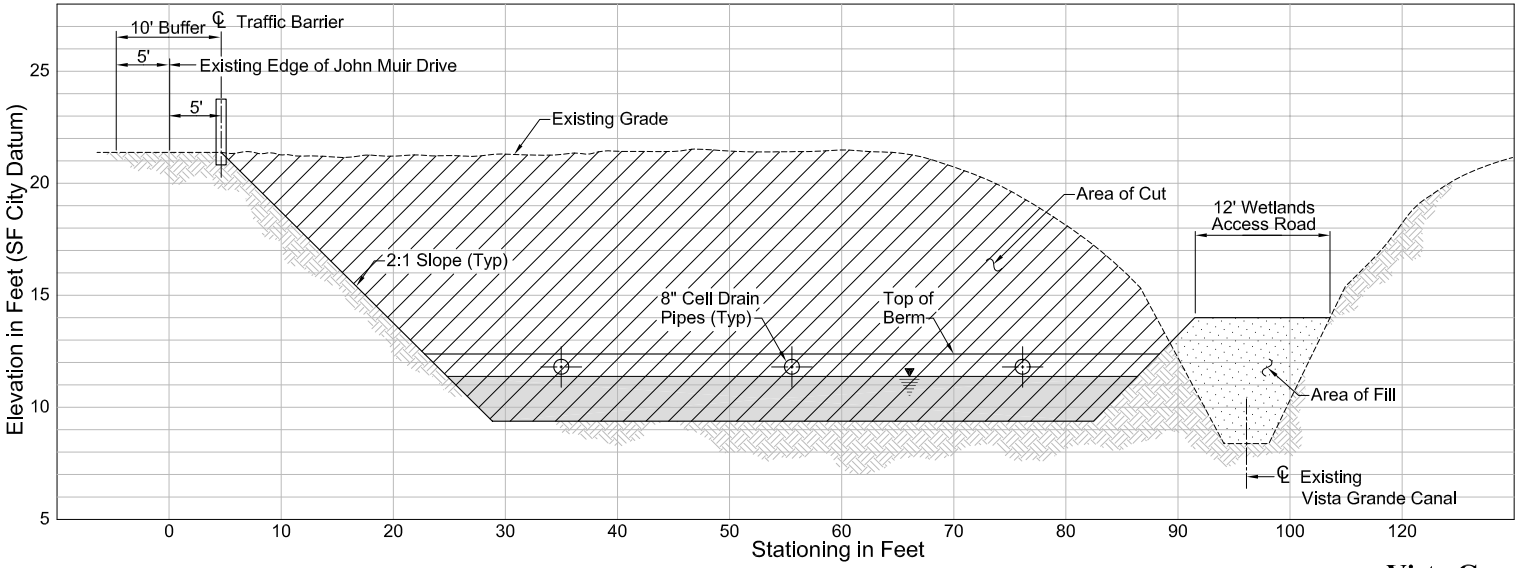



FILE: VGW-FIG2.dwg DATE: 11-22-2005 PROJECT: RMC - VISTA GRANDE WETLANDS

**Vista Grande Wetlands Profile**
**Alternative 'B'**




STA. 0+00




STA. 35+00

**Vista Grande Wetlands Sections**
**Alternative 'B'**

FILE: VGW-FIG6.dwg DATE: 11-22-2005 PROJECT: RMC - VISTA GRANDE WETLANDS

# Appendix G – Cost Estimate Escalation Information

**Total Cost Estimate for the Vista Grande Watershed Study**

| Preliminary Program Component | Planning Level Cost Estimate Range Min | Planning Level Cost Estimate Range Max | Construction Schedule Start | Construction Schedule Finish | Construction Schedule Duration (mo.) | Yrs to Midpoint Construction | Escalated Cost Estimate Range Min | Escalated Cost Estimate Range Max |
|---|---|---|---|---|---|---|---|---|
| Tunnel South of County Line | $56,100,000 | $81,600,000 | 03/01/10 | 09/31/11 | 18 | 5 | $ 71,600,000 | $ 104,100,000 |
| Vista Grande Wetland | $ 8,600,000 | | 09/01/11 | 08/31/12 | 12 | 5.5 | $ 11,200,000 | |
| Stormdrain Improvements | $ 25,000,000 | $ 35,000,000 | 01/01/11 | 03/01/15 | 50 | 7 | $ 35,200,000 | $ 49,200,000 |
| **TOTAL** | **$ 89,700,000** | **$125,200,000** | | | | | **$ 118,000,000** | **$ 164,500,000** |

Escalation Rate 5%

ENR CCI "20 City Average" escalation rate for last 3 years is approximately 4.5%

# Appendix H - March 2006 Stakeholder Workshop Attendance List

| Vista Grande Watershed Study<br>Public Workshop #2 - 03-30-06 | | |
|---|---|---|
| **Name** | **Title** | **Organization** |
| Mo Sharma | City Engineer | City of Daly City |
| ZS Goldenberg | Resident | |
| Cynthia Royer | MTS | City of Daly City |
| Karen Cantwell | Environmental Protection Specialist | |
| Dick Morten | | |
| Craig and Martha Spriggs | | Friends of Lake Merced |
| Teresa Devincenzi | Resident | City of Daly City |
| Tony Devincenzi | Resident | City of Daly City |
| Demetri Papakont | Resident | City of Daly City |
| Ellen & Harry Rubinchik | | |
| Dan Murphy | | Golden Gate Audubon Society |
| Mark Sustarich | | |
| Annette Hipona | | Original Daly City Protective Assoc. |
| Vaughn Jones | | Skyline-Palisades Assn. |
| Richard and Suzanne Swan | | Westlake Resident |
| Mona Cereghino | | Lake Merced Task Force |
| Bob Maddow | Attorney | Olympic Club |

RMC
Water and Environment
140 Geary St. ▪ Suite 900 ▪ San Francisco CA 94108 ▪ Phone: 415-321-3400 ▪ Fax: 415-321-3401

# VISTA GRANDE WATERSHED STUDY
# SUMMARY OF PUBLIC COMMENTS AND GENERALIZED RESPONSES

Comments on the Public Draft Vista Grande Watershed Study were received from 17 organizations and individuals including public agencies, Daly City residents, local businesses, environmental organizations and homeowners associations. These comments can be summarized under the following categories:

A) Location of the Tunnel South of County Line
B) Level of Protection Provided by Preliminary Program Components
C) Financing of the Preliminary Program Components
D) Stormwater Should be Beneficially Reused within the Watershed
E) Specific Comments about the Conceptual Design of the Vista Grande Wetland
F) Specific Comments about the Conceptual Design of the Tunnel South of County Line
G) General Comments on the Vista Grande Watershed Study
H) Habitat Concerns related to the Vista Grande Wetland
I) Habitat Concerns related to the Tunnel South of County Line
J) Interim Solutions
K) Regulatory Concerns / Intent of Document
L) Schedule Concerns
M) Location of the Beach Outlet Structure and its Impacts on Coastal Erosion
N) Ongoing Erosion at Lake Merced

General responses to each of these comment categories are provided below.

---

## A) Location of the Tunnel South of County Line

Concerns regarding the location of the proposed Tunnel South of County Line included:

- Daly City's drainage system should be located entirely within San Mateo County.
- The tunnel should be located entirely within San Francisco County since the preservation of Lake Merced water quality is primarily of interest to San Francisco residents.
- The New Parallel Tunnel option should be further investigated.
- Locate the tunnel from Doelger Community Center to Thornton Beach.

The overall goal of the Watershed Study is to define improvements to resolve flooding at the Vista Grande canal and the residential areas of the watershed. The Watershed Study was undertaken as a joint effort of Daly City and San Francisco because flooding at the Vista Grande canal has been an ongoing source of concern for both agencies. However, the stormwater causing overflows from the Vista Grande Canal originates from Daly City

portion of the Vista Grande Watershed. Only a small portion of stormwater which flows into the Vista Grande canal originates within San Francisco.

This study evaluated a number of preliminary options to conceptualize alternatives and established a general approach to flood protection within the watershed. The preliminary alternatives were evaluated for their ability to meet the primary flood protection objective, as well as other benefits and limitations to determine which alternatives were most feasible for further evaluation. The New Parallel Tunnel was not further evaluated as part of this study in favor of evaluating the Tunnel South of County Line which would provide a drainage system that is completely contained within the County of San Mateo and is compatible with the Vista Grande Wetland alternative for Lake Merced Lake Level enhancement.

The projects included in the preliminary program recommendations have not been selected for implementation. Any of the proposed projects identified in this study, including the Tunnel South of County Line, would require additional development and investigation if selected for implementation. The three alignments analyzed as part of the proposed the Tunnel South of County Line were included as examples to evaluate conceptual feasibility and general planning-level cost ranges. If the Tunnel South of County Line is pursued, a detailed alternatives analysis would need to be conducted in order to identify potential impacts, coordination conflicts, other implementation concerns, and to select the most cost effective, beneficial alignment. This alternatives analysis may consider additional alignments that were not developed as part of this Study. The Doelger to Thornton Beach alternative, has been added to Section 5.2.10 *Summary and Next Steps*, as a specific alignment that should be considered as part of that alternatives analysis.

## B) <u>Level of Protection Provided by Preliminary Program Components</u>

Concerns regarding the level of protection provided by the preliminary project alternatives identified in the Vista Grande Watershed Study included:

- The program should be designed to anticipate the worst occurrence that could occur based on our current level of understanding.
- The Study should evaluate more intense storms as well as the 25-year, 4-hour storm since the additional cost in providing greater protection may be incremental.
- The program should be designed to confront more extreme weather patterns and conditions that may occur due to global warming and global dimming effects.
- To eliminate flooding, the peak rainfall amounts, rather than the 4-hour average, must be accounted for.
- The peak rainfall data for the last 100 years understates the longer term historic data.

- Rising sea level should be considered in the design of the outfall structure and pipeline for the Tunnel South of County Line.
- What size and frequency of storm was selected for routing (discharge) at the County line and the other proposed tunnel locations, e.g. 10 yr.? 25 yr.? other?
- What would be the fate and impact of less-frequent, but higher flow storms, expressed in terms of flow rate, time (duration), volume, and frequency?

The Vista Grande Watershed Study presents an initial conceptualization study regarding potential solutions to flooding in the Vista Grande Watershed. The study presents a number of potential solutions and does not establish a set program for implementation. The storm intensities evaluated in this Study (25-year storm for all tunnel alternatives and the 10-year storm for Storm Drain Improvements) were used for the initial evaluation of alternatives and were selected based on standard practice for other Bay Area entities and initial estimations. However, when alternatives are selected for implementation, a detailed alternatives analysis would be conducted for each selected alternative to determine the appropriate level of protection based on cost and feasibility constraints. For example, if the Tunnel South of County Line is selected for implementation, an alternatives analysis would be conducted to refine the concepts presented in the Watershed Study. Similarly, the design level for Storm Drain Improvements would be evaluated as part of the preparation of a Storm Drain Master Plan when specific improvements to reduce upstream flooding would be identified.

These alternative analyses would analyze rainfall patters and evaluate the cost and risks associated with several design sizes, including those for larger storm events. The appropriate design size would be determined from the results of this analyses. The risks and impacts of storms exceeding the design storm criteria, and the potential impact of sea level rise would also be evaluated during the alternatives analysis stage of project implementation.

The document has been revised to clarify that the 25-yr, 4-hr storm considered for the Tunnel South of County Line, and the 10-yr, 4-hr storm considered for Storm Drain Improvements, were for planning and alternative comparison purposes only and that the design storm for each alternative would be determined by future analyses associated with the development of these proposed projects. Changes to the document include:

- Page ES-6 – add a sentence under Recommended Program
- Page ES-8 – clarify paragraph
- Page ES-12 – clarify Upstream Storm Drain Improvements paragraph 2
- Page 5-4 – add sentence to 5.2.3 Design Assumptions
- Page5-27 – clarify last bullet of next steps
- Page 5-54 – add sentence to last paragraph
- Page 5-55 – add sentence to fourth paragraph
- Page 5-57 – add sentence to 5.4.5 Storm Drain Master Planning
- Page 6-21 – add sentence to next steps

## C) Financing of the Preliminary Program Components

Concerns regarding how the preliminary program identified in the Vista Grande Watershed Study will be financed included:

- The Study doesn't discuss the likelihood of securing the $150-200 million necessary to implement the recommended improvements.
- It is likely that the landowners in the affected area will not approve any kind of assessment or bond measure since fewer than ten percent of these landowners are adversely impacted by drainage issues.
- Daly City tax money should not be used to pay for projects that benefit San Francisco.
- Lake Merced is in the City and County of San Francisco so it is inappropriate for Daly City to finance the construction or maintenance of the wetlands.
- Improvements to the Daly City drainage system should not be implemented in conjunction with other projects.
- Sewer fees over both the incorporated and unincorporated area of San Mateo County are set by the governing board of the district. It should also be noted that drainage fees that could be used to finance improvements would have to be approved by a vote of the property owners or registered voters in the area where fees are proposed to be levied.

The Vista Grande Watershed Study is a planning level document which identifies potential project alternatives and potential funding opportunities. This study continues past cooperative efforts between CCSF and Daly City for resolving integrated water resources issues involving recycled water, groundwater, stormwater, and Lake Merced. However, participation of CCSF and Daly City as joint sponsors of the Vista Grande Watershed Study should not be interpreted as a commitment by either agency to contribute funding for projects outside of their own jurisdiction. Ownership of individual projects presented in this Study has not been assigned and none of the proposed projects have been selected for implementation at this time. When projects are selected for implementation, Daly City and CCSF will establish how each agency will be involved in financing and implementing each project, and a specific financing plan will be developed. This will likely result in each agency taking responsibility for projects within its own jurisdiction. However, there are several reasons why pursuing these projects as part of a comprehensive watershed program may be beneficial. First, regulatory agencies give preference to coordinated efforts that provide multiple benefits, including ecological benefits, to the watershed. In addition, many State and Federal grants and loans are only available to comprehensive projects which address more than one issue. Thus, if the Tunnel South of County Line and the Vista Grande Wetland are pursued, it may be beneficial to both Daly City and CCSF to present them as a coordinated effort.

In addition to coordination between Daly City and CCSF, an agreement between San Mateo County and Daly City would need to be developed once a specific project or program is selected for implementation. If sewer fees are pursued as a financing option, the inherent cost sharing incorporated in these fees would need to be reflected in that

agreement. Further, it is noted that drainage fees would require a majority vote. For additional detail on the Funding Strategies and the process for approving drainage fees, please see Section 6.1 of the Watershed Study.

## D) Stormwater Should be Beneficially Reused within the Watershed

Concerns that the preliminary program recommendations to not maximize stormwater reuse benefits included:

- Discharging stormwater into the ocean is a waste of a valuable resource that could be used for other beneficial uses such as aquifer recharge or stream restoration.
- Stormwater should be used to recharge the Westside Basin Aquifer.
- The methodology used in the Sun Valley Watershed in Los Angeles County was not incorporated into this study.

The Vista Grande Public Watershed Study presents an initial conceptualization study regarding potential solutions to flooding in the Vista Grande Watershed. We are aware of the work in the Sun Valley Watershed in Los Angeles County and considered this approach in the initial alternatives developed and as part of the proposed Storm Drain Improvements. A number of alternatives were considered to reduce the volume of stormwater flowing to the ocean and use stormwater for other beneficial uses such as aquifer recharge or lake level enhancement. Since the primary objective of this Study was to solve flooding throughout the watershed, investigating the benefits of installing injection wells specifically for the purpose of recharging the groundwater basin was out of the scope of this Study. However, regional stormwater detention and aquifer recharge were investigated as part of the preliminary alternatives analysis conducted for this study. This initial alternatives analysis found that large-scale detention of stormwater to solve flooding and enhance aquifer recharge would not be feasible due to limited land availability and prohibitively high costs. Daly City does not have the highly permeable soils found in Sun Valley, thereby decreasing the recharge potential and increasing the unit cost of water supply benefit. Preliminary estimates, shown on pages 4-5, 4-7, 4-8, and 4-10 placed the cost of aquifer storage between $22,000 per acre-foot and $42,000 per acre-foot.

Although this study found that large-scale alternatives were not feasible to solve flooding issues, smaller scale efforts to reduce the volume of stormwater flowing to the ocean could be implemented as part of the Storm Drain Improvements and Ongoing Implementation of Best Management Practices portions of the program proposed by this study. Such efforts may include local storage and runoff reduction practices. This would be evaluated as part of Storm Drain Master Planning, as discussed on page 5-57 of the Vista Grande Watershed Study.

## E) Specific Comments about the Conceptual Design of the Vista Grande Wetland

Concerns regarding the conceptual design of the Vista Grande Wetland included:

- Whether the use of mushroom mycelium been considered as a component of the biofilter.
- Whether the wetland be designed to encourage aquifer recharge through leakage from the wetland.
- What the design life of the wetland is.
- Whether leakage from the wetland would be a source of groundwater pollution.
- The potential for ongoing erosion at Lake Merced. The erosion at the project site at Lake Merced cannot be eliminated without re-engineering the entire shoreline, bank and roadway structure surrounding the lake. In order to significantly reduce and control erosion, an erosion control plan for Lake Merced should be developed that prohibits the use of off-site sand and the dumping of rock on eroded sites, promotes the use of native vegetation to control erosion, incorporates bank restoration and uses engineered rip-rap with structural support beneath only as a last resort.
- How the wetlands will influence the risk of bird flu in the region.
- The conceptual design of the wetlands including how water would be introduced, the expected design capacity of the wetland, the expected water quality treatment performance of the wetland, and how water would be discharged to Lake Merced.
- The possibility of odor generation form the wetland.
- The potential for insect breeding in the wetland.

The conceptual design of the proposed Vista Grande Wetland was developed with consultation from Dr. Alex Horne, a Professor Emeritus of Environmental Engineering at the University of California, Berkeley, and a recognized expert on constructed treatment wetlands. The preliminary layout and conceptual design of the proposed Vista Grande Wetland is presented in Section 5.3 *Vista Grande Wetland*. Stormwater would be pumped from the proposed Tunnel South of County Line inlet structure into the wetland and then flow by gravity through the wetland and out into Lake Merced. Section 5.3.4 *Design Assumptions* includes additional information regarding how stormwater would flow into and out of the wetland. A number of different flow rates, volumes, durations and frequencies were analyzed as part of the preliminary assessment of the proposed wetland, as presented in Section 5.3.6 *Water Quality Considerations and Treatment Characteristics*. A number of different regulatory approvals would be needed to implement the Vista Grande Wetlands as presented in Table 5-15. The preliminary layout for the Vista Grande Wetland, including the area required and location, is discussed in Section 5.3.5 *Preliminary Layout* and shown in Figures 5-21, 5-22, 5-23, and 5-24.

The conceptual design of the Vista Grande Wetland was optimized to provide lake level enhancement to Lake Merced. The value used to calculate leakage (10% of inflow during dry-weather months, negligible during wet-weather months) was based on typical values for soil in the surrounding area. Opportunities to enhance groundwater recharge from the treatment wetland, while optimizing the lake level enhancement goal of the wetland,

could be analyzed during the design of the Vista Grande Wetland. The potential for groundwater pollution from recharge through the treatment wetland is expected to be minimal due since pollutants from stormwater will be removed by the treatment processes in the wetland and by the soils as water infiltrates into the groundwater. However, if alternatives to enhance groundwater recharge were added into the wetland design, the potential for groundwater contamination may need to be further investigated.

The preliminary design of the Vista Grande Wetland, as presented in Section 5.3, relies on cattails and bulrush to remove contaminants found in stormwater. These plants are found in natural wetlands and provide sufficient filtering and treatment for stormwater. Mushroom mycelium has not been considered as a component of the wetland. If appropriate, it could be considered during the design phase if the Vista Grande Wetland is pursued for implementation.

The wetland is not expected to generate foul odors. It will treat the same stormwater that currently flows through the canal and the treatment processes are similar to the natural wetlands which are located along the banks of Lake Merced.

Although wetlands can be a breeding ground for mosquitoes, scientific research have shown that mosquito problems associated with treatment wetlands are rare and effective mosquito abatement would be incorporated in the final wetland design, as discussed on page 5-44 in Section 5.3.7 *Wetland Construction, Operation and Maintenance*.

The wetland would be maintained on an ongoing basis by removing invasive plant species, managing water levels, managing vegetation, and monitoring sediments. With these ongoing maintenance activities and periodic removal of sediment and debris, the wetland is expected to become a sustainable feature of the environment.

While the treatment wetlands are expected to enhance and expand habitat for local and migratory birds, they are not expected to introduce bird flu to the area. According to the Centers for Disease Control and Prevention, “most cases of avian influenza infection in humans have resulted from direct or close contact with infected poultry (e.g., domesticated chicken, ducks, and turkeys) or surfaces contaminated with secretions and excretions from infected birds.” Contact with wild birds has not been identified as a primary source of human transmission by either the Centers for Disease Control and Prevention or the World Health Organization.

## F) <u>Specific Comments about the Conceptual Design of the Tunnel South of County Line</u>

Concerns regarding the conceptual design of the Tunnel South of County Line included:

- The potential for future collapses of the Colma Formation along the proposed Tunnel South of County Line alignment.
- The plan for operation and maintenance on page 5-19 seems inadequate.

- Monitoring for system failure needs to be a significant part of this plan. The pipeline should be fitted with a monitoring system capable of pinpointing leaks that could lead to system collapse due to geologic failure or during an extreme weather event.
- How earthquakes could impact the Tunnel South of County Line and what design features have been incorporated to avoid catastrophic failure of the system.
- How stormwater would be routed into the Tunnel South of County Line and the Vista Grande Wetland.
- Alternatives 1 and 2 outlet within a large landslide complex that was most recently active in 1997-98, and resulted in the closure of the golf course west of Skyline Blvd. Previous movement of this landslide complex reportedly resulted in the southbound lanes of Skyline Blvd. being shifted east. Stabilization of this landslide complex would likely be cost prohibitive, and tunneling/long term performance would likely be problematic.
- Please correct the erroneous references to the "Westpark Community Center" and "Westpark neighborhood". These should be referred to by their true names: Westlake Community Center and Westlake Estates neighborhood."

The Vista Grande Watershed Study presents an initial conceptualization study regarding potential solutions to flooding in the Vista Grande Watershed. The preliminary alternatives recommended in this study, including the Tunnel South of County Line, have been developed at the planning-level only. If the Tunnel South of County Line is selected for implementation, an alternatives analysis will be conducted to refine the concepts presented in the Watershed Study. The potential for structural collapse of the Colma Formation, strategies for dealing with future collapse, and the large landslide complex identified in the region would be considered during this alternatives analysis and the results of this investigation would be considered during project selection. Specifics regarding earthquake impacts on the system are also a design-level concern and are not addressed in this planning-level document.

The operation and maintenance (O&M) considerations presented on page 5-19 were intended to provide an overview of the type of O&M that would be necessary for the tunnel to establish the feasibility and practicality of this proposed solution. It was not intended to be a comprehensive O&M plan. A detailed O&M plan would be developed during project design for the selected alternative. This plan would include procedures for monitoring the system. The need to monitor for system failure and be able to pinpoint leaks will be considered during the development of a comprehensive O&M plan.

A brief overview of how stormwater would be conveyed into each of the three conceptual tunnel alignments presented in this Study is included in Section 5.2.4 *Preliminary Layout and Facilities*. The specific structures that would be used to convey stormwater into the tunnel would be developed during project design after a specific alignment of the Tunnel South of County Line is selected for implementation. Similarly, the mechanism that would convey water from the proposed tunnel to the proposed Vista Grande Wetland would be designed if the Wetland is selected for implementation and after a specific tunnel alignment is selected. A conceptual overview of the inlet mechanism to the

wetland is presented in Section 5.3.4 *Design Assumptions*. This section also includes a brief overview of how water would flow through the wetland and into Lake Merced. As described in this section, no stormwater would reach the wetland, the former site of the canal, without being pumped into the wetland. The proposed wetland preliminary design does not include storing water on property owned by the Olympic Club since flow into the wetland will be controlled by a pump station. No other discharges, such as Daly City treated wastewater, would be routed through the proposed new tunnel.

If the proposed Tunnel South of County Line and the Vista Grande Wetland are implemented, the existing tunnel would be maintained as an overflow structure for Lake Merced. In addition, treated secondary wastewater effluent from the North San Mateo County Sanitation District would continue to be discharged to the upstream end of the tunnel and out through an ocean outfall structure, when the tunnel is not needed for Lake Merced overflow.

References to the Westpark Community Center were changed to Doelger Community Center.

## G) General Comments on the Vista Grande Watershed Study

General comments for the Vista Grande Watershed Study included:

- The existing Vista Grande canal and tunnel should be maintained as a backup system for the proposed Tunnel South of County Line in case of catastrophic system failure.
- The Vista Grande Wetland should not be an optional element of the overall program and should be implemented and funded as part of the larger flood protection program.
- This plan should address alternative means of spoils disposal.
- The study should identify potential impacts to the subsurface environment.
- The existing system should continue to be studied and improved rather than developing new infrastructure.
- The study should give serious consideration to upstream measures that can contribute to the overall solutions being sought.
- Identification of the criteria that will be used for making decisions among the alternatives discussed in the Study.
- The specifics of the hydrology of the watershed i.e.: What stormwater runoff can be expected from the watershed, expressed in terms of flow rate, time (duration), and volume; and what frequency of such flows can be expected? What effects would various upstream stormwater management practices have on these flows and volumes? After implementation of selected management practices, what net stormwater runoff can be expected at the various proposed tunnel locations, again expressed in terms of flow rate, time (duration), volume, and frequency?
- What other options were considered/analyzed, particularly “downstream’ in the overall system?

- Move quickly of the planning and permitting of the tunnel.

The Vista Grande Watershed Study presents an initial conceptualization study regarding potential solutions to flooding in the Vista Grande Watershed. While a number of different options were considered as part of the Vista Grande Watershed Study constraints due to the highly urbanized nature of the Vista Grande Watershed limited the feasibility of a number of these alternatives. The alternatives considered are detailed in Chapter 4 *Alternatives Considered*.

The outcome of this effort was to obtain consensus on a conceptual approach to solving flooding in the watershed that uses holistic watershed management to maximize benefits and minimize costs. The conceptual approach recommended in the study includes both downstream components (the proposed Tunnel South of County Line and Vista Grande Wetland) and upstream components (Upstream Storm Drain Improvements and Ongoing Implementation of Best Management Practices). At this time, no projects have been selected for implementation; rather, the study presents a number of options and develops several proposed program components to planning-level detail. The factors that will be considered in selecting a project will include the study goal and objectives as well as additional factors that may be identified during the alternatives analysis process. Benefits and impacts to property owners and all residents in the watershed will be taken into account. In addition, an extensive environmental analysis would be conducted for any of the projects selected for implementation. This analysis would investigate the potential impacts to the subsurface, including soils and the groundwater aquifer.

If the Tunnel South of County Line and the Vista Grande Wetland are selected for implementation, the Vista Grande canal and tunnel would remain operational until the new Tunnel South of County Line is constructed and operational. After the Tunnel South of County Line is in place, the existing Vista Grande tunnel would no longer be necessary for stormwater conveyance but it could be maintained as an overflow structure for Lake Merced. Maintaining the existing canal after the Tunnel South of County Line is complete is not compatible with the Vista Grande Wetland since the canal would need to be abandoned in order to construct the wetland. However, in the unlikely event of system failure, the wetland could be flooded to contain a portion of flood waters during this state of emergency. See the discussion in Section 6.5 *Phasing and Schedule* for additional information regarding project implementation and timing.

Identifying alternate means of soil disposal is an important consideration which will be considered as the proposed program components are further developed. Since this study is a preliminary analysis intended to identify alternatives, it is out of the scope of this document to identify specific soils disposal alternatives. However, cost implications, potential beneficial uses and other considerations will be evaluated for different soil disposal options once projects are selected for implementation. For the planning-level cost estimates presented in this document, it was assumed that soils would be disposed of within ten miles of the project site.

The stormwater runoff that can be expected from the watershed is presented in Section 1.2 *Hydrology*. The effects of upstream stormwater management practices are discussed in detail in Sections 5.3 *Upstream Storm Drain Improvements* and 5.4 *Ongoing Implementation of Best Management Practices*. These flow rates would be further refined prior to selection and implementation of a proposed project alternative. "

Finally, the preliminary implementation schedules presented in the Vista Grande Watershed Study call for planning and permitting for the tunnel to begin as soon as possible.

## H) Habitat Concerns related to the Vista Grande Wetland

Concerns regarding potential habitat loss due to the construction of the Vista Grande Wetland included:

- Upland habitat loss should be considered and mitigated.
- There is less than a 50% chance of moving heritage oaks successfully so moving them seems unrealistic and prohibitively expensive. An alternative mitigation could include collecting acorns from the heritage oaks and propagate them for planting in the vicinity.
- The pines and eucalyptus are not unique, are not native to San Francisco and it would probably not be cost effective to move them. Their loss could be mitigated by planting conifers on one of the nearby golf courses.
- A construction alternative that would spare the heritage oaks is preferred.
- The trees along the west edge of the Vista Grande Canal should not be removed since these trees screen the Olympic Club and provide habitat for migrating birds.
- Another component of upland habitat that will be lost to this project is the weedy area that is significant to sparrows and finches that use this area for feeding from late summer through mid spring.
- The cattail and bulrush used in the wetlands should be genetically consistent with those species in Lake Merced.
- On page 5-43 there is a proposal to pump water from Lake Merced to the wetlands to keep them viable. There are other water sources, such as treated water from Daly City that are much more appropriate. We oppose installing pumping infrastructure in the lake for this purpose and we oppose pumping water from Lake Merced.
- The recreational use of the wetlands project site should be maintained for bird watching and other recreational uses. The solution would be to incorporate a boardwalk along the edge of the Vista Grande Canal that allows walkers to view the trees much as they can now.

The proposed Vista Grande Wetland would be constructed in the area of the existing Vista Grande canal. In order to construct the wetland, the canal would be abandoned and the area surrounding the canal would be excavated to form the wetland. Concerns

regarding the removal of trees from the site and the potential impacts to the bird habitat in the surrounding area have been noted. Based on the preliminary layout of the wetland, it is unlikely that a final design would be able to avoid the removal of the trees on this site given the land constraints in this urbanized area. However, mitigation efforts would be incorporated where appropriate.

In addition, the construction of the wetland likely would result in some loss of upland habitat for sparrows and finches. Text has been added to Section 5.3.10 regarding the impacts of this loss. The need for further investigation of these impacts during the environmental review process and these potential mitigation measures was noted in the text.

Since bulrush and cattail species are common plants in California with seeds passing easily around the region it is unlikely that there is a specific species or strain that is unique to Lake Merced. However, an investigation of the potential diversity of cattail and/or bulrush species present at Lake Merced could be conducted in order to determine whether there is a native or predominant strain. There may be more than one species already present and these species may be available as species-specific starts from nurseries. If further investigation suggests that there is some unique feature to the Merced cattails and bulrush, the plants could be grown on-site from seeds or small starts in pots. This option would require setting up a small nursery at the site a year before. The option of obtaining bulrush and cattail stock from Lake Merced has been noted in the document. The feasibility of this alternative to vegetate the wetland would be further investigated during the environmental review process and the wetland design phase."

The alternative of pumping water from Lake Merced to sustain the proposed Vista Grande Wetland during dry months was presented as an option for consideration only if another dry weather supply can not be found. Further investigation is necessary to establish the feasibility of other dry-weather water supplies.

Finally, while the construction of the proposed Vista Grande Wetland may result in the loss of some of the recreational area that is currently located along the canal, it is expected to enhance the overall recreational opportunities in the area. The Vista Grande Watershed Study mentions the inclusion of a public trail to enhance recreational opportunities in the recreation section on page 5-48. Text has been added to this section to note the existing recreation in the area and expand on the opportunities to enhance recreation in this area.

## I) <u>Habitat Concerns related to the Tunnel South of County Line</u>

Concerns regarding potential habitat loss due to the construction of the Tunnel South of County Line included:

- The draft plan refers to Plovers (page 5-21), which should be more specifically referred to “Western” Snowy Plover.

- Any survey for Western Snowy Plover should incorporate both a winter and a nesting season element.
- The Fort Funston Bank Swallow colony is one of only 2 or 3 remaining on the California coast. That colony is located in the bluffs at the north end of Fort Funston. Any construction south of the Hang Glider Observation Deck at Fort Funston is not likely to have an impact on the swallows.
- It would be necessary to survey the cliffs at the outfall site for evidence of Bank Swallow nesting during the EA preparation period. Since that period may not coincide with the swallows' nesting cycle it is necessary to plan to survey the site during May and June when the swallows would be present.
- Whether the beach outlet structure could impact ocean floor resources, thereby impacting the food resources used by wintering sea ducks.
- A survey of wintering ducks, grebes, cormorants and loons should be included in the environmental assessment for this plan. If impacts are expected to be significant, a mitigation plan should be developed.

An extensive environmental analysis will be conducted for any of the projects selected for implementation. The text in the Environmental Impacts portion Section 5.2.8 *Implementation Issues* has been revised to reflect the correct name of the Snowy Plover, indicate that a survey for the Snowy Plover should incorporate a winter and a nesting season element, and that a survey of the cliffs for Bank Swallow nesting should be conducted during May and June when the swallows would be present.
In addition, the potential impacts to sea ducks and the need to consider these impacts during the environmental review phase of project implementation have also been noted in this section.

## J) <u>Interim Solutions</u>

Concerns regarding the need for interim solutions included:

- Any interim solution which involves the direct diversion of stormwater to Lake Merced should incorporate the potential for higher managed lake levels that could connect Lake Merced and Impound Lake in its design.
- Establish and set of protocols for the maintenance of the drainage area.
- Have a pre-storm season walk through of the canal and adjacent areas as necessary to identify debris. Remove debris in the canal to minimize the potential occurrence of overflows during less than peak flow event.
- Consider installing a mechanical bar screen debris remover or other mechanical device to catch and remove debris during storm events to maintain optimum flow through the canal and tunnel.
- Include Lake Merced Shoreline restoration as part of the wetland and tunnel projects. The shoreline has been significantly altered in several places and habitat restoration is a necessary element of any proposal being considered.
- The projected completion dates of the various new tunnel options are overly optimistic and the need for interim solutions is hastily dismissed. An interim

solution such as the use of Impound Lake for overflow storage must be incorporated into the final recommendations in the plan to serve as a readily available contingency.

The three interim solutions evaluated as part of this Study were not recommended for implementation due to the extensive regulatory requirements which could delay the implementation of any interim solution for several years. This could delay the implementation of any long-term solution. Therefore, it was recommended to concentrate efforts on implementing a long-term solution.

No long-term solution can incorporate the direct diversion of stormwater into Lake Merced due to water quality concerns and regulatory constraints. The only long-term solution presented in the Study which would involve the discharge of treated stormwater to Lake Merced is the proposed Vista Grande Wetland which would be designed specifically to enhance lake levels. The Vista Grande Wetland, if selected for implementation would be one of the SFPUC's projects implemented specifically to reach the higher managed lake-level. The specific incorporation of the Vista Grande Wetland into the Lake Level Management Plan has not been analyzed but would be considered if the project is selected for implementation. Additional information on the preliminary analysis of the interim solutions can be found in Section 4.4 *Interim Solutions* and Appendix D.

Ongoing maintenance of the Vista Grande drainage system is essential to minimize flooding damages that will continue until a long-term solution is in place. Maintenance at the Vista Grande canal and the Vista Grande tunnel are of particular importance to minimize overflows issues at the canal and into Lake Merced. A pre-storm season walk through has been added as part of the recommendations for short-term maintenance of the canal and tunnel areas. The option of installing a mechanical device to catch and remove debris during storm events has also been included in the discussion of ongoing maintenance added to Section 4.4.4 *Recommendations Related to Interim Solutions* and Section 6.6 *Next Steps*.

Restoring the banks of Lake Merced which have been repeatedly impacted by overflows from the Vista Grande canal is an appropriate addition to this Study. This restoration effort should not take place until after the new Tunnel South of County Line is constructed and operational since periodic flooding may occur along the canal until that time. The next steps in the Watershed Study have been revised to include a recommendation for a bank restoration effort after tunnel implementation.

## K) <u>Regulatory Concerns / Intent of Document</u>

Concerns regarding regulatory requirements for the preliminary program recommendations and the Vista Grande Watershed Study included:

- From a review of the Draft Plan, one reasonable would conclude that the Agencies are moving toward the adoption of a final Watershed Plan without having first subjected the Watershed Plan itself to environmental review, which is required by with the California Environmental Quality Act (CEQA, Public Resources Code section 21000, et seq.) and the National Environmental Policy Act (NEPA, 42 U.S.C. section 4321 et seq.)
- Adoption of such a Watershed Plan without compliance with CEQA would seem to be in violation of the law because the Watershed Plan itself could well constitute a "project" pursuant to CEQA and would thus require environmental review before it becomes the Agencies' course of action.
- The Agencies may wish to prepare a program-level EIR for the Watershed Plan to inform decision-makers whether they should approve the Watershed Plan at all before the Agencies approve or begin to implement the Watershed Plan.
- The project should be designed to avoid, to the greatest extent feasible, impacts to NPS resources Under the laws that guide NPS land management, most specifically the Organic Act (1916), NPS cannot allow projects that harm the integrity of park resources or values.
- The GGNRA General Management Plan (GMP) states that the NPS will adhere to "Executive Order 11752 for the prevention, control, and abatement of environmental pollution for all facilities under its jurisdiction; including adequate sewage collection and disposal, solid waste collection and disposal, and protection of the quality of waters within, or flowing through, the area. To accomplish this goal, whenever possible sewage and water systems will be connected to public utilities."
- The GGNRA has consistently not authorized untreated stormwater effluent originating in areas outside the park to be discharged onto NPS land. The NPS is obligated and has a high interest in protecting the water quality within both GGNRA deeded land and State Lands Commission leased lands. Project planners need to consider alternatives to discharging untreated stormwater effluent along the shoreline, including increasing the capacity and operating procedures for accepting stormwater at the nearest local municipal water treatment plant.
- Selection and implementation of an alignment of the Tunnel South of County Line that terminates at Thornton State Beach would require obtaining an easement from CA State Parks.
- Generally speaking, the granting of easements and right of entry permits which affect or burden state park property, is strongly disfavored. In addition to first assessing and analyzing all other alignment alternatives and fully mitigating all projects impacts, the test for approving an easement is benefit to the state park system. Any easement proposal should incorporate measures to improve and enhance natural resource values and public access and recreational opportunity at this park unit.
- California State Parks would insist on detailed assessment of and mitigation for obvious site specific impacts and concerns including, but not limited to, adverse impacts to the public's use and enjoyment of this area, adverse visual

impacts of the outfall structure, short and long term impacts to the natural beach and near shore environment, coastal bluff impacts, and water quality issues associated with the discharge.

- California State Parks would also require that the project satisfy all requirements and concerns of the Golden Gate National Recreation Area (GGNRA) as Thornton State Beach may be subject of a future land transfer between our respective agencies.
- The State Lands Commission should be added to the regulatory section and tables.
- A public Works Plan with the California Coastal Commission should be considered to streamline the permitting process.

The City of Daly City and the City of San Francisco have every intention of conducting this process in full compliance with the applicable laws. The Vista Grande Watershed Study presents an initial conceptualization study regarding potential solutions to flooding in the Vista Grande Watershed. This study is a planning level document that does not present a final project for implementation. The concepts presented in this plan would need to undergo an alternatives analysis before a project can be selected. The required environmental review pursuant to CEQA and NEPA (if applicable) will be conducted as part of this process. In order to help clarify the intent of this study, the name of the document has been changed from the Vista Grande Watershed Plan to the Vista Grande Watershed Study. We believe this name more fully represents the spirit of this document and will help clarify its purpose.

Currently, all portions of the Vista Grande storm drain system, including the Vista Grande canal and tunnel, are undersized. As a result flooding is common throughout the watershed and is especially problematic at the Vista Grande canal. If the system remains in its current condition, the flooding is expected to continue. This would include upstream flooding throughout the watershed and downstream flooding at the Vista Grande canal, over John Muir Drive and into Lake Merced.

If no action is taken, periodic flooding throughout the watershed, and especially at the Vista Grande canal, will continue to cause ecological and public safety concerns. As a result it is essential that action be taken to solve these problems. This Study investigated a number of options, including options which would not include conveying stormwater to the ocean. However, preliminary investigation found that these options either were insufficient to solve the flooding or were infeasible due to land constraints of the urbanized watershed and prohibitively high costs. However, the Watershed Study recommends that, where feasible, upstream improvements include approaches that reduce peak downstream flows. Such improvements which may include local storage options, will be identified during the development of a Storm Drain Master Plan, as discussed in Section 5.4.

The Clean Water Act does not call for stormwater to be treated prior to discharge to the ocean. While Daly City strives to meet and, when economically feasible, exceed all water quality requirements, increasing the capacity and operating procedures at the municipal

wastewater treatment plan so that it could accept stormwater would to be prohibitively expensive.

The implementation of Best Management Practices (BMPs) is discussed in detail in Section 5.5 and is recommended for development as part of an overall watershed program to solve flooding issues. In addition, adherence to the San Mateo County NPDES Stormwater discharge permit is discussed in Section 5.5.2. Information regarding this permit is publicly available.

As presented in the Study, the feasible sites for the outlet structure for the Tunnel South of County Line may fall within the jurisdiction of NPS or California State Parks. The concerns of both of these agencies have been noted and their policies will be taken into consideration as the preliminary projects presented in this Study are further developed and evaluated. If the Tunnel South of County Line is selected for implementation, a detailed alternatives analysis will be conducted to refine the concepts presented in the Watershed Study. This alternatives analysis would consider a number of alignments to identify the preferred alternative. This analysis would consider aesthetic, ecological, recreational and other factors in order to minimize impacts at the selected site. In addition, the project would be further refined and mitigation measures may be identified as part of the CEQA/NEPA environmental review process.

A discussion of the permitting and coordination requirements with the California State Parks has been added to Section 6.6 *Regulatory Requirements*. In addition, applicable information regarding coordination with the California State Parks has been added to Table 6-3 *Summary of State and Federal Regulatory Requirements*, Figure 6-2 *Regulatory Agency Relationships*, and Table 6-4 *Summary of Recommended Institutional Arrangements*.

The option to prepare a Public Works Plan with the California Coastal commission is discussed on pages 6-11 and 6-12 of the Vista Grande Watershed Study. As discussed in this section, a Public Works Plan may make the permitting process more efficient. This option will be considered when the agencies select the project(s) for implementation."

Finally text regarding the State Lands Commission and their relationship to the potential projects identified in this Study was added to Section 6.6 *Regulatory Requirements*.

## L) <u>Schedule Concerns</u>

Concerns regarding the proposed schedule for the preliminary program included:

- Involving a number of different organizations will delay implementation of the final program.
- In June 2012 the Olympic Club will host the United States Open Golf Tournament.

Coordination between Daly City and San Francisco is necessary due to the layout of the current drainage system. In addition, implementing multiple projects together as an overall watershed program with multiple benefits may facilitate the permitting process, allowing the projects to proceed more quickly. Further, the Vista Grande Wetland, the only portion of the recommended program located within San Francisco, is scheduled to be implemented after other program elements are completed or underway.

The Vista Grande Watershed Study recognizes the need for coordination of project implementation with the Olympic Club to avoid impacts to the U.S. Open that will be hosted by the Olympic Club in 2012 as part of the implementation concerns outlined on page 5-23. As shown in Figure 5-18, the preliminary implementation schedules for the proposed Tunnel South of County, and Figure 6-4, construction for the Tunnel would be completed by 2012. This schedule includes only permitting, design and construction phases and is contingent on securing funding. If project implementation is delayed, the updated project schedule would be carefully coordinated with the Olympic Club to insure that construction would not interfere with the U.S. Open.

## M) Location of the Beach Outlet Structure and its Impacts on Coastal Erosion

Concerns regarding the location of the proposed Tunnel South of County Line beach outlet structure and its potential impacts on coastal erosion included:

- The a beach outfall should not be placed on any part of Thornton Beach within Daly City due to concerns that it damage the beach.
- Public access should be reopened at Thornton Beach.
- Erosive forces will make major impacts on the cliff face at the point of discharge.
- Outfall features on the beach are unnatural features that impact the visual quality of the area and pose safety concerns.
- Beach outlet structures are discouraged in areas under GGNRA's jurisdiction.
- Any beach outlet structure would need to be designed with the consideration of avoiding impacts to wildlife and visitors, and design and construct the structure to be more aesthetically compatible with the surrounding natural features.
- Outlet structures and supporting infrastructure proposed to be built on lands under the jurisdiction of the NPS, including leaseholdings through the State Lands Commission, would have to be appropriately permitted prior to construction, and National Environmental Policy Act (NEPA) appropriate compliance completed.
- The beach outlet structure would be located the Colma Formation and thus is placed in consolidated sand and not rock face as stated in the site description.

The study identifies two general sites as possible locations for the outlet structure for the proposed Tunnel South of County Line. If the Tunnel South of County Line is selected for implementation, a detailed alternatives analysis would be conducted to select a

preferred alignment and identify the specific site and design of the outlet structure. This analysis would consider aesthetic, ecological, recreational and other factors in order to minimize impacts at the selected site. This alternatives analysis would further investigate the potential for erosion at the outlet structure and would address structural concerns regarding the placement of the beach outlet structure in the Colma Formation. In addition, erosion and other impacts to the beach would be further investigated during the CEQA/NEPA environmental review process and mitigation alternatives may be identified. Finally, it is recognized that the proposed Tunnel South of County Line will require permits and approvals from a number of different regulatory agencies, potentially including NPS. We will work with the agencies to ensure all applicable permits and approvals are secured prior to construction.

Reopening public access at Thornton Beach is out of the scope of this document.

## N) Ongoing Erosion at Lake Merced

Concerns regarding the potential for ongoing erosion at Lake Merced included:

- The erosion at the project site at Lake Merced cannot be eliminated without re-engineering the entire shoreline, bank and roadway structure surrounding the lake.
- In order to significantly reduce and control erosion, an erosion control plan for Lake Merced should be developed that prohibits the use of off-site sand and the dumping of rock on eroded sites, promotes the use of native vegetation to control erosion, incorporates bank restoration and uses engineered rip-rap with structural support beneath only as a last resort.

The Vista Grande Watershed Study evaluates preliminary solutions that will eliminate flooding in the watershed and from the Vista Grande canal, across John Muir Drive, and into Lake Merced. The preliminary solutions which were recommended for further evaluation would prevent flooding at the canal, thus eliminating this source of erosion on the shores of Lake Merced. While this would not eliminate all erosion at Lake Merced, it would eliminate a significant source of frequent large-scale erosion. Although bank stabilization was considered as a potential interim solution, the study does not advocate the use of riprap as a long-term solution and advises against the implementation of any interim solution. A recommendation to add bank restoration as part of the overall watershed program has been added to the study. If bank restoration is incorporated into the final program, concerns for properly designing the restoration efforts will be incorporated into the design.

**VISTA GRANDE WATERSHED STUDY - SUMMARY OF PUBLIC COMMENTS AND GENERALIZED RESPONSES**

| General Comment Category | Generalized Comment | Response/Discussion Item (RMC) |
|---|---|---|
| A | A) Location of the Tunnel South of County Line<br><br>Concerns regarding the location of the proposed Tunnel South of County Line included:<br><br>– Daly City's drainage system should be located entirely within San Mateo County.<br>– The tunnel should be located entirely within San Francisco County since the preservation of Lake Merced water quality is primarily of interest to San Francisco residents.<br>– The New Parallel Tunnel option should be further investigated.<br>– Locate the tunnel from Doelger Community Center to Thornton Beach. | The overall goal of the Watershed Study is to define improvements to resolve flooding at the Vista Grande canal and the residential areas of the watershed. The Watershed Study was undertaken as a joint effort of Daly City and San Francisco because flooding at the Vista Grande canal has been an ongoing source of concern for both agencies. However, the stormwater causing overflows from the Vista Grande Canal originates from Daly City portion of the Vista Grande Watershed. Only a small portion of stormwater which flows into the Vista Grande canal originates within San Francisco.<br><br>This study evaluated a number of preliminary options to conceptualize alternatives and established a general approach to flood protection within the watershed. The preliminary alternatives were evaluated for their ability to meet the primary flood protection objective, as well as other benefits and limitations to determine which alternatives were most feasible for further evaluation. The New Parallel Tunnel was not further evaluated as part of this study in favor of evaluating the Tunnel South of County Line which would provide a drainage system that is completely contained within the County of San Mateo and is co |
| B | B) Level of Protection Provided by Preliminary Program Components<br><br>Concerns regarding the level of protection provided by the preliminary project alternatives identified in the Vista Grande Watershed Study included:<br><br>– The program should be designed to anticipate the worst occurrence that could occur based on our current level of understanding.<br>– The Study should evaluate more intense storms as well as the 25-year, 4-hour storm since the additional cost in providing greater protection may be incremental.<br>– The program should be designed to confront more extreme weather patterns and conditions that may occur due to global warming and global dimming effects.<br>– To eliminate flooding, the peak rainfall amounts, rather than the 4-hour average, must be accounted for.<br>– The peak rainfall data for the last 100 years understates the longer term historic data.<br>– Rising sea level should be considered in the design of the outfall structure and pipeline for the Tunnel South of County Line.<br>– What size and frequency of storm was selected for routing (discharge) at the County line and the other proposed tunnel | The Vista Grande Watershed Study presents an initial conceptualization study regarding potential solutions to flooding in the Vista Grande Watershed. The study presents a number of potential solutions and does not establish a set program for implementation. The storm intensities evaluated in this Study (25-year storm for all tunnel alternatives and the 10-year storm for Storm Drain Improvements) were used for the initial evaluation of alternatives and were selected based on standard practice for other Bay Area entities and initial estimations. However, when alternatives are selected for implementation, a detailed alternatives analysis would be conducted for each selected alternative to determine the appropriate level of protection based on cost and feasibility constraints. For example, if the Tunnel South of County Line is selected for implementation, an alternatives analysis would be conducted to refine the concepts presented in the Watershed Study. Similarly, the design level for Storm Drain Improvements would be evaluated as part of the preparation of a Storm Drain Master Plan when specific improvements to reduce upstream flooding would be identified.<br><br>These alternative analyses would analyze rainfall patters and evaluate the cost and risks associated with several design sizes<br><br>The document has been revised to clarify that the 25-yr, 4-hr storm considered for the Tunnel South of County Line, and the 1<br>Page ES-6 – add a sentence under Recommended Program<br>Page ES-8 – clarify paragraph |
| C | C) Financing of the Preliminary Program Components<br><br>Concerns regarding how the preliminary program identified in the Vista Grande Watershed Study will be financed included:<br><br>– The Study doesn't discuss the likelihood of securing the $150-200 million necessary to implement the recommended improvements.<br>– It is likely that the landowners in the affected area will not approve any kind of assessment or bond measure since fewer than ten percent of these landowners are adversely impacted by drainage issues.<br>– Daly City tax money should not be used to pay for projects that benefit San Francisco.<br>– Lake Merced is in the City and County of San Francisco so it is inappropriate for Daly City to finance the construction or maintenance of the wetlands.<br>– Improvements to the Daly City drainage system should not be implemented in conjunction with other projects.<br>– Sewer fees over both the incorporated and unincorporated area of San Mateo County are set by the governing board of the district. It should also be noted that drainage fees that could be used to finance improvements would have to be approved by a vote of the property owners or registered voters in the area where fees are proposed to be levied. | The Vista Grande Watershed Study is a planning level document which identifies potential project alternatives and potential funding opportunities. This study continues past cooperative efforts between CCSF and Daly City for resolving integrated water resources issues involving recycled water, groundwater, stormwater, and Lake Merced. However, participation of CCSF and Daly City as joint sponsors of the Vista Grande Watershed Study should not be interpreted as a commitment by either agency to contribute funding for projects outside of their own jurisdiction. Ownership of individual projects presented in this Study has not been assigned and none of the proposed projects have been selected for implementation at this time. When projects are selected for implementation, Daly City and CCSF will establish how each agency will be involved in financing and implementing each project, and a specific financing plan will be developed. This will likely result in each agency taking responsibility for projects within its own jurisdiction. However, there are several reasons why pursuing these projects as part of a comprehensive watershed program may be beneficial. First, regulatory agencies give preference to coor<br><br>In addition to coordination between Daly City and CCSF, an agreement between San Mateo County and Daly City would nee |
| D | D) Stormwater Should be Beneficially Reused within the Watershed<br><br>Concerns that the preliminary program recommendations to not maximize stormwater reuse benefits included:<br><br>– Discharging stormwater into the ocean is a waste of a valuable resource that could be used for other beneficial uses such as aquifer recharge or stream restoration.<br>– Stormwater should be used to recharge the Westside Basin Aquifer.<br>– The methodology used in the Sun Valley Watershed in Los Angeles County was not incorporated into this study. | The Vista Grande Public Watershed Study presents an initial conceptualization study regarding potential solutions to flooding in the Vista Grande Watershed. We are aware of the work in the Sun Valley Watershed in Los Angeles County and considered this approach in the initial alternatives developed and as part of the proposed Storm Drain Improvements. A number of alternatives were considered to reduce the volume of stormwater flowing to the ocean and use stormwater for other beneficial uses such as aquifer recharge or lake level enhancement. Since the primary objective of this Study was to solve flooding throughout the watershed, investigating the benefits of installing injection wells specifically for the purpose of recharging the groundwater basin was out of the scope of this Study. However, regional stormwater detention and aquifer recharge were investigated as part of the preliminary alternatives analysis conducted for this study. This initial alternatives analysis found that large-scale detention of stormwater to solve flooding and enhance aquifer recharge would not be |

| General Comment Category | Generalized Comment | Response/Discussion Item (RMC) |
|---|---|---|
| E | E) Specific Comments about the Conceptual Design of the Vista Grande Wetland<br><br>Concerns regarding the conceptual design of the Vista Grande Wetland included:<br><br>– Whether the use of mushroom mycelium been considered as a component of the biofilter.<br>– Whether the wetland be designed to encourage aquifer recharge through leakage from the wetland.<br>– What the design life of the wetland is.<br>– Whether leakage from the wetland would be a source of groundwater pollution.<br>– The potential for ongoing erosion at Lake Merced. The erosion at the project site at Lake Merced cannot be eliminated without re-engineering the entire shoreline, bank and roadway structure surrounding the lake. In order to significantly reduce and control erosion, an erosion control plan for Lake Merced should be developed that prohibits the use of off-site sand and the dumping of rock on eroded sites, promotes the use of native vegetation to control erosion, incorporates bank restoration and uses engineered rip-rap with structural support beneath only as a last resort. | The conceptual design of the proposed Vista Grande Wetland was developed with consultation from Dr. Alex Horne, a Professor Emeritus of Environmental Engineering at the University of California, Berkeley, and a recognized expert on constructed treatment wetlands. The preliminary layout and conceptual design of the proposed Vista Grande Wetland is presented in Section 5.3 Vista Grande Wetland. Stormwater would be pumped from the proposed Tunnel South of County Line inlet structure into the wetland and then flow by gravity through the wetland and out into Lake Merced. Section 5.3.4 Design Assumptions includes additional information regarding how stormwater would flow into and out of the wetland. A number of different flow rates, volumes, durations and frequencies were analyzed as part of the preliminary assessment of the proposed wetland, as presented in Section 5.3.6 Water Quality Considerations and Treatment Characteristics. A number of different regulatory approvals would be needed to implement the Vista Grande Wetlands as presented in Table 5-15. The preliminary layout for the Vista Grande Wetland, including the area required and location, is discussed in Section 5.3.5 Prelim<br><br>The conceptual design of the Vista Grande Wetland was optimized to provide lake level enhancement to Lake Merced. The v |
| F | F) Specific Comments about the Conceptual Design of the Tunnel South of County Line<br><br>Concerns regarding the conceptual design of the Tunnel South of County Line included:<br><br>– The potential for future collapses of the Colma Formation along the proposed Tunnel South of County Line alignment.<br>– The plan for operation and maintenance on page 5-19 seems inadequate.<br>– Monitoring for system failure needs to be a significant part of this plan. The pipeline should be fitted with a monitoring system capable of pinpointing leaks that could lead to system collapse due to geologic failure or during an extreme weather event.<br>– How earthquakes could impact the Tunnel South of County Line and what design features have been incorporated to avoid catastrophic failure of the system.<br>– How stormwater would be routed into the Tunnel South of County Line and the Vista Grande Wetland.<br>– Alternatives 1 and 2 outlet within a large landslide complex that was most recently active in 1997-98, and resulted in the closure of the golf course west of Skyline Blvd. Previous movement of this landslide complex reportedly resulted in the southbound lanes of Skyline Blvd. being shifted east. Stabilization of this landslide complex would likely be cost prohibitive, a | The Vista Grande Watershed Study presents an initial conceptualization study regarding potential solutions to flooding in the Vista Grande Watershed. The preliminary alternatives recommended in this study, including the Tunnel South of County Line, have been developed at the planning-level only. If the Tunnel South of County Line is selected for implementation, an alternatives analysis will be conducted to refine the concepts presented in the Watershed Study. The potential for structural collapse of the Colma Formation, strategies for dealing with future collapse, and the large landslide complex identified in the region would be considered during this alternatives analysis and the results of this investigation would be considered during project selection. Specifics regarding earthquake impacts on the system are also a design-level concern and are not addressed in this planning-level document.<br><br>The operation and maintenance (O&M) considerations presented on page 5-19 were intended to provide an overview of the type of O&M that would be necessary for the tunnel to establish the feasibility and practicality of this proposed solution. It was<br><br>A brief overview of how stormwater would be conveyed into each of the three conceptual tunnel alignments presented in this<br><br>If the proposed Tunnel South of County Line and the Vista Grande Wetland are implemented, the existing tunnel would be ma |
| G | G) General Comments on the Vista Grande Watershed Study<br><br>General comments for the Vista Grande Watershed Study included:<br><br>– The existing Vista Grande canal and tunnel should be maintained as a backup system for the proposed Tunnel South of County Line in case of catastrophic system failure.<br>– The Vista Grande Wetland should not be an optional element of the overall program and should be implemented and funded as part of the larger flood protection program.<br>– This plan should address alternative means of spoils disposal.<br>– The study should identify potential impacts to the subsurface environment.<br>– The existing system should continue to be studied and improved rather than developing new infrastructure.<br>– The study should give serious consideration to upstream measures that can contribute to the overall solutions being sought.<br>– Identification of the criteria that will be used for making decisions among the alternatives discussed in the Study.<br>– The specifics of the hydrology of the watershed i.e.: What stormwater runoff can be expected from the watershed, | The Vista Grande Watershed Study presents an initial conceptualization study regarding potential solutions to flooding in the Vista Grande Watershed. While a number of different options were considered as part of the Vista Grande Watershed Study constraints due to the highly urbanized nature of the Vista Grande Watershed limited the feasibility of a number of these alternatives. The alternatives considered are detailed in Chapter 4 Alternatives Considered.<br><br>The outcome of this effort was to obtain consensus on a conceptual approach to solving flooding in the watershed that uses holistic watershed management to maximize benefits and minimize costs. The conceptual approach recommended in the study includes both downstream components (the proposed Tunnel South of County Line and Vista Grande Wetland) and upstream components (Upstream Storm Drain Improvements and Ongoing Implementation of Best Management Practices). At this time, no projects have been selected for implementation; rather, the study presents a number of options and develops several proposed program components to planning-level detail. The factors that will be considered in selecting a pro<br><br>If the Tunnel South of County Line and the Vista Grande Wetland are selected for implementation, the Vista Grande canal an<br><br>Identifying alternate means of soil disposal is an important consideration which will be considered as the proposed program c |

| General Comment Category | Generalized Comment | Response/Discussion Item (RMC) |
|---|---|---|
| H | H) Habitat Concerns related to the Vista Grande Wetland<br><br>Concerns regarding potential habitat loss due to the construction of the Vista Grande Wetland included:<br><br>– Upland habitat loss should be considered and mitigated.<br>– There is less than a 50% chance of moving heritage oaks successfully so moving them seems unrealistic and prohibitively expensive. An alternative mitigation could include collecting acorns from the heritage oaks and propagate them for planting in the vicinity.<br>– The pines and eucalyptus are not unique, are not native to San Francisco and it would probably not be cost effective to move them. Their loss could be mitigated by planting conifers on one of the nearby golf courses.<br>– A construction alternative that would spare the heritage oaks is preferred.<br>– The trees along the west edge of the Vista Grande Canal should not be removed since these trees screen the Olympic Club and provide habitat for migrating birds.<br>– Another component of upland habitat that will be lost to this project is the weedy area that is significant to sparrows and | The proposed Vista Grande Wetland would be constructed in the area of the existing Vista Grande canal. In order to construct the wetland, the canal would be abandoned and the area surrounding the canal would be excavated to form the wetland. Concerns regarding the removal of trees from the site and the potential impacts to the bird habitat in the surrounding area have been noted. Based on the preliminary layout of the wetland, it is unlikely that a final design would be able to avoid the removal of the trees on this site given the land constraints in this urbanized area. However, mitigation efforts would be incorporated where appropriate.<br><br>In addition, the construction of the wetland likely would result in some loss of upland habitat for sparrows and finches. Text has been added to Section 5.3.10 regarding the impacts of this loss. The need for further investigation of these impacts during the environmental review process and these potential mitigation measures was noted in the text.<br><br>Since bulrush and cattail species are common plants in California with seeds passing easily around the region it is unlikely that there is a specific species or strain that is unique to Lake Merced. However, an investigation of the potential diversity of |
| I | I) Habitat Concerns related to the Tunnel South of County Line<br><br>Concerns regarding potential habitat loss due to the construction of the Tunnel South of County Line included:<br><br>– The draft plan refers to Plovers (page 5-21), which should be more specifically referred to “Western” Snowy Plover.<br>– Any survey for Western Snowy Plover should incorporate both a winter and a nesting season element.<br>– The Fort Funston Bank Swallow colony is one of only 2 or 3 remaining on the California coast. That colony is located in the bluffs at the north end of Fort Funston. Any construction south of the Hang Glider Observation Deck at Fort Funston is not likely to have an impact on the swallows.<br>– It would be necessary to survey the cliffs at the outfall site for evidence of Bank Swallow nesting during the EA preparation period. Since that period may not coincide with the swallows’ nesting cycle it is necessary to plan to survey the site during May and June when the swallows would be present.<br>– Whether the beach outlet structure could impact ocean floor resources, thereby impacting the food resources used by | An extensive environmental analysis will be conducted for any of the projects selected for implementation. The text in the Environmental Impacts portion Section 5.2.8 Implementation Issues has been revised to reflect the correct name of the Snowy Plover, indicate that a survey for the Snowy Plover should incorporate a winter and a nesting season element, and that a survey of the cliffs for Bank Swallow nesting should be conducted during May and June when the swallows would be present.<br>In addition, the potential impacts to sea ducks and the need to consider these impacts during the environmental review phase of project implementation have also been noted in this section. |
| J | J) Interim Solutions<br><br>Concerns regarding the need for interim solutions included:<br><br>– Any interim solution which involves the direct diversion of stormwater to Lake Merced should incorporate the potential for higher managed lake levels that could connect Lake Merced and Impound Lake in its design.<br>– Establish and set of protocols for the maintenance of the drainage area.<br>– Have a pre-storm season walk through of the canal and adjacent areas as necessary to identify debris. Remove debris in the canal to minimize the potential occurrence of overflows during less than peak flow event.<br>– Consider installing a mechanical bar screen debris remover or other mechanical device to catch and remove debris during storm events to maintain optimum flow through the canal and tunnel.<br>– Include Lake Merced Shoreline restoration as part of the wetland and tunnel projects. The shoreline has been significantly altered in several places and habitat restoration is a necessary element of any proposal being considered.<br>– The projected completion dates of the various new tunnel options are overly optimistic and the need for interim solutions is hastily dismissed. An interim solution such as the use of Impound Lake for overflow storage must be incorporated into the f | The three interim solutions evaluated as part of this Study were not recommended for implementation due to the extensive regulatory requirements which could delay the implementation of any interim solution for several years. This could delay the implementation of any long-term solution. Therefore, it was recommended to concentrate efforts on implementing a long-term solution.<br><br>No long-term solution can incorporate the direct diversion of stormwater into Lake Merced due to water quality concerns and regulatory constraints. The only long-term solution presented in the Study which would involve the discharge of treated stormwater to Lake Merced is the proposed Vista Grande Wetland which would be designed specifically to enhance lake levels. The Vista Grande Wetland, if selected for implementation would be one of the SFPUC’s projects implemented specifically to reach the higher managed lake-level. The specific incorporation of the Vista Grande Wetland into the Lake Level Management Plan has not been analyzed but would be considered if the project is selected for implementation.<br>Additional information on the preliminary analysis of the interim solutions can be found in Section 4.4 Interim Solutions and Ap<br><br>Ongoing maintenance of the Vista Grande drainage system is essential to minimize flooding damages that will continue until a |

| General Comment Category | Generalized Comment | Response/Discussion Item (RMC) |
|---|---|---|
| K | K) Regulatory Concerns / Intent of Document<br><br>Concerns regarding regulatory requirements for the preliminary program recommendations and the Vista Grande Watershed Study included:<br><br>– From a review of the Draft Plan, one reasonable would conclude that the Agencies are moving toward the adoption of a final Watershed Plan without having first subjected the Watershed Plan itself to environmental review, which is required by with the California Environmental Quality Act (CEQA, Public Resources Code section 21000, et seq.) and the National Environmental Policy Act (NEPA, 42 U.S.C. section 4321 et seq.)<br>– Adoption of such a Watershed Plan without compliance with CEQA would seem to be in violation of the law because the Watershed Plan itself could well constitute a "project" pursuant to CEQA and would thus require environmental review before it becomes the Agencies' course of action.<br>– The Agencies may wish to prepare a program-level EIR for the Watershed Plan to inform decision-makers whether they should approve the Watershed Plan at all before the Agencies approve or begin to implement the Watershed Plan. | The City of Daly City and the City of San Francisco have every intention of conducting this process in full compliance with the applicable laws. The Vista Grande Watershed Study presents an initial conceptualization study regarding potential solutions to flooding in the Vista Grande Watershed. This study is a planning level document that does not present a final project for implementation. The concepts presented in this plan would need to undergo an alternatives analysis before a project can be selected. The required environmental review pursuant to CEQA and NEPA (if applicable) will be conducted as part of this process. In order to help clarify the intent of this study, the name of the document has been changed from the Vista Grande Watershed Plan to the Vista Grande Watershed Study. We believe this name more fully represents the spirit of this document and will help clarify its purpose.<br><br>Currently, all portions of the Vista Grande storm drain system, including the Vista Grande canal and tunnel, are undersized. As a result flooding is common throughout the watershed and is especially problematic at the Vista Grande canal. If the syste<br><br>If no action is taken, periodic flooding throughout the watershed, and especially at the Vista Grande canal, will continue to cau |
| L | L) Schedule Concerns<br><br>Concerns regarding the proposed schedule for the preliminary program included:<br><br>– Involving a number of different organizations will delay implementation of the final program.<br>– In June 2012 the Olympic Club will host the United States Open Golf Tournament. | Coordination between Daly City and San Francisco is necessary due to the layout of the current drainage system. In addition, implementing multiple projects together as an overall watershed program with multiple benefits may facilitate the permitting process, allowing the projects to proceed more quickly. Further, the Vista Grande Wetland, the only portion of the recommended program located within San Francisco, is scheduled to be implemented after other program elements are completed or underway.<br><br>The Vista Grande Watershed Study recognizes the need for coordination of project implementation with the Olympic Club to avoid impacts to the U.S. Open that will be hosted by the Olympic Club in 2012 as part of the implementation concerns outlined on page 5-23. As shown in Figure 5-18, the preliminary implementation schedules for the proposed Tunnel South of County, and Figure 6-4, construction for the Tunnel would be completed by 2012. This schedule includes only permitting, design and construction phases and is contingent on securing funding. If project implementation is delayed, the updated |
| M | M) Location of the Beach Outlet Structure and its Impacts on Coastal Erosion<br><br>Concerns regarding the location of the proposed Tunnel South of County Line beach outlet structure and its potential impacts on coastal erosion included:<br><br>– The a beach outfall should not be placed on any part of Thornton Beach within Daly City due to concerns that it damage the beach.<br>– Public access should be reopened at Thornton Beach.<br>– Erosive forces will make major impacts on the cliff face at the point of discharge.<br>– Outfall features on the beach are unnatural features that impact the visual quality of the area and pose safety concerns.<br>– Beach outlet structures are discouraged in areas under GGNRA's jurisdiction.<br>– Any beach outlet structure would need to be designed with the consideration of avoiding impacts to wildlife and visitors, and design and construct the structure to be more aesthetically compatible with the surrounding natural features.<br>– Outlet structures and supporting infrastructure proposed to be built on lands under the jurisdiction of the NPS, including leaseholdings through the State Lands Commission, would have to be appropriately permitted prior to construction, and Natio<br>– The beach outlet structure would be located the Colma Formation and thus is placed in consolidated sand and not rock fac | The study identifies two general sites as possible locations for the outlet structure for the proposed Tunnel South of County Line. If the Tunnel South of County Line is selected for implementation, a detailed alternatives analysis would be conducted to select a preferred alignment and identify the specific site and design of the outlet structure. This analysis would consider aesthetic, ecological, recreational and other factors in order to minimize impacts at the selected site. This alternatives analysis would further investigate the potential for erosion at the outlet structure and would address structural concerns regarding the placement of the beach outlet structure in the Colma Formation. In addition, erosion and other impacts to the beach would be further investigated during the CEQA/NEPA environmental review process and mitigation alternatives may be identified. Finally, it is recognized that the proposed Tunnel South of County Line will require permits and approvals from a number of different regulatory agencies, potentially including NPS. We will work with the agencies to ensure all applicable permits and approvals are secured prior to construction.<br><br>Reopening public access at Thornton Beach is out of the scope of this document. |
| N | N) Ongoing Erosion at Lake Merced<br><br>Concerns regarding the potential for ongoing erosion at Lake Merced included:<br><br>– The erosion at the project site at Lake Merced cannot be eliminated without re-engineering the entire shoreline, bank and roadway structure surrounding the lake.<br>– In order to significantly reduce and control erosion, an erosion control plan for Lake Merced should be developed that prohibits the use of off-site sand and the dumping of rock on eroded sites, promotes the use of native vegetation to control erosion, incorporates bank restoration and uses engineered rip-rap with structural support beneath only as a last resort. | The Vista Grande Watershed Study evaluates preliminary solutions that will eliminate flooding in the watershed and from the Vista Grande canal, across John Muir Drive, and into Lake Merced. The preliminary solutions which were recommended for further evaluation would prevent flooding at the canal, thus eliminating this source of erosion on the shores of Lake Merced. While this would not eliminate all erosion at Lake Merced, it would eliminate a significant source of frequent large-scale erosion. Although bank stabilization was considered as a potential interim solution, the study does not advocate the use of riprap as a long-term solution and advises against the implementation of any interim solution. A recommendation to add bank restoration as part of the overall watershed program has been added to the study. If bank restoration is incorporated into the final program, concerns for properly designing the restoration efforts will be incorporated into the design. |