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.

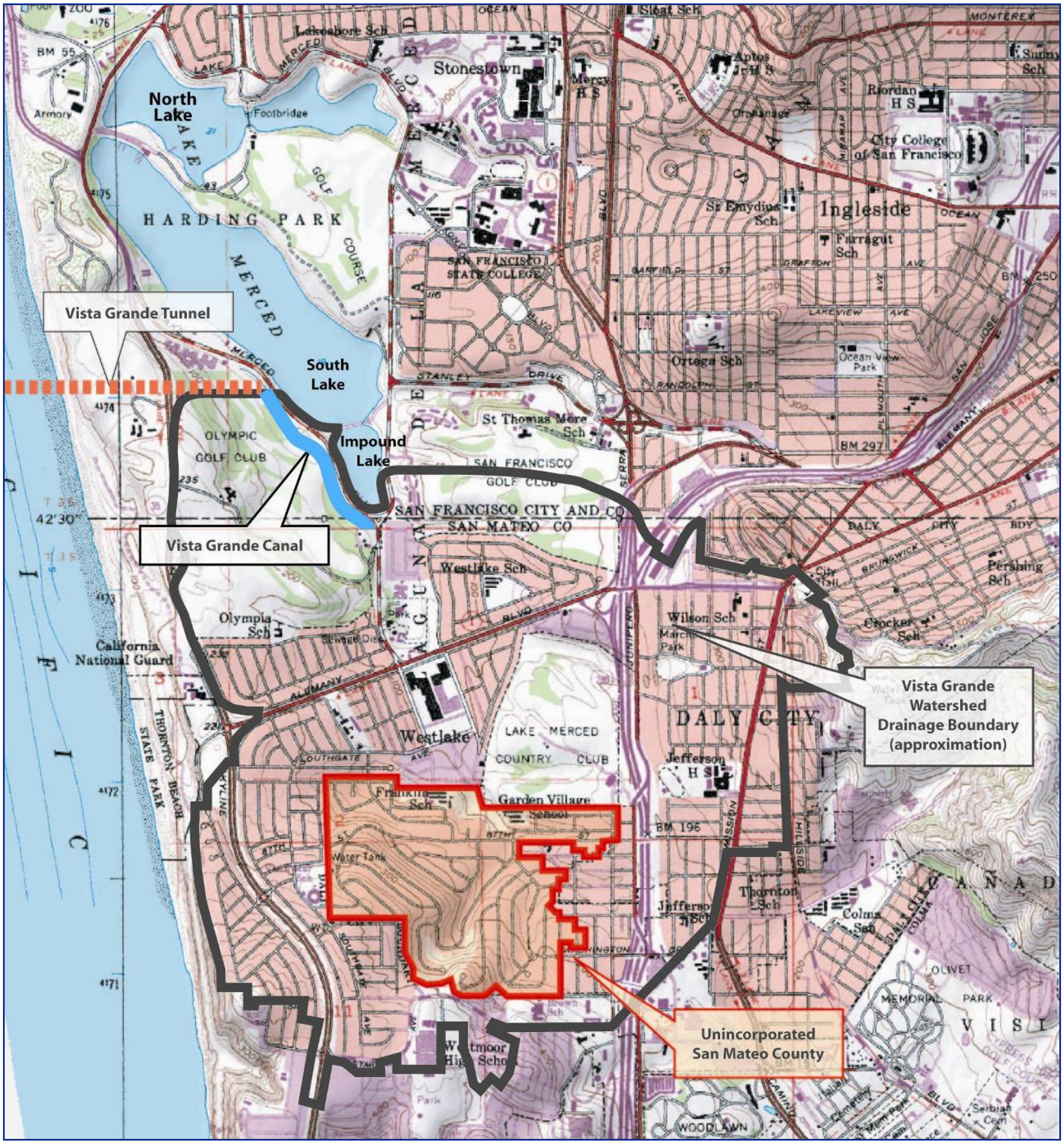
1.1 Intent of Document

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

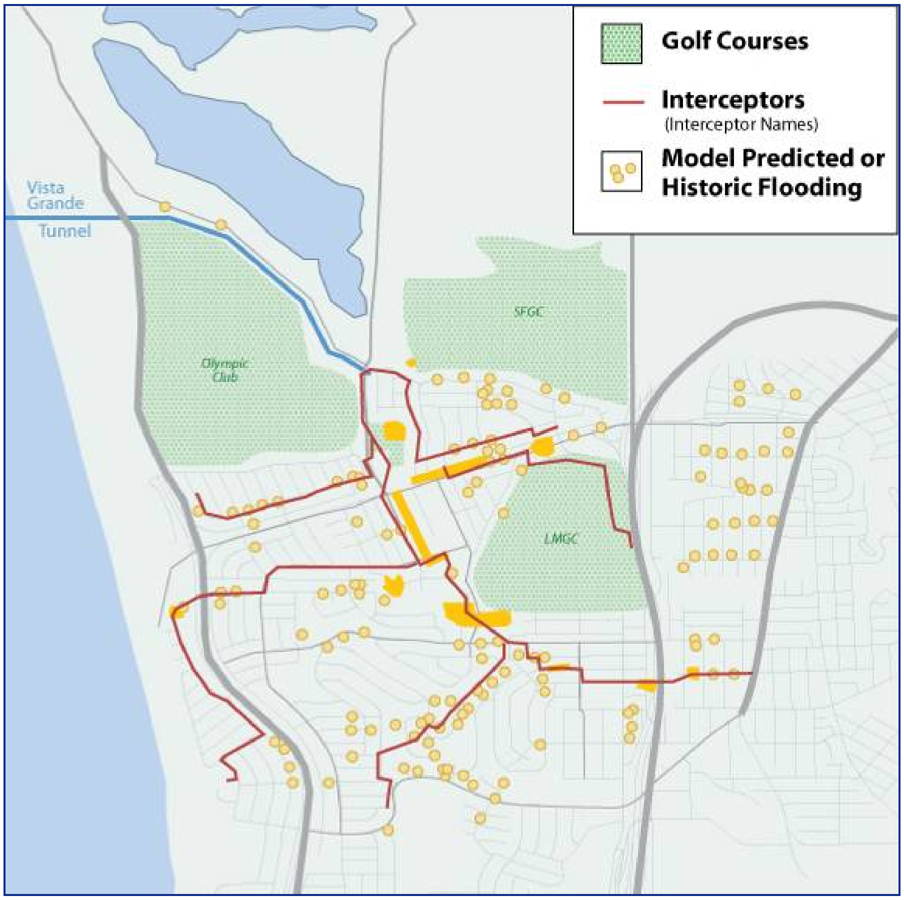
Source: Google, 2006

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

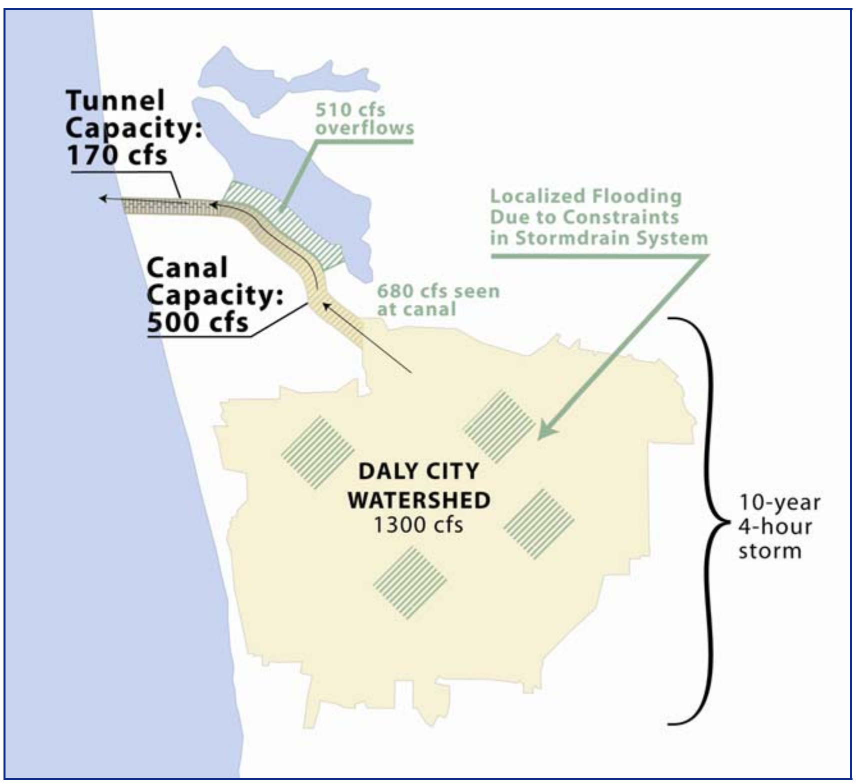


Figure 1-14 Upstream Flooding in the Vista Grande Watershed

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.