Project Memorandum

To: Robert Ovadia

From: Blake Rothfuss

Job Number: 3957.1

Date: August 29, 2008

Subject: Vista Grande Drainage Basin Alternatives Analysis Project
Supplemental Analyses (Final)

This memorandum summarizes the supplemental analyses of the three alternatives selected by the City of Daly City (City) to provide additional storm drainage capacity for the Vista Grande Drainage Basin. These alternatives are identified as Alternative 5B, Alternative 6B, and Alternative 7 combined with peak stormwater flow storage at Westlake Park. This work builds upon the previous analyses of 17 alternative concepts completed in December 2007 by Jacobs Associates (JA, 2007) and public input received during the Public Outreach activities.

Public Outreach

During February and March, 2008, the City of Daly City conducted a series of public outreach meetings introducing the draft Vista Grande Drainage Basin Alternatives Analysis report to the public, resource agencies, and the City and County of San Francisco. City staff facilitated two town-hall-style meetings within the City of Daly City on February 21 and February 26, 2008. There was also a meeting with the SFPUC to update them on the project's current scope. The issues that were raised in these meetings were:

- The community sought reassurance that the 25-year 4-hour design storm provided an appropriate level of flood protection.

  The Vista Grande Watershed Study (RMC 2006) assumed that storm drain improvements for the basin would be implemented to provide conveyance for the 10-year storm event. The 10-year event has become a standard for storm drain design for most cities in California because it provides a balance between level of service and affordability. Subsequent to the RMC study, the City directed the project team to use a storm with a 25-year recurrence interval and a 4-hour duration as the basis for planning for the Vista Grande diversion/storage, canal upgrade, new tunnel, and beach discharge. This design storm was selected because it provided a higher level of flood protection where significant damage to property would occur from storm-caused flooding. The level of protection can be further evaluated by looking separately at the storm frequency and the storm duration.

  Storm frequency. It is common to use a 25-year return frequency storm event for the design of major storm drains. This basically means the system will keep the road, etc free from flooding for all **statistically average** storm events up to the 25-year event (for the selected duration). Using this storm for design means that rain events will occur that may flood the road, but statistically less than once every 25 years on average. It is possible to have multiple 25-year events over a few years but then not have any for many more years.

Storm duration. A lot of cities and counties use a 24-hour storm duration, so they might use a 25-year/ 24-hour event. This means that the storm is spread over 24 hours and the rainfall intensity (inches/hr) is typically less than for shorter events. By using a 4-hour event, the rainfall intensities are usually larger. Designing to a 25-yr/4-hour event typically gives you a higher level of flood protection than designing to a 25-year/24-hour event. A 25-year/1-hour event would typically be a very intense storm. For storm drain designs with a positive outfall, it is the intensity that is important, not the total rainfall. In Daly City, you could compare the intensities for a 24-hour storm versus a 4- hour storm to see which one has the greatest intensity.

Inherently, there is a small reserve hydraulic capacity in the system associated with conservative design and construction practices. Unfortunately, the reserve capacity cannot be accurately predicted or relied upon as an additional level of flood protection. The proposed Vista Grande facilities could be designed to accommodate larger events (higher peak flows and/or longer storm durations). Due to the slight elevation difference between the tunnel inlet and the beach outfall, increasing the tunnel's diameter would not significantly increase the tunnel's flow capacity. Alternatives to provide additional capacity include: adding more diversion/storage, a larger canal section, and/or a third, parallel new tunnel. At a significantly higher capital cost, these additional facilities would be effective in reducing flooding within the City only if upstream stormwater facilities were correspondingly upsized to convey larger flows downstream.

Following the completion of upper watershed stormwater transmission system improvements, storm events larger than the design storm are likely to exceed the hydraulic capacity of the proposed Vista Grande facilities. When the Westlake Park stormwater storage tank is full, the water diversion system will prevent additional water from entering the storage tank. As the reserve tunnel capacity is consumed and the Vista Grande tunnels reach their maximum flow capacity, stormwater will backup in the canal until the water surface reaches the top of the gross solids (debris) removal system located along John Muir Drive near Lake Merced Blvd.

If the stormwater flows continue to increase, then the canal's water surface will rise above the debris removal system until the entire canal corridor has been filled with water. This temporary auxiliary storage capacity could be as large as 5 to 9 million gallons depending on the size of the proposed wetlands and the final canal configuration. Since there is no additional auxiliary storage capacity in the canal corridor beyond this level, any increase in stormwater inflow would cause overtopping along the canal corridor. Once outside of the canal corridor, the excess stormwater would become surface flow.

- The community was also interested in keeping the project within the City of Daly City to simplify the permits and land right-of-way acquisition.

  The project team recognizes that constructing the project within a single jurisdiction simplifies the building permit and land use permissions. During the alternatives evaluation, two significant influences limit the viability of the alternatives located wholly within the City of Daly City—geology and regulatory permitting. Geotechnical reconnaissance for this project has found considerable evidence of deep-seated landslides in the vicinity of Thorton State Beach, one of the possible new outfall structure sites. This area is prone to landsliding and aggressive bluff erosion. A new tunnel and outfall structure constructed in the geologically unstable area would be exposed to routine sloughing and landslides. Routine outfall structure maintenance would involve removing landslide material from the structure and waterway using large earthmoving equipment. The City would also need to relocate the beach structure landward more frequently than if the structure were

constructed further north. The existing Daly City Outfall Structure site, at Fort Funston, is considerably less susceptible to landslides and aggressive bluff erosion.

A new outfall structure, regardless of its location along the coast, will require the California Coastal Commission's (Commission) authorization. The Commission's staff indicated that obtaining the necessary permits would be difficult and time consuming. They suggested that the City focus its evaluation on the alternatives which used the existing outfall structure area. The Commission staff also expressed strong reservations for construction of a beach discharge structure that would require frequent relocation if a more stable location was readily available.

The proposed inlet to the stormwater system improvements should be located at or downstream of the confluence of the existing stormwater system. Locating the tunnel inlet elsewhere in the Vista Grande watershed would reduce the level of flood protection in the lower watershed or require a pumping facility to move stormwater from lower in the basin back to the City's tunnel. Such facilities would add considerable cost while reducing system reliability (compared to gravity operation) and increasing operational complexity. Siting the debris screening and new stormwater conveyance systems completely within the City of Daly City would not completely satisfy the project objectives.

- The SFPUC identified opportunities to coordinate this project with SFPUC efforts to improve the Lake Merced water quality.

  The proposed improvements to the Vista Grande Canal along John Muir Drive would be compatible with the SFPUCs interests in diverting some stormwater from the canal into wetlands adjacent to Lake Merced. There might, however, be an issue of timing the drainage system improvement project with the SFPUC's water quality improvement project. A cooperative project effort could result in a larger area being developed for wetlands. If the wetlands construction precedes the canal and tunnel construction, replacing recently constructed wetlands would be an additional cost to the Vista Grande project.

- The SFPUC expressed its concerns about construction impacts on citizens of San Francisco and suggested moving the tunnel inlet portal into San Mateo County.

  The Project Team considered several inlet locations within San Mateo County. The project team found that it was not possible to completely eliminate construction along Lake Merced Blvd. and John Muir Drive, but the proposed designs were modified to reduce the construction impacts on the communities within San Francisco and Daly City. The design modifications are described below.

In 2007 and 2008, the team discussed the project with representatives from the Golden Gate National Recreation Area, California Coastal Commission, and the Bay Area Regional Water Quality Control Board. Separate meetings were held with each agency in order to improve the understanding of the regulatory requirements for this project, inform the agencies about the development of this project, and engage their participation and feedback on the design alternatives, and gather information to aid in streamlining the permitting process. The issues that were raised in these meetings by each agency with regards to the design alternatives were:

- The **California Coastal Commission's** primary concern is the development of a project that conflicts with their mission of enforcing the Coastal Zone Act, which must prevent/minimize disruption public access to the coast.
- The **Golden Gate National Recreation Area/National Park Service (NPS)** has expressed concern about the staging of construction on NPS property if a practicable alternative exists. They also raised concern about the truck traffic generated during construction, and the potential for encounter with archaeological resources by the ground disturbance.

- The **Regional Water Quality Control Board, San Francisco Bay Region,** has expressed concerns about stormwater treatment and water quality issues.

Modified Design Elements

In response to the comments and suggestions received during the public outreach efforts, the alternatives were reviewed and revised, as appropriate, to improve public benefits and reduce adverse impacts. The following changes made were:

- A new inlet portal was considered within San Mateo County near the intersection of John Muir Drive and Lake Merced Blvd. This portal would be identical to the Alternative 5B portal except that it would be moved approximately 800 feet southeast into San Mateo County. The tunnel portal would be located immediately adjacent to The Olympic Club's maintenance facility on Lake Merced Blvd, and would disrupt the maintenance facility's operations throughout tunnel construction. Constructing the tunnel from this location would require traffic restrictions along Lake Merced Blvd to provide a construction staging area as well as dump truck staging along John Muir Drive. Constructing the tunnel from this location would have similar impacts on the community and would significantly affect operations at The Olympic Club.
- A temporary construction shaft near SR-1 was considered to reduce construction impacts. Relocating the main construction activities away from John Muir Drive would significantly reduce traffic congestion, dump truck staging, and noise in the area. An area at Fort Funston between its parking lot and Highway 35 could be used to construct a temporary construction shaft. From this shaft, the beach outfall structure and tunnel could be constructed. A second potential construction shaft location on the east side of SR-1 was considered; it was determined that such a shaft would significantly disrupt activities at The Olympic Club.
- The design team will work to reduce disruption of coastal access during project construction.
- The outfall structure temporary coffer dam dimensions could be significantly reduced if the temporary construction shaft near SR-1 is acceptable to the GGNRA. A large cofferdam would prevent the public from walking past the construction site if access from a shaft on GGNRA property is infeasible.

The gross screening devices will remove suspended particles greater in size than 6 mm. This is an improvement on the water quality as well as will reduce the amount of debris on the beach. This change will greatly reduce or eliminate staff and volunteer efforts to collect and dispose of debris after storms.

Functional Design Criteria

Functional design criteria summarize the initial design basis for the supplemental analyses and are included as Attachment 1. They include a recent draft watershed hydrograph predicting the peak stormwater flow near Westlake Park and the estimated flow-duration curve of the 25-year/4-hour design storm prepared by RMC Water and Environmental on March 24, 2008 (RMC 2008). The estimated unconstrained peak stormwater flow at Westlake Park is 1,660 cubic feet per second (cfs). Based on the shape of the hydrograph, approximately 660 cfs can be diverted to the stormwater storage facility while approximately 1,000 cfs is transported through the existing and new tunnels to the outfall. The criteria also document the design assumptions used in the conceptual design and layout of the proposed project features. The alternatives are briefly described below.

Description of Alternative 5B

Alternative 5B, located within the city limits of San Francisco, would include a drop structure, a gross solid screening device, an 800-foot-long box culvert within the existing canal corridor, a new drainage tunnel that would be approximately 5,300 feet long, and a 4-million gallon (MG)underground stormwater storage tank beneath Westlake Park in Daly City. The existing

tunnel outfall structure would be rehabilitated and modified to accommodate the new tunnel flow capacity.

A new drop structure, located at the canal inlet (John Muir and Lake Merced Blvd.), would collect the flows from the major culvert lines and direct the flows to the gross solid screening device. Assuming the screens were no more than 25% full, the screening device would have a capacity of 1,000 cfs. The transition between the screening device and the new box culvert would incorporate an overflow weir to split the flows. Flows up to 170 cfs would flow through a box culvert to the existing canal north of the new tunnel inlet and through the existing tunnel. Flows in excess of 170 cfs would flow over a weir into a separate double box culvert leading to the new tunnel inlet.

The new tunnel would run northwest from the wide section of the canal corridor, located approximately 800 feet downstream of the canal inlet, to the rehabilitated Vista Grande Outfall Structure. The tunnel would run under the Olympic Club, Highway 35, and the GGNRA lands.

Description of Alternative 6B

Alternative 6B, located within the city limits of San Francisco, would include a drop structure, a gross solid screening device, a 2,100-foot-long box culvert within the existing canal corridor, a new drainage tunnel that would be approximately 4,200 feet long, and a 4-MG underground stormwater storage tank beneath Westlake Park in Daly City. The existing tunnel outfall structure would be rehabilitated and modified to accommodate the new tunnel flow capacity.

A new drop structure, located at the canal inlet, would collect the flows from the major culvert lines and direct the flows to the gross solid screening device. Assuming the screens were no more than 25% full, the screening device would have a capacity of 1,000 cfs. The transition between the screening device and the new box culvert would incorporate an overflow weir to split the flows. Flows up to 170 cfs would flow through a box culvert to the existing canal north of the new tunnel inlet and through the existing tunnel. Flows in excess of 170 cfs would flow over a weir into a separate double culvert leading to the new tunnel inlet.

The new tunnel would run northwest from a wide section of the canal, located approximately 2,100 feet downstream of the canal inlet, to the rehabilitated Vista Grande Outfall Structure. The tunnel would run under the Olympic Club, Highway 35, and the GGNRA lands.

Description of Alternative 7

Alternative 7, located within the city limits of San Francisco, would include a drop structure, a gross solid screening device, a 3,500-foot-long box culvert within the existing canal corridor, a new drainage tunnel that would be approximately 3,200 feet long, and a 4-MG underground stormwater storage tank beneath Westlake Park in Daly City. The existing tunnel outfall structure would be rehabilitated and modified to accommodate the new tunnel flow capacity.

A new drop structure, located at the canal inlet, would collect the flows from the major culvert lines and direct the flows to a gross solid screening device. Assuming the screens were no more than 25% full, the screening device would have a capacity of 1,000 cfs. The transition between the screening device and the new box culvert would incorporate an overflow weir to split the flows. Flows up to 170 cfs would flow through a box culvert to the existing canal north of the new tunnel inlet and through the existing tunnel. Flows in excess of 170 cfs would flow over a weir into a separate double box culvert leading to the new tunnel inlet. The flows up to 170 cfs would flow through a separate box culvert to the existing canal north of the new tunnel inlet.

The new tunnel would run west from a point in the canal approximately 200 feet south of the existing tunnel inlet, to the rehabilitated Vista Grande Outfall Structure. The tunnel would run beneath the Olympic Club, Highway 35, and the GGNRA lands.

Description of Stormwater Storage Basin

The Stormwater Storage Basin, located within the city limits of Daly City, beneath Westlake Park. The underground stormwater detention facility would include an intercept, a pneumatically controlled hydraulic diverter, a gross solid screening device, a 4-MG underground storage tank, pumps, and associated instrumentation and controls. This facility provides peak stormwater flow shaving capacity of up to 663 cfs and 4-MG. The pumps would drain the storage back to the stormdrain system within 24 hours.

A stormwater interceptor and pneumatic hydraulic diverter would be constructed near the existing wastewater treatment plant adjacent to the existing underground box culvert. When water levels in the canal and tunnels approach their normal maximum levels, the diverter would inflate and divert a portion of the stormwater to detention. The intercept would divert stormwater flows through a gross solids screening device to the storage basin. When the canal and tunnel water levels recede, the diverter would deflate and automatic pumps would return the detained stormwater to the box culvert where it would flow to the canal. The pumps would be sized to drain the tank in preparation for back-to-back storm events. If, however, the canal and tunnel water levels continue to rise, and the storage basin is full, the hydraulic diverter would deflate to pass the entire stormwater flow through the box culvert to the canal's drop structure.

Supplemental Conceptual Designs

Figure A.1 presents the general arrangement of Alternatives 5B, 6B, and 7. Conceptual schematic layouts of a stormwater storage structure in Westlake Park and the rehabilitation concepts for the existing Daly City Outfall Structure were developed, and are included as Attachment 2.

Stormwater Storage Structure

The stormwater storage structure concept is an underground circular prestressed concrete tank that will store up to 4 MG of screened stormwater beneath one of the Westlake Park softball fields. The arrangement provides space for additional underground tanks if additional peak shaving capacity is desired. A modular lift station, backup power generator, compressor station, and logical control system will also be required to provide automated stormwater peak shaving capacity. Figures A.20 and A.28 present these conceptual design of the underground storage tank.

Rehabilitated Outfall Structure

The outfall structure will be relocated approximately 27 feet south of its current location and set into the existing bluff below Fort Funston. The rehabilitated outfall structure will incorporate the Daly City Wastewater Treatment Plant (WWTP) force main effluent pipeline and connections with the existing submarine pipeline. The outfall structure design concept considers the continued coastal retreat of about 2 feet per year. At this retreat rate, it is estimated that the structure will require modifications in about 50 years. Figure A.29 presents the outfall structure design concept.

Canal and Tunnel

The canal and tunnel design concepts were also revisited in recognition of the ideas and opinions expressed during the public outreach meetings and comment period in February and March of this year. The hydraulic capacity of the canal improvements and new tunnel was re-evaluated based on the draft watershed unconstrained hydrograph. Screening facilities are included in the initial canal reach. The hydraulic routing includes diversions to future wetlands developments along John Muir Drive; to the existing Vista Grande Tunnel; and the proposed new tunnel.

The new tunnel can be constructed from the canal or from a temporary construction shaft at Fort Funston. Overall, the tunnel is divided into two reaches:

- A tunnel reach of varying lengths and depths from the canal, beneath The Olympic Club, and extending to Fort Funston.

- A tunnel reach from Fort Funston, running sub-parallel and adjacent to the existing Vista Grande Tunnel where the new tunnel alignment converges with the existing tunnel alignment.

Additional interpretation of the existing 1895 Vista Grande Tunnel construction records provided insight into the anticipated tunneling conditions and potential tunnel construction risks including potential locations of flowing and running ground. The tunnel may be constructed using a pressurized face tunnel boring machine (TBM) with bolted and gasketed segments to provide ground support and control groundwater inflows. The TBM can be launched and supported from the canal along John Muir Drive or from a temporary construction shaft at Fort Funston.

The canal staging area was included in the base case cost estimate. A cross-over tunnel would connect the existing brick lined tunnel with the new tunnel and rehabilitated outfall structure. The existing tunnel, upstream of the cross-over, could be rehabilitated to improve its long-term reliability. Downstream of the cross-over, the tunnel would be abandoned and filled with controlled density low-strength material (CDLM). The TBM would exit at the beach beneath Fort Funston into a large cofferdam. Heavy equipment traffic would be expected along the beach to support this operation.

Construction Staging

The construction staging areas were re-evaluated relative to input provided during the public outreach meetings. The visual impacts, traffic impacts, recreational impacts, access restrictions, noise, and vibration were considered in the planning of the canal, tunnel, and outfall structure construction staging. An alternative to staging the tunneling operation along John Muir Drive and constructing a large cofferdam at the outfall was developed. Attachment 3 includes a discussion of the temporary construction shaft. A temporary construction shaft at Fort Funston adjacent to the north parking lot is included as an alternative. This temporary shaft would launch and support the tunneling operation, as well as the outfall construction. The shaft would support tunneling in two directions, to the canal and also to the outfall structure, and significantly reduce construction activities on John Muir Drive and along the beach. Because of its proximity to the existing WWTP effluent force main, the main could be intercepted near the shaft and routed along the tunnel to the submarine outfall pipeline.

Agency Input

A design review meeting was held on May 28, 2008 with the Golden Gate National Recreation Area/ National Park Service. On May 16, 2008, the California Conservation Commission staff reviewed the project design concepts and discussed the Commission's review process. In the Staff's review, they consider: visual aesthetics, hazard reduction, public access, traffic, and water quality. These agencies have resource management responsibilities over the outfall structure and portions of the tunnel. Their input will be used to shape the construction limits and specific conditions under which the proposed project features will be constructed.

Budget Level Cost Estimates

Using the Association for the Advancement of Cost Engineering's classification system, budget level cost estimates were prepared for the three alternatives using unit costs developed from comparable projects, supplier quotes, and allowances. The estimates are included as Attachment 3. The opinions of probable project cost consider the contractor's direct and indirect costs, project professional services, an escalation estimate, and design contingency. The estimate assumes that a pressurized face TBM will be driven from a tunnel portal adjacent to the Vista Grande Canal. The start of tunnel construction was dependent on the partial completion of the canal improvements to facilitate re-use of the staging areas. Table 1 presents the opinion of probable project costs for the base estimate.

In the alternate cost estimate, the tunnel construction staging activities were moved to an open area at Fort Funston. From this staging area, two tunnel headings were developed in addition to the outfall construction.

Disconnecting the tunnel construction from the canal construction allowed parallel work activities, reduced the overall construction duration, and 8% to 11% cost reductions among the alternatives. Table 2 presents the opinion of probable project costs for the alternate estimate.

Table 1 Opinion of Probable Project Costs (Budget Level Accuracy)
Base Estimate

Base Estimate- Tunnel staging from canal	Alternative 5B	Alternative 6B	Alternative 7
Estimated Construction Duration	24 months	25 months	25 months
Contractor's direct & indirect costs	$97,767,000	$101,793,000	$106,450,000
Professional services	26,397,000	27,484,000	28,741,000
Estimated escalation	19,776,000	20,591,000	21,532,000
Design Contingency (40%)	$57,576,000	$59,947,000	$62,689,000
Total	$201,517,000	$209,815,000	$219,412,000

Table 2 Opinion of Probable Project Costs (Budget Level Accuracy)
Alternate Estimate

Alternative Estimate- Tunnel staging from Ft. Funston	Alternative 5B	Alternative 6B	Alternative 7
Estimated Construction Duration	19 months	20 months	23 months
Contractor's direct & indirect costs	$87,439,000	$91,933,000	$98,022,000
Professional services	23,608,000	24,822,000	26,466,000
Estimated escalation	17,687,000	18,596,000	19,828,000
Design Contingency (40%)	$51,494,000	$54,141,000	$57,726,000
Total	$180,228,000	$189,492,000	$202,042,000

The evaluation methodology previously developed and used to prepare the Vista Grande Drainage Basin Alternatives Analysis Report (Draft) was utilized on the three selected alternatives. The results of the scoring suggested a preliminary ranking of alternatives presented in Table 3. Attachment 4 presents the alternatives evaluation matrix.

Table 3 Example Preliminary Alternatives Ranking based upon the Project Evaluation Methodology

Overall Rank	Overall Score *(golf scoring)*	Description
1	7	Alternative 6B constructed using the Ft. Funston temporary construction shaft
1	7	Alternative 5B constructed using the Ft. Funston temporary construction shaft
3	13	Alternative 7 constructed using the Ft. Funston temporary construction shaft
4	17	Alternative 5B constructed using John Muir Drive for staging the tunnel & outfall construction
5	21	Alternative 6B constructed using John Muir Drive for staging the tunnel & outfall construction
6	25	Alternative 7 constructed using John Muir Drive for staging the tunnel & outfall construction

Alternatives 5B and 6B had the best scores of the six alternatives because it: deliver the desired public benefits; provides for an efficient operation; satisfies environmental and regulatory requirements both during construction and when in operation; is constructible; and is the most cost effective of the alternatives considered. Both alternatives, constructed using a temporary construction shaft at Fort Funston, meets these expectations, and:

- Complements the City & County of San Francisco's Lake Merced water quality improvement efforts, i.e. wetlands development along John Muir Drive;
- May provide a source of substantial quantities of beach replenishment sand;
- Addresses coastal retreat impacts on the North San Mateo County Sanitary District/City of Daly City's effluent force main and outfall structure.

Alternative 6B is preferred over Alternative 5B since it provides a greater opportunity to support the SFPUC's efforts to improve Lake Merced's water quality and would have a lower impact on traffic between San Francisco and Daly City.

Attachments:

1. Functional Design Criteria Memorandum
2. Conceptual Design Figures
3. Budget Level Cost Estimate Memorandum
4. Project Alternatives Evaluation Matrix

Attachment 1 - Functional Design Criteria

Attachment 2 - Conceptual Design Figures

Attachment 3 - Budget Level Cost Estimates

Attachment 4 - Alternatives Evaluation