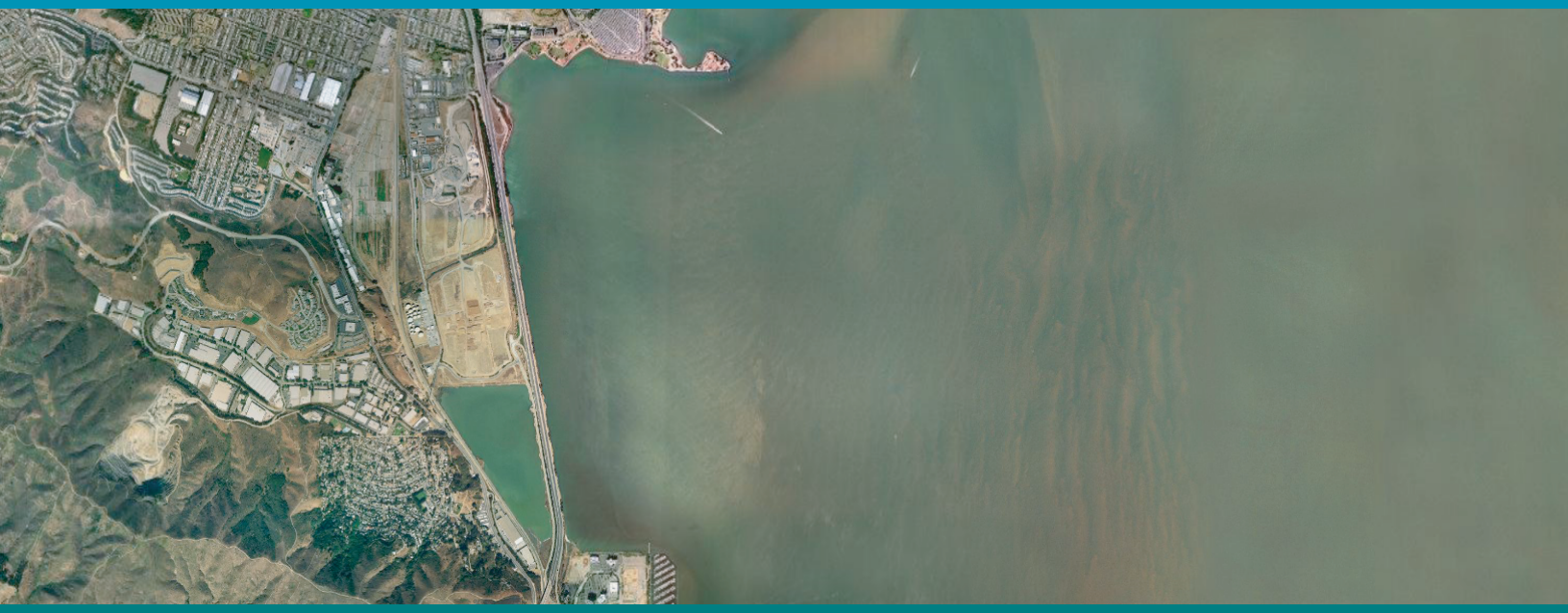
CDM



Report for

City of Brisbane

Final Report of Findings Environmental Engineering Peer Review Baylands Remediation Efforts

November 2, 2005

CDM
One Walnut Creek Center, 100 Pringle Avenue, Suite 300
Walnut Creek, California 94596
tel: 925 933-2900
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November 2, 2005

Mr. Randy Breault, P.E.
Director of Public Works
50 Park Place
Brisbane, California 94005-1310

Subject: Environmental Engineering Peer Review Report
Baylands Remediation Efforts, Brisbane, California

Dear Mr. Breault:

Camp Dresser & McKee Inc. (CDM) is pleased to submit our report presenting the results of CDM's Environmental Engineering Peer Review, Baylands Remediation Efforts, Brisbane, California, dated November 2, 2005. This report serves as an update to CDM's previous report titled "Revised Draft, Environmental Engineering Peer Review, Baylands Remediation Efforts, dated April 20, 2005." As requested by the City, this submittal includes 10 bound reports and one CD report in PDF format.

It has been a pleasure working with you and the City on this important project, please feel free to contact me at (925) 933-2900 with any questions or additional information needs.

Very truly yours,

Michael G. Gray, C.E.G.
Principal
Camp Dresser & McKee Inc.

Contents

Tables

Figures *(at end of report)*

List of Acronyms

B&McD	Burns & McDonnell Engineering Company, Inc.
Baylands	Baylands Development Project
bgs	below ground surface
CCR	California Code of Regulations
CDC	Central Drainage Channel
CDM	Camp Dresser & McKee, Inc.
CHSC	California Health and Safety Code
cis-1,2 DCE	cis-1,2-dichloroethylene
City	City of Brisbane
COPC	Chemicals of Potential Concern
County	County of San Mateo Environmental Health Division
DNAPL	dense nonaqueous phase liquids
DTSC	California Department of Toxic Substances Control
MCL	Maximum Contaminant Level
µg/L	micrograms per liter
mg/L	milligrams per liter
MTBE	Methyl-tert-butyl ether
OU-1	Groundwater Operable Unit One
OU-2	Groundwater Operable Unit Two
PAH	Polycyclical aromatic hydrocarbons
PCE	Tetrachloroethylene
RAO	Remedial Action Objectives
RAP	Remedial Action Plan
RWQCB	San Francisco Bay Regional Water Quality Control Board
SFIA	San Francisco International Airport
SMP	Soil Management Plan
SPRR	Southern Pacific Railroad
SWAT	Solid Waste Water Quality Assessment Test
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
UP/JPB	Union Pacific/Joint Powers Board
UPC	Universal Paragon Corporation
VC	Vinyl Chloride
VOCs	Volatile Organic Compounds
WDR	Waste Discharge Requirement

Executive Summary

Executive Summary

E.1 Introduction

Camp Dresser & McKee Inc. (CDM) is providing the City of Brisbane (City) environmental engineering peer review services for the Baylands Remediation Efforts to support the Baylands Development Project (Baylands). The Baylands comprises an area of approximately 537 acres of mostly undeveloped land bounded by Bayshore Boulevard on the west, by Highway 101 to the east, by Sunnydale and Beatty Avenues to the north, and the Brisbane Lagoon, Kinder-Morgan Tank Farm and Ice House Hill to the south.

This report presents the final findings of CDM's Environmental Engineering Peer Review (Peer Review) for the Baylands Remediation Efforts and serves as an update to the previous report titled, "Revised Draft, Environmental Engineering Peer Review, Baylands Remediation Efforts", dated April 20, 2005. The documents included in the City's Request for Proposals (RFP) was the information deemed necessary by the California Department of Toxic Substance Control, California Regional Water Quality Control Board San Francisco Bay Region (RWQCB), County of San Mateo Environmental Health Division (County) and the City for the initial review.

The information presented in this Peer Review report presents a summary of CDM's data review, evaluation and findings, and recommendations based on the data reviewed at this point in time. In the process of conducting the initial Peer Review, it became apparent that several additional project reports and related data were not included as part of the initial document review set. The requested documents are listed in the document titled, "Revised Draft Environmental Engineering Peer Review, Baylands Remediation Efforts", dated April 20, 2005 (CDM, 2005). The purpose of requesting these additional documents was to evaluate the referenced reports and to provide needed information to advance the Peer Review understanding of the environmental conditions and related site issues that form the basis of the proposed remedial actions. The relevant findings of these supplemental documents are incorporated into this Final Peer Review report. In addition to reviewing the project prepared environmental documents, CDM reviewed the City's workshop minutes and videotapes from informational workshops held on April 28 and November 8, 2003. At these workshops, Universal Paragon Corporation (UPC), the property owner and proponent of the re-development of the Baylands presented *Brisbane Baylands Subsurface Environmental Conditions* and *Development Plan Presentations*.

Based on historic land use and current regulatory oversight the Baylands have been divided into the following three subareas, as depicted on Figure E-1, Site Map.

- Brisbane Landfill, regulated by the RWQCB and County
- Groundwater Operable Unit 1 (OU-1), regulated by DTSC
- Groundwater Operable Unit 2 (OU-2), regulated by the RWQCB

Universal Paragon Corporation (UPC) currently owns all of the Baylands, with the exception of the Schlage Lock facility, which is continuous with OU-1; and four out properties that include Sierra Point Lumber, South San Francisco Scavenger Company, Bayshore Sanitary District pump station, and the Kinder-Morgan Tank Farm facilities.

E.1.1 Phase I Development Concept

For the Baylands, the current owner of the property, UPC, is planning to transform the current brownfields land into a mix of commercial development, parkland, and open space (UPC, 2004). Consistent with the City's General Plan, no residential development is proposed in the Phase I Specific Plan. Through a series of informational workshops, UPC and their consultants have outlined the extent of soil and groundwater contamination, the proposed remedial approach, and the development plan concept for the Baylands. As acknowledged in the Specific Plan, the Baylands Phase I Specific Plan is the first step of a multi-year effort to create a planning framework for future growth and development. The Phase I Planning Area comprises 447 acres of the eastern portion of the Baylands, which includes 329 upland acres and 118 lagoon acres (refer to Figure E-1, Site Map). As proposed, the planned Phase I Development presented in the Specific Plan encompasses the remediation and redevelopment of the former Brisbane Landfill area and Brisbane lagoon located east of the UPRR/JPB rail corridor and west of Highway 101 (UPC, 2004). Development of the remaining upland area, designated as Operable Unit 1 (comprising the former Schlage Lock facility and northern portion of the Southern Pacific Railyard), and Operable Unit 2 (comprising the remaining area of the former Southern Pacific Railyard) within the Baylands is planned in future development phases. Note that the Schlage Lock facility and northern portions of OU-1 lie beyond the City of Brisbane and are not considered part of the Baylands project in this review. In March 2005, the City deemed UPC's Specific Plan incomplete and awaits resubmittal of the revised Phase 1 Specific Plan.

E.2 Purpose and Scope of Work

CDM's primary role, as defined by the City, is to provide environmental engineering peer review and technical guidance to the City with respect to protection of public health and the environment in relation to the proposed Baylands development. A key secondary objective defined by the City includes functioning as a community advocate to assist in the dissemination of environmental information related to the Baylands. Additionally, CDM's review evaluated UPC's proposed Phase I Specific Plan for conformance to the overarching regulatory framework established by DTSC, RWQCB, and San Mateo County.

The specific objectives of this Peer Review evaluation are to provide input to the City regarding the following:

- Adequacy of environmental characterization
- Appropriateness of remedial action
- Protection of public health and environment

Using the criteria listed above, CDM reviewed and interpreted the project documents to develop our findings and recommendations.

E.3 Summary of Findings

The following discussion presents the summary of findings on a subarea basis. Information tabulated in Table E-1, Summary of Findings, succinctly catalogs key findings of the Peer Review, which are summarized in this section. Refer to Section 4, Findings (this report) for a detailed discussion of the findings presented herein.

Table E-1
Summary of Findings

Area and Evaluation Category	***Assessment***
Brisbane Landfill	
Risk Assessment • Human Health • Ecological	• Evaluations incomplete o Final assessment pending development plan
Limits of Waste	• Adequately defined, except for southern boundary. • Agree with plan to extend cap to Guadalupe Channel.
Landfill Settlement	• Recommend future studies to estimate short- and long-term settlement characteristics.
Landfill Gas	• Concur that majority of organic waste is decomposed. • Recommend re-initiation of landfill gas monitoring.
Groundwater Quality	• Adequately characterized.
Leachate	• Adequately characterized.
Remedial Approach	• Evaluation incomplete – dependent on final plan • Final closure plan will address o Gas control system o Final cover and surface water management system. o Settlement o Final human health and ecological assessment

Table E-1 Summary of Findings	
Area and Evaluation Category	***Assessment***
Operable Unit 1	
Risk Assessment • Human Health • Ecological	• Evaluations incomplete • Final assessment pending development plan
Groundwater	• Generally adequately characterized. • Existing treatment system mitigates potential infiltration into Sunnydale sewer. • Additional information needed for o DNAPL source o A-aquitard windows o B-aquifer contaminant mechanism • Remedial Action Plan – in review
Soil	• Evaluation incomplete. • DTSC request additional work o Site characterization o Remedial action workplan
Surface Water	• Adequately characterized • Existing treatment system mitigates potential infiltration into Sunnydale sewer.
Soil Vapor	• Future studies likely needed based on final development plan.
Remedial Approach	• Evaluation incomplete. • Remedial action plans in review/preparation. • General approach consistent with industry practice.
Operable Unit 2	
Risk Assessment • Human Health • Ecological	• Evaluations incomplete • Final assessment pending development plan
Soil & Groundwater	• Adequately characterized.
Soil Vapor	• Future studies likely needed based on final development plan.
Surface Water	• Adequately characterized.
Remedial Approach	• Interim approach approved by the RQWCB • Consistent with industry practice. • Final approach – evaluation incomplete o Final RAP dependent on development plan o Soil vapor study may be required to assess vapor hazard. o Evaluate differential settlement potential.

E.4 Recommendations

The recommendations presented below are based on the interpretation of the City-provided Baylands documents, comparison of the data to the project-defined evaluation criteria and the findings presented in Section 4 of this report. The recommendations presented in this section are organized into the following groups: general, subarea specific, and recommended next steps.

E.4.1 General

In light of the subsurface conditions, which include placement of undocumented fill and underlying compressible soils, the City should evaluate the potential long-term financial liabilities associated with infrastructure operations and maintenance on the Baylands.

Financial Assurance

Development on each of the individual subareas, in particular the Brisbane Landfill, carries with it a significant degree of uncertainty with respect to maintenance of future conditions and resultant potential financial liabilities. It is important that some financial mechanism exists to ensure a secure long-term funding source to provide necessary maintenance or emergency response resulting from existing hazardous conditions. As an example, it is likely that maintenance of "public" facilities constructed on the Brisbane Landfill, as well as other areas within the Baylands Development, will require a greater level of expenditure than would typically be required for a municipal roadway or underground utility. Provisions should be put in place to assure that the developer is able to fully fund these and other long-term facility maintenance activities within the Baylands Development.

Develop a Comprehensive Conceptual Site Model and Remedial Action Plan

Historically, the environmental characterization and evaluation of the Baylands Development subareas sites has been conducted using an independent site-by-site approach. This approach is largely attributed to the following factors: past multiple landowners and operators, overlapping regulatory oversight responsibilities involving multiple regulatory agencies and intra-department jurisdiction, and the lack of a clear development proposal for the Baylands. With the consolidation of the Baylands ownership by UPC and their recent submission of the Phase I Specific Plan, it is now appropriate to consider the Baylands as a single contiguous project.

This approach will enable the City to evaluate the project development plans and applications using a uniform set of evaluation criteria for each Baylands' subarea. Consistent with this concept, it is in the City's best interest to require UPC to develop a comprehensive approach to managing site contamination to be protective of human and ecological receptors. In concept, UPC's overall approach to managing human potential exposure pathways is through various remedial actions and implementation of engineering and/or institutional controls. This approach is consistent with industry practice but lacks the necessary specificity with regard to an integrated and comprehensive approach that addresses soil and groundwater impacts with respect to human health and ecological risk. In addition, based on the documents reviewed, the remedial measures presented may not adequately address all human health and ecological exposure pathways (e.g., stormwater or groundwater) and additional consideration of these potential risks are warranted.

The benefit of developing an integrated approach is that the identified COPC and risk-based remedial action objectives (RAOs), including the proposed array of engineering and institutional controls, will be captured into a single Baylands development-focused document. For the purpose of this discussion, the plan is essentially a Baylands Remedial Action Plan with a focus on the proposed development and uniformity within subarea parcels. The intent of this plan is not to solicit regulatory agency review/concurrence as this effort would be redundant. The plan would focus on three separate but related areas: 1) determine that proposed remedial action does not expand or increase contamination within a subarea, 2) verify that development-focused objectives are achieved, and 3) ensure that remedial actions are consistent with and appropriate for the development area and subarea parcels. On a conceptual basis, the plan would be developed earlier in the project approval process, possibly in parallel with the EIR, and would be integrated into the City project approval process.

The ultimate format of this document should be flexible and updated periodically as relevant additional information is acquired and the development plan advances; the comprehensive development-based RAP and conceptual site model will serve many benefits for the City. A partial listing of these benefits includes the following:

- Demonstrate to the local community and general public that the City is acting proactively to address concerns related to potential human health and ecological risks associated with contamination at the Baylands.

- Provides a means to evaluate the three subareas as one single project using uniform evaluation criteria. This is especially significant for each subarea as final development plans and remedial actions are approved by the respective regulatory agencies.

- Simplify the City review during evaluation of the Final Specific Plan and future permitting as the individual parcels, or planning areas, are built out.

Table E-2, Summary of Anticipated Future Studies and Program Sequencing, presents in matrix format the primary anticipated future studies and project sequencing based on the categories defined below.

- Supplemental Data Review
- Prior to/concurrent with CEQA
- Required by CEQA
- Development Plan
- Post-development Plans

This table presents a summary of general and subarea environmental studies and evaluations that are anticipated for development. This listing is intended to provide the City and public with a path forward view of the Baylands development sequencing based on the Peer Review findings.

Table E-2
Summary of Anticipated Future Studies and Program Sequencing
Environmental Engineering Peer Review, Baylands Remediation Efforts

Baylands Development Area	***Study***	***Program Sequence***				
		Supplemental Data Review	***Prior to / concurrent with CEQA***	***Required by CEQA***	***Development Plan***	***Post-Development Plan***
General	**Financial Assurance**		✓			
	Development-Based Remedial Action Plan		✓			
Landfill	**Risk Assessment**					
	• **Human Health**		✓			
	• **Ecological**		✓			
	• **Residual Risk & Monitoring Plan**		✓			
	• **Monitoring**					✓
	Surface Settlement Evaluation					
	• Settlement Study		✓			
	• Settlement Monuments		✓			
	Final Cover Design/Construction					
	• Landfill Cover				✓	
	• Landfill Cover Inspections					✓
	Landfill Gas					
	• Vapor Barrier				✓	
	• Methane Monitoring				✓	
	• Landfill Gas Monitoring					✓
	• Explosion-Proof Construction				✓	
	Groundwater					
	• Monitoring Plan				✓	
	• Post Closure Monitoring					✓

Table E-2
Summary of Anticipated Future Studies and Program Sequencing
Environmental Engineering Peer Review, Baylands Remediation Efforts

Baylands Development Area	***Study***	***Program Sequence***				
		Supplemental Data Review	***Prior to / concurrent with CEQA***	***Required by CEQA***	***Development Plan***	***Post-Development Plan***
OU-1	**Risk Assessment**					
	• Human Health		✓			
	• Ecological		✓			
	• Residual Risk & Monitoring Plan		✓			
	• Monitoring					✓
	Soil					
	• Soil Condition Report	✓				
	• Revised Soil Workplan	✓				
	Groundwater					
	• Current Groundwater Monitoring/Ops Documents	✓				
	• Sunnydale Sewer Monitoring Plan				✓	
	• In-situ Treatment Evaluation				✓	
	• Upgradient VOC Source Evaluation				✓	
	• Monitoring Well Construction Evaluation				✓	
	• Revised Groundwater Remedial Action Plan	✓				
	• A-Sand Extraction Well Effectiveness				✓	
OU-2	**Risk Assessment**					
	• Human Health		✓			
	• Ecological		✓			
	• Residual Risk & Monitoring Plan		✓			
	• Monitoring					✓
	Soil					
	• Soil Removal & Drainage Closure Report	✓				
	• Final Soil Management and Residual Risk Management Plan				✓	
	Groundwater					
	• Feasibility Analysis In-situ Bioremediation Treatment				✓	
	• Post Well Abandonment/Replacement plan				✓	
	Other					
	• Brick-Line Arch Sewer Evaluation		✓		✓	
	• Soil Cap Settlement Evaluation		✓		✓	

E.4.2 Subarea Specific Recommendations

The subarea specific recommendations listed below were developed to further the understanding of the site characterization, assess impacts to human-health and the environmental risks, develop remedial action measures, verify regulatory compliance, and assure protection of public health and the environment.

E.4.2.1 Brisbane Landfill

Provided below are recommendations for further action at the Brisbane Landfill. A number of the recommendations are consistent with information presented in the Closure and Post Closure Maintenance Plan (Burns & McDonnell, 2002a). However, further explanation and clarification is provided as a way of highlighting the benefits of completing this work in the near-term.

Human Health and Ecological Risk Assessment

- Provide and/or develop a site conceptual model to assess human health and ecological risk including residual risk and monitoring program.

- Prepare update to final human health and ecological risk assessment based on development plan.

Landfill Surface Settlement Evaluation

- **Settlement Studies –** Over time, landfill waste prisms typically undergo some degree of differential settlement. For the Brisbane Landfill, the magnitude of differential settlement will be compounded by consolidation of the underlying Bay Mud sediments. CDM recommends developing and implementing a full-scale field load test program to evaluate long-term settlement potential prior to initiating design of structures on the landfill.

- **Settlement Monuments –** CDM recommends installation of permanent settlement monuments to monitor differential settlement within and adjacent to the landfill footprint.

Final Cover Design and Construction

- **Landfill Cover –** The design and installation of the landfill final cover should be as a single, integrated unit over the entire landfill surface, rather than in individual parcels as development proceeds.

  A number of ongoing issues at the Brisbane Landfill are tied to the presence of liquid within the waste prism. The shallow groundwater lies almost entirely within the landfill refuse and represents a significant source of leachate with the potential for downgradient transport and discharge to the Brisbane Lagoon and the San Francisco Bay. Although it is not entirely clear what the source of this water is, there are indications that surface water infiltration is a major component. For example, mounding in the north central portion of the landfill suggests that

water infiltration continues to occur (see figures 3 and 5 from GeoSyntec, 2004). Installation of the final cover will prevent surface water infiltration and will contribute to minimizing leachate seeps at locations along the earthen dike between the southern end of the landfill and Brisbane Lagoon and seeps into the Central Drainage Channel.

- **Landfill Cover Inspections** –Periodic inspections of the integrity of the landfill cover as part of the ongoing monitoring and maintenance program.

Landfill Gas

- **Vapor Barriers** – Development plans should include sub-slab vapor barriers to mitigate the potential for vapor intrusion into commercial buildings.

- **Methane Monitoring** – Structures built on or near the landfill footprint should be equipped with methane monitoring devices.

- **Landfill Gas Monitoring** – As part of the ongoing monitoring and maintenance program, it is important to re-initiate perimeter monitoring and surface emission monitoring in areas where appropriate, which may include border areas with OU-1 and OU-2. Additionally, it would be useful to evaluate the presence of landfill gas in structures on or adjacent to the landfill.

- **Explosion Proof Construction** – CDM recommends that underground utilities be constructed using intrinsically safe and/or explosion-proof (e.g., NEMA 7) equipment.

- **Groundwater Monitoring** – Provide additional information that supports the reduction in the number of monitoring wells proposed in the post-closure monitoring program.

E.4.2.2 Operable Unit 1

The OU-1 recommendations provided below are based on the Peer Review findings.

Human Health and Ecological Risk Assessment

- Provide and/or develop a site conceptual model to assess human health and ecological risk including residual risk and monitoring program.

- Prepare update to final human health and ecological risk assessment based on development plan.

Soil

- Provide interim and final project documents that characterize extent and type of soil contamination and remedial approach.

Groundwater

- Incorporate management and monitoring plan to monitor potential infiltration of VOC-impacted water into Sunnydale Sewer.
- Evaluate short and long-term benefits of in-situ treatment technologies on impacted groundwater to treat and reduce VOC groundwater concentrations. The benefits of in-situ treatment include source reduction and positive augmentation of the final remedy.
- Evaluate presence of offsite upgradient VOC contaminant source, if any, and address impacts to groundwater quality and treatment system.
- Evaluate existing monitoring well completions that are possibly screened across A-sand and B-sand that may serve as a conduit for contaminant migration. Identify potential wells and abandon/remove from service.
- Provide most recent groundwater monitoring and operation report.
- Provide additional information on potential offsite upgradient VOC sources or clarify presence of residual DNAPL in soil/groundwater.
- Evaluate potential effectiveness of increased A-Sand groundwater extraction well locations as a means to control detected B-Sand VOC contamination.

Other

- Evaluate the rate and magnitude of settlement and related potential development constraints associated with the planned placement of the soil cap across the site.

E.4.2.3 Operable Unit 2

The OU-2 specific recommendations listed below are based on the Peer Review findings.

Human Health and Ecological Risk Assessment

- Provide and/or develop a site conceptual model to assess human health and ecological risk including residual risk and monitoring program.
- Prepare update to final human health and ecological risk assessment based on the development plan.

Soil

- Revise and update the Soil Management Plan and interim Residual Risk Management Plan based on the final development plan.
- Provide results, if available, from VOC removal action and north-south drainage ditch closure.

Groundwater

- Evaluate the short and long-term benefits of in-situ treatment technologies on VOC and Bunker-C-impacted soil and groundwater to treat and reduce the groundwater contaminant plume and minimize VOC vapor migration into the vadose zone soils. The benefits of in-situ treatment include source reduction and positive augmentation of the final remedy.

- Evaluate the potential for existing groundwater monitoring wells to provide a mechanism for cross-contamination between the A-soil and B-soil aquifers.

Other

- Conduct assessment of brick-lined arch sewer to evaluate structural integrity, determine if the proposed tie-in is feasible, and develop post-connection sewer monitoring plan.

- Evaluate the rate and magnitude of settlement and related potential development constraints associated with the planned placement of the soil cap across the site.

E.5 Recommended Next Steps

The recommended next steps listed below provide a listing of recommended activities that the City may adopt to improve their confidence and understanding of the Baylands and associated development, including potential human health and ecological risk issues.

- Develop an integrated conceptual site model that incorporates all identified COPC, pathways, and ecological and human health risk elements, and further develop appropriate remedial actions including engineering and institutional site controls, and assess cumulative project impacts for the proposed development.

- Meet with DTSC, RWQCB, and County personnel, as determined by the City, to determine regulatory status of the project subareas. This step will be beneficial as the landfill and OU-2 oversight activities have been consolidated to a single RWQCB contact. This step is especially important for addressing site cleanup requirements for OU-2, as the RQWCB has indicated that a site cleanup order will be adopted following City approval of the Site Development Plan and other environmental planning documents.

- Review Development Plan on a site by site basis to confirm that remedial measures are consistent with site remedial action objectives, conform with project controls, and the proposed development-based remedial action plan.

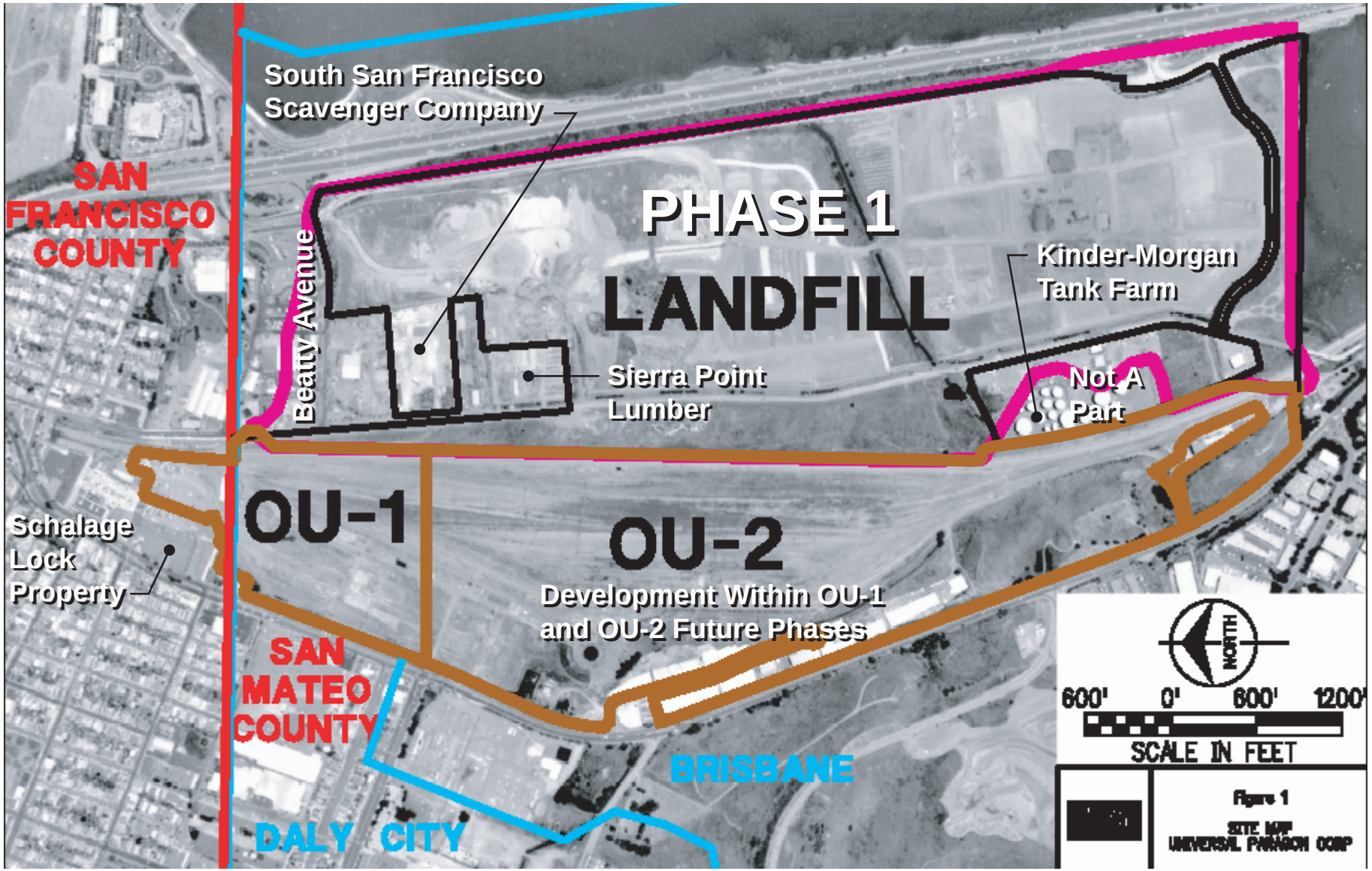

Figure E-1
Site Map
Environmental Engineering Peer Reviews
Baylands Remediation Efforts
City of Brisbane

CDM

Modified from Workshop Presentation to the City of Brisbane, Brisbane Baylands, Subsurface Environmental Conditions by Universal Paragon Corporation and Burns & McDonnell Engineering Company, Inc., November 18, 2003.

Section 1

Introduction

Section 1
Introduction

Camp Dresser & McKee Inc. (CDM) is providing the City of Brisbane (City) environmental engineering peer review services for the Baylands Remediation Efforts to support the Baylands Development Project (Baylands). The Baylands comprises an area of approximately 537 acres of mostly undeveloped land bounded by Bayshore Boulevard on the west, by Highway 101 to the east, by Sunnydale and Beatty Avenues to the north, and the Brisbane Lagoon, Kinder-Morgan Tank Farm and Ice House Hill to the south.

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Numerous field investigations and reports have been developed for the Baylands and selected data are summarized in this document. For a detailed discussion on site conditions, including soil and groundwater contamination and related impacts, proposed remedial approach, human health and ecological risk assessments, and regulatory compliance, refer to the documents referenced herein.

1.1 Phase I Development Concept

For the Baylands, the current owner of the property, UPC, is planning to transform the current brownfields land into a mix of commercial development, parkland, and open space (UPC, 2004). Consistent with the City's General Plan, no residential development is proposed in the Phase I Specific Plan. Through a series of informational workshops, UPC and their consultants have outlined the extent of soil and groundwater contamination, the proposed remedial approach, and the development plan concept for the Baylands. As acknowledged in the Specific Plan, the Baylands Phase I Specific Plan is the first step of a multi-year effort to create a planning framework for future growth and development. The Phase I Planning Area comprises 447 acres of the eastern portion of the Baylands, which includes 329 upland acres and 118 lagoon acres (refer to Figure 1, Site Map). As proposed, the planned Phase I Development presented in the Specific Plan encompasses the remediation and redevelopment of the former Brisbane Landfill area and Brisbane lagoon located east of the UPRR/JPB rail corridor and west of Highway 101 (UPC, 2004). Development of the remaining upland area, designated as Operable Unit 1 (comprising the former Schlage Lock facility and northern portion of the Southern Pacific Railyard), and Operable Unit 2 (comprising the remaining area of the former Southern Pacific Railyard) within the Baylands is planned in future development phases. Note that the Schlage Lock facility and northern portions of OU-1 lie beyond the City of Brisbane and are not considered part of the Baylands project in this review. In March 2005, the City deemed UPC's Specific Plan incomplete and awaits resubmittal of the revised Phase 1 Specific Plan.

Section 2

Purpose and Scope of Work

Section 2
Purpose and Scope of Work

The development proponent has, to date, retained various engineering consultants to prepare investigation and design documents supporting the Specific Plan. The City's General Plan requires that a Specific Plan be submitted that presents the development objectives for the Baylands area. In general, the overall objective of the Specific Plan is to present the planning area land use development program with a defined set of goals, policies, and standards to guide future actions relating to the development and creation of open space as set forth in the City's General Plan. These documents are intended to respond to technical input and requirements from the California Department of Toxic Substances Control (DTSC) and California Regional Water Quality Control Board San Francisco Bay Region (RWQCB). As the lead environmental agencies on this project for purposes of remediation, the DTSC and RWQCB provide the regulatory oversight of the proponent's project team and technical review and approval of submitted documents. As illustrated in Figure 2, Baylands Planning Process, the approval of the Specific Plan and project approval is a complex multi-stage planning process. The Peer Review process as illustrated in this figure is just one of a multitude of steps needed to achieve a permitted project that is protective of public health and the environment.

CDM's primary role, as defined by the City, is to provide environmental engineering peer review and technical guidance to the City with respect to protection of public health and the environment in relation to the proposed Baylands development. A key secondary objective defined by the City includes functioning as a community advocate to assist in the dissemination of environmental information related to the Baylands. Additionally, CDM's review evaluated UPC's proposed Phase I Specific Plan for conformance to the overarching regulatory framework established by DTSC, RWQCB, and San Mateo County.

The specific objectives of this Peer Review evaluation are to provide input to the City regarding the following:

- Adequacy of environmental characterization
- Appropriateness of remedial action
- Protection of public health and environment

To meet this objective, CDM has developed, in collaboration with City staff, the rationale and methodology for the peer review approach. Functioning as an extension of the City staff, CDM evaluated whether the appropriate level of environmental analysis was achieved and that the stipulated regulatory agency actions are appropriately addressed. CDM's approach included the activities presented below:

- Meet with City staff to establish peer review role and primary objectives.
- Review Bayland environmental documents supplied to the City from the Baylands developer.
- Review proposed remedial activities and evaluate adequacy of remedial investigations, human health and ecologic risk studies, and associated project environmental aspects.
- Determine effectiveness of proposed remedial actions for protection of human health and the environment, as well as evaluate proposed actions against other National Contingency Plan (NCP) and State threshold, screening, and balancing criteria.
- Evaluate potential/compatible alternative remedial measures that would further reduce associated human health and ecological risk, as appropriate.
- Evaluate proposed engineering and institutional controls.
- Review the Human Health and Ecologic Risk Assessments and relate the findings to City staff and at a public workshop.
- Identify potential data gaps or misinterpretation of data, and present findings.
- Develop a series of recommendations based on the Peer Review findings that will further assist the City in completing further reviews.
- Prepare this interim environmental engineering Peer Review Report and present our key findings in an upcoming public workshop.

Section 3

Background Information

Section 3
Background Information

This section summarizes key background information including environmental conditions, regulatory status, and status of remedial action for the Baylands on a subarea basis. This approach serves to address the primary community concerns, as reiterated below, as they relate to the Baylands and also establishes the framework for forthcoming discussions in Section 4, Evaluation and Findings, and Section 5, Recommendations.

The background information summarized in this section is organized into the following subsections:

- Overview of Environmental Conditions
- Regulatory Status
- Status of Remedial Action

Based on historic land use and current regulatory oversight the Baylands have been divided into three subareas, as depicted on Figure 1, Site Map.

- Brisbane Landfill is regulated by the RWQCB and the County. The regulatory roles and responsibilities of these agencies are presented in Section 3.1, Brisbane Landfill.
- Groundwater Operable Unit 1, regulated by DTSC.
- Groundwater Operable Unit 2, regulated by the RWQCB.

UPC currently owns all of the Baylands, with the exception of the Schlage Lock property, which is contiguous with OU-1; and four out properties that include Sierra Point Lumber, South San Francisco Scavenger Company, Bayshore Sanitary District pump station, and the Kinder-Morgan Tank Farm facilities; refer to Figure 1, Site Map. Evaluation of these properties was not performed in the Peer Review as they are not part of the planned Baylands development.

The following discussion presents a summary of the historical development of the Baylands property including site history and environmental conditions, regulatory status, and remedial actions for each subarea.

3.1 Site Background

Originally part of San Francisco Bay, the area that now makes up the Baylands was transformed into its present day condition through progressive infilling of tidal marshlands and the resultant eastern advancement of the shoreline to its present position east of U.S. Highway 101. In general, Bayshore Boulevard traces the early

bay shoreline. In the early 1900's, Southern Pacific Railroad (SPRR) constructed railroad tracks across the Bay. Following the 1906 San Francisco earthquake, the area west of this rail corridor was filled-in primarily with demolition rubble.

In 1914, this area became the main SPRR railroad yard until 1960 when active operations ceased. In the area west of the railroad tracks, bay infilling continued up through the mid-1950s further extending the shoreline to the east. It is in the area east of the railroad tracks that landfilling operations were initiated. The area east of the rail corridor served as the local municipal landfill from 1933 through 1967. The Baylands area is relatively unchanged since the closure of the landfill in 1967 (UPC, 2004).

3.2 Brisbane Landfill

The Brisbane Landfill site encompasses an area of approximately 364 acres and is bounded to the west by the UP/JPB railroad corridor, to the east by U.S. Highway 101, and the Brisbane Lagoon to the south. An earthen dike separates the landfill from the Brisbane Lagoon. Figure 1, Site Map, shows the location of the landfill relative to the locations of OU-1 and OU-2.

Disposal operations were initiated at the Brisbane Landfill in 1932 and continued until 1967. Waste was placed directly on tidal flats and waters at the margin of the San Francisco Bay. The edge of the refuse pile was open to direct wave action from the San Francisco Bay until construction of the U.S. Highway 101 in about 1959 (Kleinfelder, 1992). It is reported that the site was used for the disposal of primarily non-hazardous solid wastes including domestic, industrial, and shipyard waste; sewage; and rubble (RWQCB, 2001). The total volume of waste disposed at the landfill has been estimated to be 12.5 million cubic yards (B&McD, 2002d).

Current land use includes soil and aggregate material recycling operations and non-irrigated open space. The two recycling companies currently operating at the site include the Brisbane Recycling Company and Ryan Engineering. Brisbane Recycling Company maintains a concrete recycling operation in the northern portion of the site. In the southern portion of the site, Ryan Engineering maintains a soil recycling operation. Materials from the recycling operations are kept in stockpiles which have contributed to consolidation of underlying refuse and Bay Mud.

Overview of Environmental Conditions

Provided in this subsection are highlights of environmental conditions for the Brisbane Landfill.

Groundwater

The groundwater monitoring well network used for assessing groundwater quality beneath the Brisbane Landfill includes 13 shallow monitoring wells. Groundwater beneath the Brisbane Landfill, in both the shallow A-zone and the deep B-zone, has been impacted by a number of constituents. Groundwater contamination is assessed

based on comparison to Federal or State water quality standards. The primary Maximum Contaminant Level (MCL) constitutes the enforceable standard for the maximum concentration of a contaminant that is allowed in drinking water. The secondary MCL is not a health-based criterion, but has been established based on aesthetic criteria such as taste, odor, and appearance. The discussion below compares current groundwater constituents (data based on the most recent groundwater monitoring report; GeoSyntec, 2004c) to Federal/State MCLs. This report provides an accurate representation of current groundwater quality conditions beneath the landfill.

- **Organic Compounds –** Volatile organic compounds (VOCs) continue to be detected in groundwater collected from the shallow A-zone at above MCL concentrations. Above MCL detections include benzene, 1,4-dichlorobenzene, and methyl-tert-butyl ether (MTBE). Additionally, chlorobenzene was detected at below MCL concentrations. In the deep B-zone, trace concentrations of chlorobenzene were detected. In the shallow A-zone, nitrosodiphenylamine was the only semi-volatile organic compound (semi-VOC) detected during the most recently reported monitoring event. In the deep Zone B wells, trace concentrations of methylene chloride and naphthalene were detected. No semi-VOCs were detected in the deep B-zone.

- **Inorganic Chemistry Parameters –** Inorganic constituents can be naturally occurring. A comparison of concentrations in upgradient wells to downgradient wells is commonly used as a measure of water quality degradation as a result of constituents originating from the landfill. It should be noted that the groundwater beneath the Brisbane Landfill is not considered to be a drinking water supply based on total dissolved solids (TDS) concentrations greater than 1,000 milligrams per liter (mg/L) (upper limit for drinking water supplies established in Title 22, California Code of Regulations, Section 64449). Groundwater monitoring data for the shallow A-zone and the deep B-zone monitoring wells indicate an increase in concentrations of TDS and total organic carbon (TOC) from upgradient wells to downgradient wells. An inorganic constituent in the shallow Zone A wells that has exceeded regulatory standards (RWQCB water quality objectives for ammonia; GeoSyntec, 2004a) is the un-ionized fraction of ammonia, which is toxic to aquatic life.

- **Metals –** Dissolved metals detected in both the shallow Zone A and deep Zone B wells include arsenic, barium, nickel, lead, and selenium (for the deep wells).

Landfill Gas (LFG)

Decomposition of organic waste under anaerobic conditions (without the presence of oxygen) results in LFG generation. The rate of decomposition is dependent on many factors, including the moisture content of the waste. Given that landfilling operations were initiated with placement of waste on tidal flats and that subsequent borings into the waste revealed continued saturated conditions within the refuse prism, sufficient

moisture exists to promote a high rate of decomposition since disposal operations were initiated.

The greatest organic decomposition occurs during the initial 20 to 30-year period. Decomposition of the organic fraction of the waste will continue to occur over time, with a continuing decline in the rate of production of LFG. Currently, the landfill has been closed for nearly 40 years. CDM concurs that the majority of organic waste has already decomposed. Nevertheless, continued generation of landfill gas indicates that decomposition is ongoing and must be controlled to ensure protection of human health and the environment.

Leachate (with impacts to surface water from seeps).
Leachate is defined as liquid that has come into contact with solid waste, carrying dissolved or suspended materials. This liquid can either be liquid that is generated as part of the decomposition of the wastes or liquid that has percolated into the waste from external sources (e.g., surface drainage, rainfall, or groundwater). The quantity of leachate is a direct function of the amount of water entering the landfill from external sources.

The most recent leachate monitoring results (GeoSyntec, 2004c) indicated the presence of VOCs in samples collected from the 2 leachate monitoring wells (chlorobenzene, benzene, 1,4-dichlorbenzene, and naphthalene (23 µg/L). Additionally, trace concentrations of several semi-VOCs were detected, including fluorine, 2 methylnapthalene, phenanthrene, bis(2-ethylhexyl), and phthalate.

The un-ionized fraction of ammonia exceeded the RWQCB water quality objectives in terms of the maximum concentration limits (0.4 mg/L). Dissolved metals detected in the leachate wells included barium, arsenic, nickel, and lead. In all cases, the concentrations of metal constituents were relatively low.

Landfill Differential Settlement
With the ongoing decomposition of the in-place refuse and consolidation of the underlying Bay Mud, the landfill surface is expected to continue to undergo differential settlement. Landfill settlement can impact long-term durability and maintenance requirements of roadways and underground utilities. Considering the concept of future development on the Brisbane Landfill, differential settlement of the landfill surface will require detailed engineering analysis and design. Potential impacts to structures associated with differential settlement can be effectively mitigated using common foundation design methods.

Regulatory Status

Two regulatory agencies are responsible for oversight of closure/postclosure activities at the Brisbane Landfill. The RWQCB serves as the lead regulatory agency for closure activities at the former Brisbane Landfill site. The County is also involved as the Lead Enforcement Agency as granted under the authority of the California

Integrated Waste Management Board. The County performs periodic inspections of the landfill cover, landfill gas system performance monitoring, and the surface water management system. RWQCB Order No. 01-041 is the current enforcement document that governs activities at the landfill.

Status of Remedial Actions

Consistent with landfill closure requirements at the time the landfill stopped accepting waste (1967), the landfill operator placed a clean soil layer over the waste. The SWAT report (Kleinfelder, 1992) that was prepared for the landfill site characterized the soil as primarily gravelly silt. Clean cover materials continue to be added by the current operations of Ryan Engineering and Brisbane Recycling. Stockpiling of the soil serves to surcharge the refuse and underlying Bay Mud in one area of the site. Recent soil cover investigations identified variability in soil cover thickness of a few feet to greater than 30 feet; however, the soil cover thickness over much of the landfill surface is reported to exceed 10 feet (B&McD, 2002d).

Because the site was closed prior to development of existing landfill closure requirements (Title 27, California Code of Regulations [CCR]), the existing cover is not required to conform to the current Title 27 closure standard. However, for areas targeted for future development, the site owner will be required to upgrade the landfill cover to be consistent with Title 27 standards. This is supported by language in the RWQCB Order No. 01-0041 (adopted April 2001), which requires placement of a Title 27 compliant cover and preparation and submittal of a Development Proposal for each parcel planned for development prior to commencement of construction. In accordance with Title 27 requirements, the project proponent has prepared a *Final Closure and Postclosure Maintenance Plan* (B&McD, 2002d), which describes plans for closure of the landfill site and plans for ongoing monitoring and maintenance. This document generally describes the remedial actions to be taken at the Brisbane Landfill, including installation of the landfill cover, drainage and erosion control, and landfill gas control. Peer Review comments are provided in Section 5, Recommendations, relative to these landfill closure components.

3.3 Groundwater Operable Units

The former SPRR rail yard comprises an area of approximately 180 acres and consists of two separate groundwater operable units, referred to as Operable Units 1 and 2 (refer to Figure 1, Site Map). Operable Unit 1 (OU-1) is located north of Geneva Avenue, between Bayshore Boulevard on the west and the Union Pacific/Joint Powers Board (UP/JPB) railroad tracks on the east. Operable Unit 2 (OU-2) is located south of Geneva Avenue, between Bayshore Boulevard on the west and the UP/JPB railroad tracks on the east. The boundary between OU-1 and OU-2 generally coincides with the near east-west projection extending from the west property boundary at Geneva Avenue to the east boundary with the UP/JPB corridor. Initially, DTSC administered both areas as a single groundwater unit; however, in 1995 DTSC divided the areas into the two separate and distinct operable units. Currently, DTSC is the lead agency for OU-1, whereas, the RWQCB is the lead agency for OU-2.

3.3.1 Operable Unit 1

The area designated as OU-1 comprises an area of approximately 38 acres west of the UP/JPB railroad tracks in the northwest portion of the Baylands development area (Treadwell & Rollo, 2003a). This area comprises the northern portion of the former SPRR railroad and the entire Schlage Lock manufacturing facility (refer to Figure 3, Site Map, OU-1). An important fact to note is that OU-1 area comprises property within separate jurisdictions (Brisbane and San Francisco) and owned by separate entities (Schlage Lock and UPC). In September, DTSC and UPC met and agreed to an approach to further characterize site soil conditions within OU-1 (e.g., address identified data gaps), and to prepare separate updated human health risk assessments and draft soil remedial action plans for the Brisbane and San Francisco portions of OU-1. As part of this agreement, two additional monitoring wells will be installed and integrated into the current monitoring program. The overarching purpose of this meeting was to establish firm commitments with respect to document submittal requirements and review schedule milestones that will mesh with the preparation of the draft EIR for the San Francisco portion of OU-1 (DTSC, 2005b).

From 1914 through 1960, this site was used by the SPRR for major railcar rehabilitation, locomotive maintenance operations, and material transfer operations. Both Schlage Lock and SPRR ceased operations on their respective properties in 1960.

Overview of Environmental Conditions

Soil and groundwater chemicals of potential concern (COPC) associated with OU-1 contamination include VOCs, primarily trichloroethylene (TCE), tetrachloroethylene (PCE), cis-1,2-dichloroethylene (cis-1,2), vinyl chloride (VC); total petroleum hydrocarbons (TPH) as Bunker C (fuel oil); and metals, primarily chromium. Potential sources of soil and groundwater contamination include the former degreaser area, loading dock, maintenance shed, and north end of the former rail yard.

Soil

The evaluation of soil impacts at OU-1 could not be fully evaluated at this time as UPC's Draft Soil Workplan (B&McD, 2005) was deemed incomplete by DTSC (2005). Upon request, DTSC provided the City with a copy of the draft soil workplan and their correspondence letter for use in the Peer Review. Unfortunately, the report does not contain the type of information at the level of detail that is needed for this Peer Review to reach a conclusion. Significant findings of the Peer Review will be presented in Section 4, Evaluation and Findings. As previously stated, the DTSC deemed the Draft Soil Workplan as incomplete and the document will be resubmitted as a Draft Removal Action Workplan to address impacted soils beneath OU-1.

Groundwater

Groundwater beneath OU-1 is impacted with VOCs, primarily TCE, PCE, cis-1,2-DCE and VC , refer to Figure 4, Generalized Site Contaminants for OU-1 and OU-2. In addition to VOCs in groundwater, various metals and TPH have also been detected in groundwater. The primary metal constituent identified in groundwater is chromium

and hexavalent chromium in several wells. Of these contaminants, TCE and PCE is the most significant and widely distributed compound in the A-zone (both A-fill and A-sand units) and B-sand aquifers, refer to Figure 5, Stratigraphic Terminology.

The groundwater plume is controlled and treated using a granulated activated carbon system connecting seven extraction wells; with four extraction wells screened in the A-fill (wells GWE-1 through -4) and three extraction wells screened in A-sand (wells GWE-6 through -8). Extraction well GWE-5, is screened across the A-fill and A-sand and in 1996 was disconnected from the system due to oil fouling (B&McD, 2005). No extraction wells are positioned to remove VOC-impacted groundwater from the B-sand aquifer. Discharge of treated groundwater is accomplished via a permitted discharge to the sanitary sewer system. The combined well treatment and discharge flow is reportedly 10 gallons per minute (gpm) (T&R and B&McD, 2005). Project documents state that the A-aquitard is continuous beneath the site but may have 'windows' or gaps that permit direct hydraulic connection of the A-sand with the lower B-sand. An example of a "window" or gap in the A-aquitard is illustrated in Figure 3-2, Section A-A' in Treadwell & Rollo and Burns & McDonnell (2005). While this figure is not included in the Peer Review Report, the cross section shows that the A-Aquitard is not continuous near boring/well GT-1 and TR-79. Past investigations do not offer a detailed explanation for groundwater contamination in the B-Sand aquifer, especially when one considers that capture of B-sand contaminants relies on groundwater upgradient flow and subsequent capture in A-Sand wells. It is possible that the gaps in the A-aquitard provide a path for contaminant migration to the B-Sand.

Additionally, the concentrations of VOCs in groundwater exceed their respective solubility threshold by up to 30% suggesting that an unidentified source of dense nonaqueous phase liquids (DNAPLs) may be present. Treadwell & Rollo and Burns & McDonnell (2002) state that DNAPL was once likely present but now has sufficiently degraded and is absent in DNAPL-form and exists as a residual product in pockets of soil and is non-mobile. The draft groundwater RAP (B&McD, 2005) states that no active source areas have been identified on the site. This 2005 document then proceeds to state "Remaining significant soil source areas on the Schlage property, if present, will be addressed under the separate Remedial Action Plan for the Schlage Soil Operable Unit 1." If active source areas are known to exist on the Schlage property, the groundwater RAP should indicate the approach, if any, that will be used to minimize continued ongoing impacts associated with the offsite upgradient source(s) of VOCs.

Surface Water

The Sunnydale Sewer traverses the northern portion of OU-1, and is located within the VOC-impacted groundwater plume. Burns &McDonald (1998c) conducted a pump shutdown test that determined that groundwater flow does not enter the sewer when the treatment system is in operation. This study also indicated that groundwater does not flow beneath the sewer as it is cast in-place on a pile

foundation, but the evaluation did not consider the potential groundwater flow effects associated with the disturbed subgrade, potentially degraded piles, or surrounding backfill materials.

Regulatory Status

DTSC is the lead regulatory agency for OU-1. UPC indicated that there are no known notices of violation, mitigation measures or associated DTSC correspondence pertaining to this site (Hanson, 2005b).

In 1990, the DTSC issued an Imminent and Substantial Endangerment Determination and Remedial Action Order, Number 89/90-004 that required a groundwater treatment system be installed to control migration of impacted groundwater (Weiss, 2003). In 1995, the DTSC withdrew the Remedial Action Plan (RAP) and Negative Declaration for the Bayshore Railyard and divided the sites into two Operable Units (Operable Units 1 and 2). For a detailed chronology of the regulatory actions and compliance refer to Remedial Investigation Report, Joint Groundwater Investigation Report, prepared by Treadwell & Rollo and B&McD (2002) and Revised Groundwater Operable Unit Remedial Action Plan, Sunquest Properties and Schlage Lock Company, prepared by Treadwell & Rollo and B&McD (2005) . In August 2005, UPC submitted the draft soil workplan for limited soil remediation within the UPC-portion of OU-1 (B&McD, 2005). As previously stated, the draft soil Workplan was returned to UPC as DTSC deemed the document to be incomplete. The DTSC correspondence indicated that future documents shall adhere to the prescribed format consistent with a draft removal action workplan (DTSC, 2005a). As noted in Section 3.3.1, Operable Unit 1, UPC and DTSC established document submittal requirements and review schedule milestones for OU-1 (DTSC, 2005b).

Status of Remedial Actions

In 1993, contaminated soils adjacent to and beneath the former sludge traps were excavated and removed (Treadwell & Rollo, 1996). The purpose of this removal action was to remove solvent (VOC) contaminated soils from beneath sumps within the former Degreasing Room and Strip Room of Plant 3. Details on the extent and type of contaminants are summarized in the joint groundwater RAP (T&R and B&McD, 2005).

In 1995, UPC constructed a groundwater extraction and treatment system to control migration and expansion of the groundwater plume. Groundwater extraction and treatment is ongoing and groundwater is monitored on a quarterly basis. Review of the most recent groundwater monitoring information indicates that the detected constituents and plume pattern are generally unchanged when compared to previous monitoring events (B&McD, 2003a). For a comprehensive listing of documents, including summary of remedial actions conducted at the site and adjacent Schlage Lock property, refer to the document titled Revised Groundwater Operable Unit Remedial Action Plan, Sunquest Properties and Schlage Lock Company, prepared by Treadwell & Rollo and B&McD (2005).

3.3.2 Operable Unit 2

With a site history similar to OU-1, the area designated as OU-2 comprises an area of approximately 142 acres west of the UP/JPB railroad tracks in the center and southwest portion of the Baylands development area. This area comprises approximately 75% of the former SPRR railroad (refer to Figure 1, Site Map). From 1914 through 1960, this site was used by the SPRR for major railcar rehabilitation, locomotive maintenance operations, and material transfer operations. In 1960 SPRR ceased operations and the site has been inactive and unoccupied since that time.

Summary of Environmental Conditions

Soil and Groundwater

Primary soil and groundwater COCs include total petroleum hydrocarbons as Bunker C fuel oil; metals as lead; and volatile organic compounds, primarily PCE. On the basis of chemical constituent and contaminated media (soil and/or groundwater), OU-2 identified source areas are defined as follows: the Oil Tank Area, South Disposal Area, and the north-south drainage channel. Groundwater and surface water is monitored on a semi-annual basis.

Groundwater concentrations of Bunker C and metals exceed proposed Remedial Action Objectives (RAOs) in soil and will require remediation (B&McD, 2002a).

Surface Water

Sediment within the vicinity and underlying the north-south drainage ditch are impacted with Bunker C and metals. Presently, water entering this channel, flows into a structure referred to as the 'brick arch' sewer, which crosses the adjacent landfill to the east and then discharges into San Francisco Bay. The surface water drainage ditch has been identified as a preferential pathway allowing impacted surface water and suspended sediments to be transported into the San Francisco Bay.

Figure 4, Generalized Site Contaminants for OU-1 and OU-2, illustrates the general distribution of soil and groundwater contaminants for OU-1 and OU-2.

Differential Settlement

In 2004, Michelucci and Associates (2004) conducted a geotechnical investigation to evaluate the general geotechnical engineering characteristics of the site soils. As part of this work, 11 soil borings were drilled and samples were collected and analyzed for engineering properties. Settlement analysis conducted as part of this evaluation indicated that primary consolidation of the current railyard area is essentially complete but that settlement of new proposed fill would be on the order of several inches for new fill (soil cap) placed up to several feet thick and up to almost 2 feet for new fill up to about 8 feet thick. In addition, the settlement versus time plots indicated that primary consolidation would occur over several decades (Michelucci, 2004). The amount and rate of settlement is a function of the properties and thickness of existing fill and underlying bay muds. Hence, the areas with the largest

anticipated differential settlement is in the south and eastern portions of the former railyard where the thickness of bay muds is the greatest.

Regulatory Status

As stated above in the OU-1 discussion, in 1995 the DTSC withdrew the RAO and Negative Declaration for the Bayshore railyard and divided the sites into individual groundwater operable units. At this time, lead regulatory jurisdiction for OU-2 was transferred to the RWQCB. A copy of the DTSC rescission order was not provided for the Peer Review but is not considered significant as the RWQCB maintains jurisdictional oversight.

During the review process, it was determined that a RWQCB site cleanup order, pursuant to Water Code 13304, had not been prepared or adopted by the RWQCB. Past and ongoing site environmental studies are being conducted on a voluntary basis in accordance with Water Code 13267. Subsequent discussions with the RWQCB indicated that a site cleanup order will be drafted and adopted after the following sequence of events: City approval of the development plan, certification of the Environmental Impact Report (EIR), submittal and approval of the final Remedial Action Plan (personal communication, Elias, D., 2005). The RWQCB also indicated that Deed Restrictions and a Residual Risk Management Plan will likely be required if contamination is left in place as presently proposed by UPC.

Status of Remedial Actions

For the oil tank and south disposal area, the proposed Remedial Action Plan (RAP) concept includes placing a 7 to 10-foot thick clean soil cap over areas impacted with Bunker C and lead (Oil tank and south disposal areas), and the development and implementation of engineering and institutional site controls coupled with long-term groundwater monitoring.

To address soil, surface water, and groundwater impacts associated with the north-south drainage, the proposed RAP consists of closing and capping the existing drainage ditch with construction of a new interim ditch to collect surface water until the grading plan is complete (B&McD, 2002a). A localized zone of shallow soil impacted with PCE will be excavated as part of the remedial actions at OU-2 (B&McD, 2002a).

On October 13, 2005, the City Planning Commission conducted a hearing regarding the suitability of UPC's grading permit application for the excavation and removal of approximately 1,200 cubic yards of soil contaminated with Halogenated Volatile Organic Compounds (HVOCs) and subsequent backfill with clean imported soil. At that time, the Planning Commission approved recommending the City Engineer issue the requested grading permit. The removal action is expected to occur in 2006 following the completion of the rainy season.

Section 4

Evaluation and Findings

Section 4
Evaluation and Findings

This section presents CDM's evaluation of the information provided to the City for the Peer Review and a summary of the key findings related to the proposed Baylands Development at this time.

The information presented in this section is organized on a project subarea-basis for clarity and will also serve as a means to organize our recommendations presented in Section 5. The primary objective of our evaluation was to review the City-provided documents that summarize and present the site historic uses, the nature and extent of soil and groundwater contamination, and past and current remedial activities in order to determine compliance with regulatory objectives, and to assess UPC's approach as presented in the Phase I Specific Plan dated October 2004. Also summarized in this section are the known or anticipated regulatory actions that may be imposed to achieve agency specified remedial goals and compliance.

The standard used to conduct our data evaluation and to formulate our findings is based on the following criterion:

- Adequacy of Environmental Characterization
- Appropriateness of Remedial Action
- Protection of Public Health and the Environment

This evaluation criteria is based on the primary concerns expressed by the community-at-large during past Bayland public workshops. The first two criteria are focused on environmental aspects and the third criterion considers the development-specific aspects for the Baylands. This approach results in the application of a uniform standard to evaluate each of the Bayland subareas with respect to the Specific Plan.

In addition to the three criteria listed-above, the Peer Review also evaluated the site information for compliance with the secondary criteria listed below:

- Conformance with established regulatory orders and actions
- Consistency with applicable Federal and State requirements including, but not limited to,
    - National Oil and Hazardous Substance Pollution Contingency Plan and State Evaluation Criteria
    - Safe Drinking Water Act, Maximum Contaminant Level (MCLs) for drinking water (Title 40)

- Title 27, Environmental Protection, Division 2, Solid Waste, California Health and Safety Code (CHSC)
  - Division 20, Chapter 6.5, Hazardous Waste Control
  - Division 20, Chapter 6.7, Underground Storage of Hazardous Substances
  - Division 20, Chapter 6.75, Petroleum Underground Storage Tank Cleanup
  - Division 101, Part 3, Chapter 4, Article 5, (Section 101480 - 101490), Administration of Public Health, Local Health Departments
- California Water Code, Division 7, Water Quality (Porter-Cologne Water Quality Control Act)
- California Code of Regulations (CCR)
  - Title 22, Division 4, Chapter 30, Hazardous Wastes
  - Title 23, Division 3, Chapter 16, Underground Storage Tanks

No known outstanding regulatory notices or corrective actions were identified during this Peer Review evaluation.

4.1 Findings

The information presented in the findings section presents CDM's review and interpretation of the City-provided documents for the Baylands on a subarea basis. The findings presented herein are organized by evaluation criteria on a subarea basis.

4.1.1 Brisbane Landfill

Adequacy of Environmental Characterization

As part of assessing the adequacy of environmental characterization of the Brisbane Landfill, CDM has considered the following issues:

- Limits of Waste
- Landfill Settlement
- Landfill Gas
- Groundwater Quality
- Leachate

Each of these elements of the overall environmental characterization are discussed in more detail below.

Limits of Waste

Final cover and the ongoing soil recycling operations have resulted in the placement of clean soils over the in-place refuse. Therefore, near surface soils are not impacted by constituents of concern originating from the landfill. An important issue associated with the Brisbane Landfill is definition of the limits of the waste. The limits of waste must be accurately defined to assure that landfill capping systems are sufficiently extensive to cover the entire footprint. For several areas of the landfill, the limits of waste are defined by physical features:

- Western extent – terminates just east of the Caltrain/JPB rail line
- Eastern extent – U.S. Highway 101
- Southwestern extent – extends into the nearby aboveground tank farm.

Based on the fill investigations performed by GeoSyntec (2000a and 2000c), the lateral extent of waste has been adequately defined except for the southern boundary. In this area, the proposal is to extend the landfill cap to the edge of the Guadalupe Lagoon in order to achieve coverage of all refuse.

Landfill Settlement

Given consideration of development on or near the former landfill site, an important issue to address is settlement of the landfill surface and resulting structural stability concerns. A number of the engineering reports have been prepared which highlighted the variable nature of the existing soil cover in terms of the type and thickness, including:

- B&McD, 2001a. *Landfill Cover Thickness Investigation Report,* February 2001.
- GeoSyntec. 2000a. *Identification of Property Owners and Delineation of Landfill Footprint, Brisbane Landfill, Brisbane, California*. April 26, 2000.
- GeoSyntec. 2000. *Draft Technical Memorandum, Geotechnical Evaluation of Existing Cover Material, Brisbane Landfill, Brisbane, California*. June 27, 2000 (document requested, not provided for review by CDM as part of the Peer Review Evaluation. UPC indicated that this document is not finalized. The City's stated requirement is that this study will be finalized prior to preparing development documents).
- Michelucci & Associates (2004), Railyard Geotechnical Report, January 2004.

Various soil types will undergo settlement at different rates and to varying extents. Settlement of the landfill surface is further complicated by the existence of Bay Mud underlying the refuse, the depth of which varies across the site. As is pointed out in B&McD (2001a), there are a number of factors which influence the rate and extent of settlement of the underlying Bay Mud including weight of the superimposed improvements; depth, thickness and relative consolidation of compressible Bay Mud

and overlying fill materials; load chronology of previous fills at the site; and the rate and distribution of loadings. CDM agrees that a rigorous analysis must be performed to assess the impacts of development on the short- and long-term behavior of both the refuse/landfill cover and the underlying Bay Mud. CDM also concurs that consideration should be given to a full-scale field load test program with long-term settlement monitoring to verify localized predicted settlement criteria (B&McD, 2001d).

Landfill Gas

Prior to installation of the current LFG control system, landfill gas investigations resulted in detections of LFG in utility vaults, stromwater drains, structures on or near the landfill and in soil beyond the property boundary (Kleinfelder 1990a and 1990b). The LFG control system has been in operation since 1991.

It is CDM's understanding that LFG monitoring typically performed as part of a long-term postclosure monitoring and maintenance is no longer performed at the former landfill site. The most recent surface emissions survey was performed in 1991. The most recent perimeter probe monitoring was conducted in 1996. The most recent evaluation of LFG in structures was performed in 1990 (Kleinfelder, 1990a). It is important to re-initiate perimeter probe monitoring, surface emissions monitoring, and monitoring of structures on or adjacent to the landfill. This is discussed as part of the recommendations in Section 5.

Groundwater Quality

CDM believes that hydrogeologic and groundwater quality conditions have been adequately characterized. Section 3 of this document briefly summarizes the current groundwater quality conditions based on information provided by the most recent monitoring reports (GeoSyntec, 2004c). The organic constituents and their respective concentrations do not differ appreciably in comparing the most recent groundwater monitoring data (GeoSyntec, 2004c) and the baseline data as reflected in the SWAT Report (Kleinfelder, 1992).

A statistical analysis was performed on the August 2004 groundwater and leachate monitoring data to determine whether constituent concentration levels were increasing or decreasing over time (GeoSyntec, 2004c). Other than sulfate, no other constituent exceeded the intrawell prediction limits established by the statistical analytical method. This analysis suggests that although groundwater impacts exist, concentrations of the various constituents are not increasing. This is supported by comparison of current data with data from the Landfill SWAT report (Kleinfelder, 1992), in which no significant differences were observed both in terms of the constituents detected and the respective concentrations.

Leachate

Leachate seeps that have been observed in the Central Drainage Canal (CDC) and in the earthen dike adjacent to the Brisbane Lagoon result in transport of leachate to

surface waters, with eventual transport to the San Francisco Bay. Analyses performed to date to assess the influence of seeps along the southern landfill boundary have concluded no significant impact to the quality of surface and pore water of Brisbane Lagoon (B&McD, 2004b).

Appropriateness of Remedial Action

The remedial actions which have been implemented or proposed for the Brisbane Landfill are defined in the *Final Closure and Post Closure Maintenance Plan* (B&McD, 2002c). Issues of concern to address in closure of a landfill site include landfill gas generation and migration, leachate generation and transport into groundwater and surface water, and settlement of the landfill surface and underlying geologic materials. The remedial action measures selected for a particular landfill closure are, of course, dependent on the nature of the proposed development. As an example, landfill gas migration is of less concern if open space is the selected land use. Alternatively, there are potentially significant safety and health issues associated with landfill gas migration if a commercial structure is constructed on or near a closed landfill.

There are a set of minimum, presumptive actions that must be taken to achieve landfill closure and minimize or eliminate risk to human health and the environment. These measures have been generally described in B&McD (2002d). Figure 6, Site Cleanup for Landfill, is a schematic which illustrates the elements of UPC's proposed remedial approach for the Brisbane Landfill. Landfill closure requires, at a minimum, the following components:

- **Landfill Final Cover System –** The primary objectives of the final landfill cover are containment (i.e., preventing exposure of the public or the ecosystem to the in-place waste), preventing percolation of liquids through to the underlying waste, and preventing landfill gas emissions. Federal and State regulations clearly spell out the components of the prescriptive final landfill cover -- a fairly complex design consisting of multiple layers intended to achieve the regulatory performance objectives. Landfill closure regulations require long-term maintenance to ensure the continued integrity of the final cover system.

- **Landfill Gas Control System –** Decomposition of the organic component of solid waste leads to generation of landfill gas. Uncontrolled migration of landfill gas can lead to the creation of explosive conditions, primarily in or near enclosed areas (structures, utility vaults, etc.). A LFG control system typically consists of a system of interconnected horizontal and vertical pipes connected to vacuum blower. LFG is extracted by the collection system and combusted using a LFG flare that is typically permitted by the local air quality management district. Long-term system maintenance and a landfill perimeter and surface emissions monitoring program are important for ensuring effectiveness of the LFG control system.

- **Surface Water Management System –** Percolation of water into the waste prism will result in the generation of leachate. Actions must be taken to prevent percolation of water through the cover system and into the waste. A surface water management system is intended to facilitate surface transport of stormwater across the final cover and away from the landfill surface. This includes maintaining a minimum grade of 3% for all landfill surfaces. Relative to the generation of leachate, leachate migrating into the CDC and Brisbane Lagoon has been identified as a reoccurring condition and will be mitigated by reconstructing and installing a barrier membrane to prevent landfill leachate from migrating into the CDC. Our review did not identify an approach specifically for eliminating future leachate migration into the lagoon.

During the post closure monitoring period (defined in the regulations as a minimum of 30 years), it is critical to maintain the cover with respect to grade to prevent ponding of water and erosion, maintain operation of the LFG control system, and continue groundwater monitoring and perimeter and landfill surface emissions monitoring. The information provided in B&McD (2002d) which address the remedial action measures are general in nature. In accordance with the WDRs, the developer will be required to prepare location-specific plans, which define the particular remedial action components that will be put into place for closure to accommodate the proposed development. These location-specific plans must address issues such as final grading consistent with Title 27 regulations, which requires a 3% minimum grade. The current grading plan does not meet the Title 27 requirement. For example, Drawing 3, Brisbane Landfill Closure Plan, Final Grading Plan (B&McD, 2002d), shows flat grading of individual pads but lacks information regarding pad elevation, slope, and surface water collection and drainage features. Such a configuration is inconsistent with the regulations and could result in ponding and percolation of ponded water through the final cover. The location-specific plans must also address long-term maintenance of these remedial action components.

Protection of Public Health and the Environment

The documents listed below are screening-level assessments of risk prepared for the Brisbane Landfill:

- GeoSyntec Consultants. 2003b. Screening Level Ecology Risk Assessment, Brisbane Landfill, Brisbane, California. November 17, 2003.

- GeoSyntec Consultants. 2003c. Revised Tables and Figure, Screening Level Ecology Risk Assessment, Brisbane Landfill, Brisbane, California. December 23, 2003.

- GeoSyntec Consultants. 2004a. Ammonia Toxicity in Sediment, Screening Level Risk Assessment, Brisbane Landfill, Brisbane, California. March 10, 2004.

- GeoSyntec Consultants. 2004b. Surface Water Monitoring of Guadalupe Lagoon, Screening Level Risk Assessment, Brisbane Landfill, Brisbane, California. March 22, 2004.

These documents were reviewed for adequacy as part of this peer review. This subsection provides a listing of potential exposure pathways associated with human health risk and ecological risk.

Human Health

The most significant risk associated with LFG is the migration and accumulation of methane within enclosed spaces, potentially leading to explosive conditions. LFG may also contain constituents hazardous to human health. Intrusion of vapors into commercial buildings can result in exposure of commercial workers or visitors. Additionally, migration of LFG constituents away from the source and dissolution into groundwater can result in a degradation of groundwater quality.

Potential human health exposure pathways associated with impacted groundwater or leachate, in-place refuse, and LFG are identified below. A complete exposure pathway requires a source and mechanism of release of chemicals to the environment, a transport medium for the released chemical, an exposure point (point of potential contact between receptor and transport medium), and an exposure route. Populations could be exposed to impacted groundwater through the exposure pathways listed below. This listing assumes that land use on or near the landfill footprint will be commercial, retail, roadways, and open space, and that no residential development will occur.

- Construction Worker during trenching or excavation activities
  - Incidental ingestion of and dermal contact with impacted groundwater
  - Incidental ingestion of and dermal contact with leachate
  - Incidental dermal contact with refuse
- Indoor Commercial Worker
  - Inhalation of volatile components of LFG in indoor air (resulting from vapor intrusion).
- Recreational User at locations of leachate seeps
  - Incidental ingestion of and dermal contact with leachate

Ecological

The most significant ecological exposure pathway is the transport of hazardous constituents into the San Francisco Bay or the Brisbane Lagoon. Recent groundwater

and leachate monitoring data (GeoSyntec, 2004a) indicate the presence of un-ionized ammonia fraction at levels exceeding the RWQCB water quality objectives for ammonia. The un-ionized ammonia fraction is toxic to aquatic life.

The end result of the screening level ecological risk assessment (SLERA) is referred to as a "scientific management decision point." In the SLERA evaluation, the scientific management decision point is intended to serve as the determination point for rating potential risk. Specifically, whether the risk is considered negligible or if additional risk assessment is needed. The existing SLERA (GeoSyntec, 2003b), does not contain adequate information for making any scientific management decisions with respect to either negligible risk or advancement to a baseline risk assessment. In addition, it appears that the SLERA exposure estimates are based on average concentration sampling results, as opposed to the 90th or 95th percentile upper control limits (UCL) or the maximum concentration value, which are typically used for exposure estimates for small sample sizes. Based on these findings, CDM recommends that a new SLERA be conducted.

4.1.2 OU-1

Adequacy of Environmental Characterization

As part of assessing the adequacy of environmental characterization of the OU-1, the Peer Review has considered the following issues:

- Soil
- Groundwater
- Surface Water
- Soil Vapor

Soil

Impacts to the site attributed to soil contamination could not be evaluated as relevant documents presenting the current type and distribution of contaminants, if any, were not sufficiently developed by the time this peer review was completed. At this time, no assessment regarding adequacy of characterization for soil can be made.

Groundwater

Groundwater beneath OU-1 is impacted with VOCs, primarily TCE, PCE, cis-1,2-DCE and VC; metals, primarily chromium/hexavalent chromium; TPH as Bunker C, refer to Figure 4, Generalized Site Contaminants for OU-1 and OU-2. Of these contaminants, TCE and PCE is the most significant and widely distributed compound in the A-zone (both A-fill and A-sand units and B-sand aquifers).

- During non-pumping conditions of the groundwater treatment system surface water and impacted shallow groundwater infiltrates the Sunnydale sewer line and

is subsequently discharged into the City/County of San Francisco sewer system (B&McD, 2000b).

- Site investigation documents, state that the A-aquitard is continuous beneath the site but may have 'windows' or gaps that permit direct hydraulic connection of the A-sand with the lower B-sand. Project documents further state that if these windows are in fact present then the hydraulic gradient is generally up from the B-sand into the A-sand and contaminant migration from A-sand to B-sand would not occur. While the site data supports the interpretation that there is an upward vertical gradient from B-sand into the A-sand, no mechanism for the VOC contamination of the B-sand aquifer is proposed.

- Based on a detailed data review, a plausible alternate B-sand contamination mechanism has been developed and is illustrated in Figure 7, Simplified Conceptual Aquifer Development.

  In an effort to understand potential mechanisms for the B-sand VOC contamination, a detailed review of the available hydrogeological data was conducted as part of the Peer Review. Existing documents suggested that the observed VOC-contamination is a result of 'windows' or gaps in the low permeability A-aquitard that separates the A-sand from the lower B-sand aquifers. When the deposits are viewed in a depositional context, the sediment sequence consists of a staggered and layered package of beach deposits (B-sand), back-bay mud flats (A/B-aquitard), and offshore barrier bar (A-sand) deposits.

  As shown in Figure 7A, this framework is initiated as a laterally flat relationship between beach deposits (B-sand), back-bay mud flats (A-aquitard), and offshore barrier bar (A-sand). With marine transgression (increase in relative sea level) this lateral relationship migrates landward, westward, and upwards. The mud flats that comprise the A-aquitard would exhibit a sequentially stepped layer configuration, as shown in Figure 7A. With infilling, the above sediment sequence would compact over time, as shown in Figure 7B. Typically, compaction is greater basinward (east) than shoreward (west); hence the sequentially stepped layers of the A-aquitard would become tilted due to the increased sediment thickness and compaction in the basin, as illustrated in Figure 7C.

  The hydraulic mechanism that moves water-borne contamination laterally from A-sand, to B-sand deposits, may not represent a natural phenomenon. Both Operable OU-1 and OU-2 have man-made structures near the indicated pre A-fill (pre-bay infilling) shoreline that induce groundwater table depressions. OU1 has a large diameter sewer (Sunnydale Avenue) near the geologic contact between the A-fill, Bay Margin Muds, and the A-sand, which forms a piezometric depression for the A-fill and A-sand aquifers. OU2 has a drainage channel that forms a major piezometric depression for the A-fill and A-sand aquifers. Superimposing the basin margin groundwater depression on the shallow A-aquitard mud flat

deposits, and a basinal groundwater mound over deep mud flat deposits results in vertical downward hydraulic gradient that transports contamination laterally and upwards from the A-sand, through the stepped gaps and channel fill deposits separating the mud flat deposits (A-aquitard), into the B-sand (refer to Figure 7D).

- Concentrations of VOCs in groundwater in some monitoring wells exceed their respective solubility threshold by up to 30% and based on this information it seems likely that the site contains an unidentified source of DNAPLs. B&McD (2002c) state that DNAPL was once likely present but now has sufficiently degraded and is absent in DNAPL-form and only exists as a residual product in soil pore space and is non-mobile. In a subsequent document, an offsite upgradient source is alluded to as an alternate explanation for the relatively unchanged VOC groundwater concentrations (T&R and B&McD, 2005).

Surface Water
The Sunnydale Sewer traverses the OU-1 area and there is a concern that surface water and impacted shallow groundwater may infiltrate the sewer line and serve as a migration pathway, refer to Figure 8, Sunnydale Avenue Sewer. Investigations focused on this concern (B&McD, 2002a and T&R and B&McD, 2000), indicates that infiltration of surface water and impacted groundwater does not occur when the groundwater treatment system is operating as intended.

Soil Vapor
No known soil vapor studies have been conducted for OU-1.

Appropriateness of Remedial Action

Based on the available information. RAOs for soil or groundwater have not been approved.

The evaluation of the soil remedial action could not be fully evaluated as UPC's draft soil workplan (B&McD, 2005) was deemed incomplete by the DTSC. With the inclusion of a site-specific soil removal action and augmentation of the existing groundwater treatment and monitoring system, UPC's remedial concept proposed at the Public Workshop is fundamentally unchanged from previous scenarios (UPC, 2003).

The draft soil Workplan report (B&McD, 2005) contains several inconsistencies, the most significant of which is the reference to residential land use, which the City's General Plan prohibits. In addition, the document indicates that all utility work will be completed before the cap is placed. However, the development plan has not been prepared or submitted to the City for review. In general, the draft Soil Workplan lacks sufficient discussion and detail to be included in the Peer Review. At this time, it is not possible to evaluate site soil impacts as the Soil Conditions Report (prepared by Burns & McDonnell, 2005) was not provided for the Peer Review but will be presented in UPC's forthcoming revised draft soil workplan. Based on the available

information, the Peer Review recommendations relevant to the soil contamination within OU-1 are presented in Section 5. The remedial concept as proposed by UPC is illustrated on Figure 9, Proposed Remedial Action. Figure 10, Proposed Engineering Control for OU-1, illustrates the locations of additional OU-1 extraction monitoring wells with areas of engineering controls.

Based on the remedial approach proposed in the draft Soil Workplan (B&McD, 2005) the following remedial action is proposed at the site. Note that the DTSC will review the revised soil Workplan and the approach listed below is simply a summary of UPC's proposed approach.

- VOC impacted soils will be excavated and removed to Bay Mud at two selected locations.
- Metals impacted soils will be capped with three to five feet of clean import soil.
- Cap the entire site with an impermeable cap to prevent infiltration of surface water and exposure routes (dermal and ingestion pathways).
- Deploy institutional (e.g., Deed Restrictions) and engineering controls (e.g., caps and vapor barriers) to eliminate risk exposure pathways.
- Continued operation of the groundwater pump and treat system.

In concept, this approach is considered an acceptable solution, but without information regarding the type and extent of soil contamination, review of and development of site-specific engineering and institutional controls, a final opinion regarding the adequacy of the remedial approach cannot be made at this time. In addition, if VOCs migrating from groundwater through the vadose zone are predominantly from the A-Fill, remediation of the A-Fill may be beneficial and negate the need for a soil vapor barriers at selected areas of OU-1 as the Bay Mud unit may serve as a confining layer that minimizes vapor migration from the A-Sand unit into the vadose zone soil. Further evaluation of this pathway may clarify the contaminant migration mechanism in OU-1.

The joint groundwater RAP (T&R and B&McD, 2005) states that the proposed remedial action (referred to as Alternative No. 3), consisting of the existing groundwater treatment system with three new extraction wells will reduce groundwater VOC concentrations. While this statement is generally true, the report goes on to state that the groundwater treatment system will need to function for decades to reduce concentrations to current MCLs. The Peer Review finding is that continued long-term operation of the treatment system is not expected to significantly reduce VOC concentrations in groundwater without reduction of residual VOCs or substantial source reduction. At this time, chemical oxidation or other means to significantly reduce VOC concentrations in groundwater (or saturated soils) is not

proposed. The existing health risk documents do not adequately address exposure pathway for incidental contact with groundwater.

The Sunnydale Sewer traverses the OU-1 area and when the groundwater treatment system is shutdown, impacted shallow groundwater infiltrates the sewer line through leaking pipe joints or cracks, refer to Figure 8, Sunnydale Avenue Sewer. Flow of impacted groundwater into the Sunnydale Avenue Sewer is prevented during operation of the existing groundwater treatment system.

With the exception of potential windows in the A-aquitard and B-sand contamination source the groundwater conditions are adequately defined from a development standpoint. It appears that the existing groundwater extraction and treatment system is functioning adequately as the VOC plume does not appear to be migrating. As a means to further reduce continued degradation of B-sand water quality, consideration of supplementing the existing A-sand extraction wells should be evaluated as part of the long-term groundwater management strategy.

Protection of Public Health and Environment

At this time, a comprehensive evaluation of the remedial action and appropriateness of the selected method in regards to protection of public health and the environment is not possible based on the available data. No RAOs for soil or groundwater have been approved for OU-1. UPC has prepared/submitted a soil workplan (B&McD, 2005) and the joint groundwater RAP (T&R and B&McD, 2005); these documents have not been approved by DTSC as previously discussed in Section 3.

Public Health

For protection of public health the following documents listed below were reviewed and subsequent areas of concern were identified. In the section below general findings are followed by specific findings relevant to the reviewed documents.

General

- Site documents characterizing site soil impacts, proposed remedial actions, and risk assessment studies were either not made available (Soil Conditions Report) or are incomplete so no comprehensive evaluation can be made at this point in time.

- UPC's Soil Workplan (2005) was determined to be incomplete by the DTSC and will be revised. An important aspect of this Soil Workplan is to address the site soil, groundwater, and vapor phase COPC using a uniform approach. The existing human health risk assessment only evaluated health risks associated with dissolved and vapor phase media in VOC contaminated groundwater (T&R and B&McD, 2005). This evaluation did not consider potential health impacts associated with impacted site soils. Once the soil and groundwater remedial

approaches are approved, UPC plans to submit an integrated RAP that will address soil, groundwater and vapor phase contaminants.

- To minimize or eliminate risk associated with contaminated site soils and groundwater, non-specific engineering and institutional controls are proposed to interrupt exposure pathways.

Specific

- Burns & McDonnell and Treadwell & Rollo, 2003b. Final Human Health Risk Assessment of Joint Groundwater Operable Unit (OU-1), March 2003.

    - **Data Evaluation –**Questionable methods for screening out COPCs are used. For example, soil analytical results from artificial fill at the Presidio were used as background for screening metals in site groundwater. The cited report was updated in 2002, the assumptions used in Burns & McDonnell and Treadwell & Rollo (2003b) should be validated with the most recent Presidio report (EKI, 2002). In addition, the quality of the data, such as reporting limits, data representativeness, potential hot spots, and frequency of detection, were not adequately described.

    - **Toxicity Assessment –** Readily available toxicity values from EPA/OEHHA were not included for all COPCs (e.g., lead and nickel).

    - **Exposure Assessment –** Not all of the potential exposure pathways for the identified receptors are evaluated (e.g., construction worker incidental ingestion of groundwater). Some of the exposure parameters used in the calculations differ from the recommended values by USEPA (inhalation rate for a child age 1-6, building air exchange rates). The calculation of the exposure concentration makes a faulty assumption (i.e., it was assumed that all environmental data are log normally distributed). The division of data into exposure units (uppermost groundwater and comprehensive dataset) is not adequately described and may not be warranted for the evaluated exposure pathways.

    - **Risk Characterization –** Risks resulting from exposure to lead were not adequately characterized. Risk characterization in the document did not identify risk drivers and indicate significance of risk (i.e., whether calculated risks and hazards are acceptable).

    - **Uncertainties –** The uncertainties section is incomplete and provides illogical conclusions based on irrelevant information. Several examples of inconsistencies with the uncertainty analysis are provided below.

        - The assessment includes statements regarding TCE being a carcinogen but does not provide a similar discussion on PCE. The

report then later concludes that PCE is not a carcinogen and then goes on to state that the risk is likely overestimated. This conclusion is not supported by the evidence presented and an overestimation or underestimation of risk is not evident.

- The inhalation assessment compares calculated outdoor and indoor vapor concentrations to mean ambient air measurements from BAAQMD. This comparison does not appear to be relevant or to add any information to this evaluation. In addition, ambient air concentrations are subject to higher rates of dilution from wind than indoor air concentrations where the air is contained.

Ecological Risk
Ecological risk has not been evaluated for OU-1 as ecological risk assessment (screening level or otherwise) documents evaluating ecological risk have not been identified. Therefore, no assessment of ecologic risk can be made at this time.

In concept, UPC's proposed remedial approach consisting of capping the site and placement of a vapor barrier beneath building foundations coupled with implementation of engineering and institutional controls (UPC, 2003a) addresses health risks associated with inhalation (vapor). This approach does not sufficiently address risk associated with incidental and dermal contact within VOC impacted groundwater. Engineering and institutional controls will be required to appropriately mitigate potential health risks (inhalation, ingestion and dermal pathways) associated with impacted site soils.

4.1.3 OU-2

As part of assessing the adequacy of environmental characterization of OU-2, the Peer Review has considered the following issues:

- Soil
- Groundwater
- Surface Water
- Soil Vapor

Adequacy of Environmental Characterization

Soil and Groundwater
As the soil and groundwater impacts and characterization are closely linked to one another on OU-2, these topics will be addressed together. On the basis of chemical constituent, contaminated media (soil and/or groundwater), OU-2 has been divided into three areas: the Oil Tank Area, South Disposal Area, and the north-south drainage channel (B&McD, 1999b). The primary soil and groundwater contaminants include TPH as Bunker C fuel oil, heavy metals, and VOCs. The general distribution of soil contaminants as identified for OU-2 is illustrated on Figure 4, Generalized Site

Contaminants for OU-1 and OU-2. For soil and groundwater, COPCs include TPH as Bunker C fuel oil, metals (copper and lead), and VOCs (B&McD, 2003). A localized area between the former turntable and oil tank areas contains VOC contamination in the soil and groundwater (B&McD, 2002b). Not shown on Figure 4 are the locations and distribution of VOC impacted soil and groundwater.

Groundwater beneath the site is impacted with VOCs, TPH and metals (B&McD, 2003a). Currently, the site is monitored on semiannual basis and no groundwater extraction and treatment system is present. VC and cis-1,2 DCE are the biodegradation products of PCE and TCE. As such, augmenting the highly impacted areas using in-situ bioremediation techniques may significantly reduce groundwater hot-spot concentrations, resulting in a long-term project benefit. B&McD's (2002b) study did not measure degradation products for VC, ethene and ethane. Based on the high levels of VC present, it is likely that complete dechlorination to ethene/ethane may be occurring, but a second study should be considered to confirm this process and evaluate possible limitations in the rate of dechlorination.

Based on the Peer Review data, soil and groundwater impacts at OU-2 are adequately characterized. To assess plume stability of Bunker-C impacted groundwater, Burns & McDonnell (1998c) reviewed and evaluated groundwater concentrations during a three year period from 1995 to 1998. This study was intended to verify that the concentration and extent of Bunker-C in groundwater is relatively unchanged. The results of this evaluation indicate that the existing groundwater contamination plume is stable. Contrary to the findings presented by Burns & McDonnell (1998c), natural attenuation and biodegradation of Bunker-C in groundwater does not appear to be occurring at any appreciable rate.

Surface Water

Based on review of the available data, soil and groundwater within proximity of the north-south drainage is impacted with VOCs and TPH. The site data indicates that this area is adequately characterized.

Soil Vapor

No known soil vapor studies have been conducted for OU-2. A relatively small area of VOC impacted soil has been identified between the former turntable and oil tank areas (B&McD, 2002b). The VOC plume is of limited size and it may be more cost-effective to reduce the VOC concentrations than to block the vapor exposure pathway by installing a vapor barrier.

Appropriateness of Remedial Action

Soil and shallow groundwater within the A-zone water bearing units contains concentrations of TPH as Bunker C, metals (lead) and VOCs (TCE). All of these constituents were identified as COPC and were evaluated in various human-health and ecological risk assessments (B&McD, 1998 and 2004).

The assessment modeled health risk associated with commercial maintenance workers, golf course groundskeepers, construction worker, utility workers, and residents (B&McD, 1999). The Interim Remedial Measures Workplan (B&McD, 2004), proposes to place a 7 to 10–foot thick soil to eliminate or reduce potential risk associated with these COPCs. With the exception of areas underlain by VOC contamination or excavation in areas that penetrate the soil cap that contain soil contaminant concentrations that exceed the approved RAOs this approach is effective. For these instances, a series of engineering and institutional controls are proposed in the Soil Management Plan and appended Interim Residual Risk Management Plan (B&McD, 2004a). The Revised Remedial Action Plan, (B&McD, 2002) proposes to address soil and groundwater VOC concerns on a site-specific basis as the development plan advances.

Current remedial approach for areas underlain by VOC contaminated soil and groundwater does not adequately reduce risk associated with the inhalation pathway for all potential receptors.

Surface Water
The proposed remedial action includes remediation of the existing north-south, excavation and removal of soils that exceed approved RAOs, backfilling the ditch and regrading the area to prevent ponding of water, and constructing an interim drainage system until the final development and site grading is conducted. This approach has been approved by the RWQCB and adequately addresses potential human health and ecological impacts.

Soil Vapor
No remedial action was identified for the migration of VOC vapors from soils and groundwater.

Protection of Public Health and Environment

In 1999, The RWQCB conditionally approved UPCs proposed RAOs for OU-2. This conditional approval was issued with the caveat that updated or revised RAOs would be submitted by UPC for RWQCB approval when the development plan finalized. As the development plan is not final and the related RAOs have not been updated, a definitive evaluation of the remedial action and appropriateness of the selected method in regards to protection of public health and the environment is not possible at this time.

It is important to reiterate that final human health and ecological risk assessments will be prepared when the development plan is completed. The results of these assessments will be incorporated into the forthcoming RWQCB site cleanup order and City-required development approach.

Public Health

The key aspect for reducing and eliminating human-health and ecological risk at OU-2 relies on leaving all site soils in-place, capping the entire site with 7 to 10 feet of clean soil, and closure of the north-south drainage ditch. The exception to this approach is the removal of 1,200 cubic yards of VOC-impacted soils located southeast of the roundhouse. With these three key aspects in place, most associated human health and ecological risks are significantly reduced or eliminated for COPCs Bunker C and metals in soil and groundwater, refer to Figure 11, Proposed Remedial Action for OU-2. UPC's basis for this approach is due to the substantially greater extent of contamination than previously estimated, the inherent physical characteristics of Bunker C prevent mobilization and migration, low water solubility, the dissolved phase groundwater plume is stable, and lastly the metals within the saturated soils are relatively insoluble and do not leach into groundwater (B&MCD, 2004a). To monitor long-term groundwater quality and related ecologic impacts, the interim RAP includes a long-term groundwater monitoring program.

As part of developing the Interim Remedial Action Work Plan (B&McD, 2004a), a Soil Management Plan (SMP) was developed that presents the general process for handling, managing, tracking, and treatment/reuse and disposal procedures for site impacted soils. This SMP presents the framework for future site-specific SMPs and will be modified when the development plan is completed.

For protection of public health the following documents listed below were reviewed and subsequent areas of concern were identified. In the section below general findings are followed by specific findings relevant to the reviewed documents.

<u>General</u>

- Site documents characterizing site soil impacts, proposed interim remedial actions, and risk assessment studies were conditionally approved by the RWQCB (1999) with the stipulation that final risk assessments will be conducted once the development plan is prepared. The currently approved interim remedial actions are consistent with industry standards and the final remedial action plan will be prepared once the development plan is finalized.

- In concept, UPC's proposed remedial approach consisting of capping the site and placement of a vapor barrier beneath building foundations coupled with implementation of engineering and institutional controls (UPC, 2003a) sufficiently addresses health risks associated with inhalation (vapor), with the exception of incidental contact with groundwater, and dermal contact within VOC impacted groundwater. Engineering and institutional controls will be required to appropriately mitigate potential health risks (inhalation, ingestion and dermal pathways) associated with impacted site soils and groundwater.

Specific

- Burns & McDonnell, Investigation Report Chlorinated Solvents, South Area, Former Bayshore Railyard, Brisbane, California, May 2002

  - The report concludes that concentrations may pose a risk to human health and the environment. Only ecological cleanup values are provided in the report for comparison. No human health criteria are presented in the report to support this conclusion. It is unclear if Burns & McDonnell is relying on the results presented in their February 2002 (2002a) evaluation.

- Burns & McDonnell, Revised Remedial Action Plan Southern Area of the Former Bayshore Railyard Site, Brisbane, California, dated February 2002.

  - Risk issues discussed in this document are adequately addressed. This analysis also acknowledges that groundwater will not be used for any purpose and that human health RAOs will need to be developed. These issues will be addressed in the final remedial action plan when the development plan is completed (B&McD, 2004).

- Levine-Fricke, Appendix G, Public Health and Environmental Evaluation, Supplemental Remedial Investigation Data Study Report, The Bayshore Railyard, Brisbane, California, December 3, 1990.

  - **Data Evaluation –** Data evaluation excluded data prior to 1990 stating that these "Level 1 or Level 2 type data [are] appropriate for site characterization and engineering design only." This assumption should be revisited if the soils analyzed remain in-place and the appropriateness of this data should be addressed in the uncertainty analysis. The data evaluation is unusual in that regulatory criteria and regional background concentrations were used to screen out COPCs. This practice is generally not accepted by regulatory agencies.

  - **Toxicity Assessment –** Substitution, or surrogation, of certain chemicals was used to minimize the list of compounds in the calculations. This practice results in additional uncertainties that could have been avoided by treating the compounds separately. Generally, this approach is typically applied to evaluation of PAHs as benzo(a)pyrene equivalents. The toxicity of TPH (Bunker C) was also not evaluated. Recent guidance, such as TPH Working Group ([TPHWG] 1997a, 1997b, 1998a, 1998b, and 1999) and Massachusetts Department of Environmental Protection ([MDEP] 2002a, 2002b, and 2003) documents the evaluation of PAHs and should be considered in the final evaluations.

  - **Exposure Assessment –** Inhalation of indoor air and a construction worker scenario was not assessed. Some exposure parameters are not consistent with current standards.

Ecological Risk

The Levine-Fricke Assessment (1990) states that a qualitative approach was used for the ecological assessment since "there are little data regarding ecological toxicity and site specific concentrations in ecological media for the chemicals of potential concern." As this report was written in 1990, new guidance regarding ecological toxicity, such as *Ecological Risk Assessment Guidance for Superfund* (USEPA 1997) and the *Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities* (CalEPA 1996), have since been released.

In addition, Burns & McDonnell's (2002b) subsequent evaluation used provisional ecological protection cleanup values for the San Francisco International Airport (SFIA). While these standards are commonly applied along the Bay margin, the discussion does not clearly state the precedence for this approach and confirm that the SFIA provisional values are suitable for this site. Ecological risk should be revisited in light of more recent guidance and available studies regarding ecological toxicity.

Section 5

Recommendations

Section 5
Recommendations

The recommendations presented herein are based on the interpretation of the City-provided Baylands documents, comparison of the data to the project-defined evaluation criteria and the findings presented in Section 4 of this report. The recommendations presented in this section may be modified upon the receipt and review of additional documents.

The information presented in this section is organized in two ways 1) general comments applicable to the entire Baylands development area, and 2) on a project subarea basis. In each section a series of recommended next steps and additional analysis needed to comply with the General Plan and regulatory requirements, if needed, is provided to assist the City in their planning process.

5.1 General

In light of the subsurface conditions, which include placement of undocumented fill and underlying compressible soils, the City should consider the potential long-term financial liabilities related to infrastructure operations and maintenance.

Financial Assurance

Development on each of the individual subareas, in particular the Brisbane Landfill, carries with it a significant degree of uncertainty with respect to maintenance of future conditions and resultant potential financial liabilities. It is important that some financial mechanism exists to ensure a secure long-term funding source to provide necessary maintenance or emergency response resulting from existing hazardous conditions. As an example, it is likely that maintenance of "public" facilities constructed on the Brisbane Landfill, as well as other areas within the Baylands Development, will require a greater level of expenditure than would typically be required for a municipal roadway or underground utility. Provisions should be put in place to assure that the developer is able to fully fund these and other long-term facility maintenance activities within the Baylands Development.

Comprehensive Conceptual Site Model and Integrated Development-Based Remedial Action Plan

Historically, the environmental characterization and evaluation of the Baylands Development subareas sites has been conducted using an independent site-by-site approach. This approach is largely attributed to the following factors: past multiple landowners and operators, overlapping regulatory oversight responsibilities involving multiple regulatory agencies and intra-department jurisdiction, and the lack of a clear development proposal for the Baylands. With the consolidation of the Baylands ownership by UPC and their recent submission of the Phase I Specific Plan, it is now appropriate to consider the Baylands as a single contiguous project.

This approach will enable the City to evaluate the project development plans and applications using a uniform set of evaluation criteria for each Baylands' subarea. Consistent with this concept, it is in the City's best interest to require UPC to develop a comprehensive approach to managing site contamination to be protective of human and ecological receptors. In concept, UPC's overall approach to managing human potential exposure pathways is through various remedial actions and implementation of engineering and/or institutional controls. This approach is consistent with industry practice but lacks the necessary specificity with regard to an integrated and comprehensive approach that addresses soil and groundwater impacts with respect to human health and ecological risk. In addition, based on the documents reviewed, the remedial measures presented may not adequately address all human health and ecological exposure pathways (e.g., stormwater or groundwater) and additional consideration of these potential risks are warranted.

The benefit of developing an integrated approach is that the identified COPC and risk-based remedial action objectives (RAOs), including the proposed array of engineering and institutional controls, will be captured into a single Baylands development-focused document. For the purpose of this discussion, the plan is essentially a Baylands Remedial Action Plan with a focus on the proposed development and uniformity within subarea parcels. The intent of this plan is not to solicit regulatory agency review/concurrence as this effort would be redundant. The plan would focus on three separate but related areas: 1) determine that proposed remedial action does not expand or increase contamination within a subarea, 2) verify that development-focused objectives are achieved, and 3) ensure that remedial actions are consistent with and appropriate for the development area and subarea parcels. On a conceptual basis, the plan would be developed earlier in the project approval process, possibly in parallel with the EIR, and would be integrated into the City project approval process.

Key elements of this plan could include the follow:

- Overview of Proposed Development.
- Proposed Development Concept for each subarea.
- Historic Land Use, Nature of Contamination.
- Completed Remedial Actions.
- Regulatory Status.
- Characterization and distribution of identified residual contaminants by matrix (e.g., soil, groundwater,, vapor, surface water).
- Summary of Analytical Data with Trend Plots.

- Geologic cross sections illustrating geologic and hydrogeologic conditions, cross sections may also include relevant site data including monitoring and extraction well locations with recent analytical results.

- Site maps and figures showing the horizontal extent of contamination, contaminant concentrations, groundwater gradient, location of suspected source areas.

- Estimated volume of impacted matrix by contaminant and media.

- Groundwater monitoring and treatment system information as appropriate.

- Develop conceptual site model for human and ecological risk evaluation that presents contaminated media, migration pathways, contact media, exposure routes, and potential receptors with remedial strategies to eliminate or reduce identified risk to "*acceptable*" levels based on the approved final development plan.

The ultimate format of this document should be flexible and updated periodically as relevant additional information is acquired and the development plan advances; the comprehensive development-based RAP and conceptual site model will serve many benefits for the City. A partial listing of these benefits includes the following:

- Demonstrate to the local community and general public that the City is acting proactively to address community concerns related to potential human health and ecological risks associated with contamination at the Baylands.

- Provides a means to evaluate the three subareas as one single project using uniform evaluation criteria. This is especially significant for each subarea as final development plans and remedial actions are approved by the respective regulatory agencies.

- Simplify the City review during evaluation of the Final Specific Plan and future permitting as the individual parcels, or planning areas, are built out.

At the end of this section, Table 1, Summary of Anticipated Future Studies and Program Sequencing, presents in matrix format the primary anticipated future studies and project sequencing based on the categories defined below.

- Supplemental Data Review
- Prior to/concurrent with CEQA
- Required by CEQA
- Development Plan
- Post-development Plans

This table presents a summary of general and subarea environmental studies and evaluations that are anticipated for development. This listing is intended to provide

the City and public with a path forward view of the Baylands development sequencing based on the Peer Review findings.

Table 1
Summary of Anticipated Future Studies and Program Sequencing
Environmental Engineering Peer Review, Baylands Remediation Efforts

Baylands Development Area	*Study*	*Program Sequence*				
		Supplemental Data Review	*Prior to / concurrent with CEQA*	*Required by CEQA*	*Development Plan*	*Post-Development Plan*
General	**Financial Assurance**		✓			
	Development-Based Remedial Action Plan		✓			
Landfill	**Risk Assessment**					
	• **Human Health**		✓			
	• **Ecological**		✓			
	• **Residual Risk & Monitoring Plan**		✓			
	• **Monitoring**					✓
	Surface Settlement Evaluation					
	• Settlement Study		✓			
	• Settlement Monuments		✓			
	Final Cover Design/Construction					
	• Landfill Cover				✓	
	• Landfill Cover Inspections					✓
	Landfill Gas					
	• Vapor Barrier				✓	
	• Methane Monitoring				✓	
	• Landfill Gas Monitoring					✓
	• Explosion-Proof Construction				✓	
	Groundwater					
	• Monitoring Plan				✓	
	• Post Closure Monitoring					✓

Table 1
Summary of Anticipated Future Studies and Program Sequencing
Environmental Engineering Peer Review, Baylands Remediation Efforts

Baylands Development Area	***Study***	***Program Sequence***				
		Supplemental Data Review	***Prior to / concurrent with CEQA***	***Required by CEQA***	***Development Plan***	***Post-Development Plan***
OU-1	**Risk Assessment**					
	• Human Health		✓			
	• Ecological		✓			
	• Residual Risk & Monitoring Plan		✓			
	• Monitoring					✓
	Soil					
	• Soil Condition Report	✓				
	• Revised Soil Workplan	✓				
	Groundwater					
	• Current Groundwater Monitoring/Ops Documents	✓				
	• Sunnydale Sewer Monitoring Plan				✓	
	• In-situ Treatment Evaluation				✓	
	• Upgradient VOC Source Evaluation				✓	
	• Monitoring Well Construction Evaluation				✓	
	• Revised Groundwater Remedial Action Plan	✓				
	• A-Sand Extraction Well Effectiveness				✓	
OU-2	**Risk Assessment**					
	• Human Health		✓			
	• Ecological		✓			
	• Residual Risk & Monitoring Plan		✓			
	• Monitoring					✓
	Soil					
	• Soil Removal & Drainage Closure Report	✓				
	• Final Soil Management and Residual Risk Management Plan				✓	
	Groundwater					
	• Feasibility Analysis In-situ Bioremediation Treatment				✓	
	• Post Well Abandonment/Replacement plan				✓	
	Other					
	• Brick-Line Arch Sewer Evaluation		✓		✓	
	• Soil Cap Settlement Evaluation		✓		✓	

5.2 Subarea Specific Recommendations

The subarea specific recommendations listed below were developed to further the understanding of the site characterization, assess impacts to human-health and the environmental risks, develop remedial action measures, verify regulatory compliance, and assure protection of public health and the environment.

5.2.1 Brisbane Landfill

Provided below are recommendations for further action at the Brisbane Landfill. A number of the recommendations are consistent with information presented in the Closure and Post Closure Maintenance Plan (Burns & McDonnell, 2002a). However, further explanation and clarification is provided as a way of highlighting the benefits of completing this work in the near-term.

Human Health and Ecological Risk Assessment

- Provide and/or develop a site conceptual model to assess human health and ecological risk including residual risk and monitoring program.

- Prepare update to final human health and ecological risk assessment based on development plan.

Landfill Surface Settlement Evaluation

- **Settlement Studies –** Over time, landfill waste prisms typically undergo some degree of differential settlement. For the Brisbane Landfill, the magnitude of differential settlement will be compounded by consolidation of the underlying Bay Mud sediments. CDM recommends developing and implementing a full-scale field load test program to evaluate long-term settlement potential prior to initiating design of structures on the landfill.

- **Settlement Monuments –** CDM recommends installation of permanent settlement monuments to monitor differential settlement within and adjacent to the landfill footprint.

Final Cover Design and Construction

- **Landfill Cover –** The design and installation of the landfill final cover should be as a single, integrated unit over the entire landfill surface, rather than in individual parcels as development proceeds.

  A number of ongoing issues at the Brisbane Landfill are tied to the presence of liquid within the waste prism. The shallow groundwater lies almost entirely within the landfill refuse and represents a significant source of leachate with the potential for downgradient transport and discharge to the Brisbane Lagoon and the San Francisco Bay. Although it is not entirely clear what the source of this water is, there are indications that surface water infiltration is a major component. For example, mounding in the north central portion of the landfill suggests that

water infiltration continues to occur (see figures 3 and 5 from GeoSyntec, 2004). Installation of the final cover will prevent surface water infiltration and will contribute to minimizing leachate seeps at locations along the earthen dike between the southern end of the landfill and Brisbane Lagoon and seeps into the Central Drainage Channel.

- **Landfill Cover Inspections** –Periodic inspections of the integrity of the landfill cover as part of the ongoing monitoring and maintenance program.

Landfill Gas

- **Vapor Barriers** – Development plans should include sub-slab vapor barriers to mitigate the potential for vapor intrusion into commercial buildings .

- **Methane Monitoring** – Structures built on or near the landfill footprint should be equipped with methane monitoring devices.

- **Landfill Gas Monitoring** – As part of the ongoing monitoring and maintenance program, it is important to re-initiate perimeter monitoring and surface emission monitoring in areas where appropriate, which may include border areas with OU-1 and OU-2. Additionally, it would be useful to evaluate the presence of landfill gas in structures on or adjacent to the landfill.

- **Explosion Proof Construction** – CDM recommends that underground utilities be constructed using intrinsically safe and/or explosion-proof (e.g., NEMA 7) equipment.

- **Groundwater Monitoring** – Provide additional information that supports the reduction in the number of monitoring wells proposed in the post-closure monitoring program.

5.2.2 Operable Unit 1

The OU-1 recommendations provided below are based on the Peer Review findings.

Human Health and Ecological Risk Assessment

- Provide and/or develop a site conceptual model to assess human health and ecological risk including residual risk and monitoring program.

- Prepare update to final human health and ecological risk assessment based on development plan.

Soil

- Provide interim and final project documents that characterize extent and type of soil contamination and remedial approach.

Groundwater

- Incorporate management and monitoring plan to monitor potential infiltration of VOC-impacted water into Sunnydale Sewer.
- Evaluate short and long-term benefits of in-situ treatment of impacted groundwater to reduce VOC groundwater concentrations. The benefit of in-situ treatment includes source reduction and beneficial augmentation of the final remedy.
- Evaluate presence of offsite upgradient VOC contaminant source, if any, and address impacts to groundwater quality and treatment system.
- Evaluate existing monitoring well completions that are possibly screened across A-sand and B-sand that may serve as a conduit for contaminant migration. Identify potential wells and abandon/remove from service.
- Provide most recent groundwater monitoring and operation report.
- Provide additional information on potential offsite upgradient VOC sources or clarify presence of residual DNAPL in soil/groundwater.
- Evaluate potential effectiveness of increased A-Sand groundwater extraction well locations as a means to control detected B-Sand VOC contamination.

Other

- Evaluate the rate and magnitude of settlement and related potential development constraints associated with the planned placement of the soil cap across the site.

5.2.3 Operable Unit 2

The OU-2 specific recommendations listed below are based on the Peer Review findings.

Human Health and Ecological Risk Assessment

- Provide and/or develop a site conceptual model to assess human health and ecological risk including residual risk and monitoring program.
- Prepare update to final human health and ecological risk assessment based on the development plan.

Soil

- Revise and update the Soil Management Plan and interim Residual Risk Management Plan based on the final development plan.
- Provide results, if available, from VOC removal action and north-south drainage ditch closure.

Groundwater

- Evaluate the feasibility of in-situ treatment technologies to reduce and control the Bunker C and VOC groundwater contaminant plume and vapor migration into the vadose zone soils. The benefit of in-situ treatment includes source reduction and beneficial augmentation of the final remedy.

- Evaluate the potential for existing groundwater monitoring wells to provide a mechanism for cross-contamination between the A-soil and B-soil aquifers.

Other

- Conduct assessment of brick-lined arch sewer to evaluate structural integrity, determine if the proposed tie-in is feasible, and develop post-connection sewer monitoring plan.

- Evaluate the rate and magnitude of settlement and related potential development constraints associated with the planned placement of the soil cap across the site.

5.3 Recommended Next Steps

The recommended next steps listed below provide a listing of recommended activities that the City may adopt to improve their confidence and understanding of the Baylands and associated development, including potential human health and ecological risk issues.

- Develop an integrated conceptual site model that incorporates all identified COPC, pathways, and ecological and human health risk elements, and further develop appropriate remedial actions including engineering and institutional site controls, and assess cumulative project impacts for the proposed development.

- Meet with DTSC, RWQCB, and County personnel, as determined by the City, to determine regulatory status of the project subareas. This step will be beneficial as the landfill and OU-2 oversight activities have been consolidated to a single RWQCB contact. This step is especially important for addressing site cleanup requirements for OU-2, as the RQWCB has indicated that a site cleanup order will be adopted following City approval of the Site Development Plan and other environmental planning documents.

- Review Development Plan on a site by site basis to confirm that remedial measures are consistent with site remedial action objectives, conform with project controls, and the proposed development-based remedial action plan.

Section 6

References

Section 6
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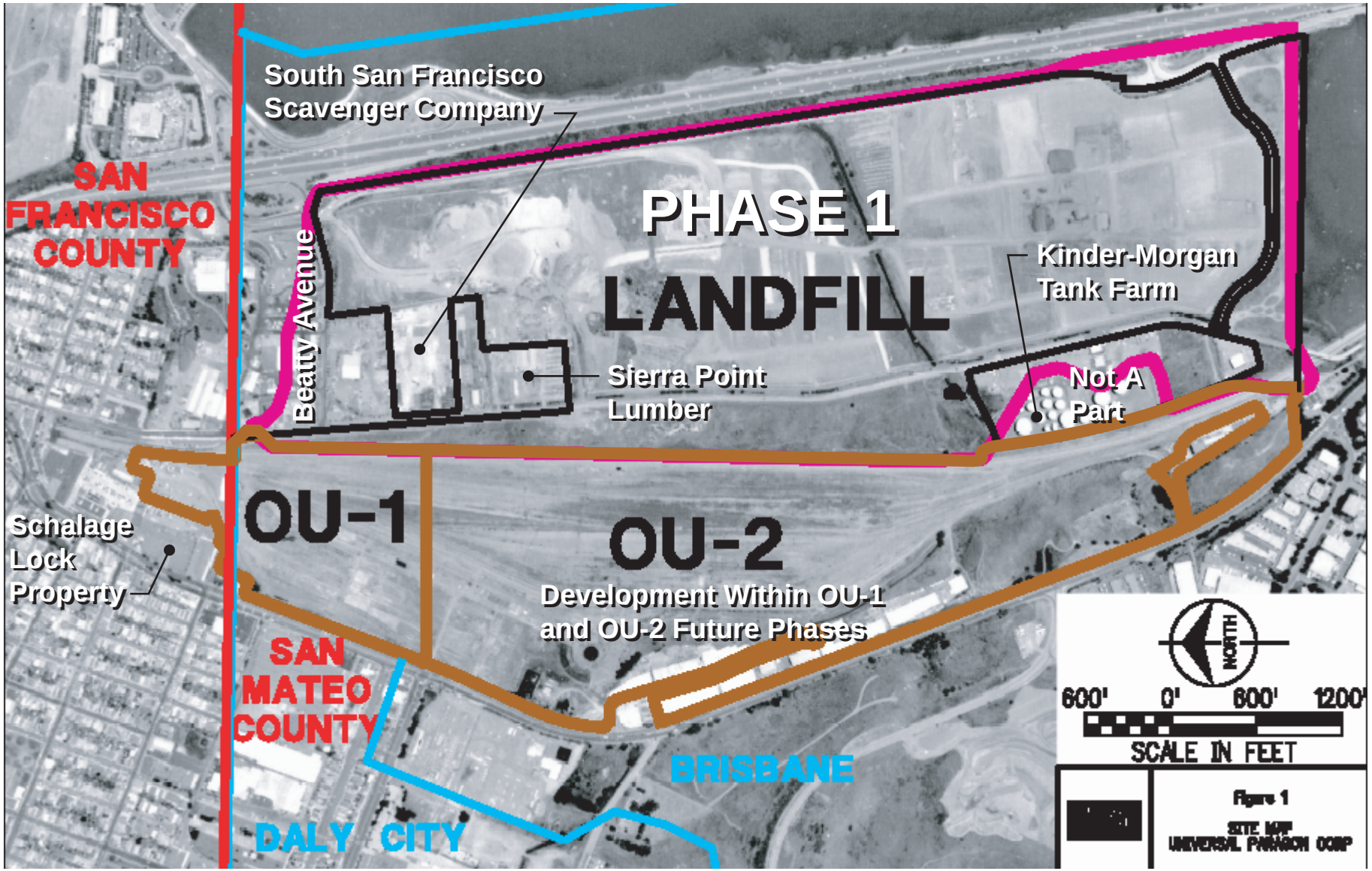


Figure 1
Site Map
Environmental Engineering Peer Reviews
Baylands Remediation Efforts
City of Brisbane

CDM

Modified from Workshop Presentation to the City of Brisbane, Brisbane Baylands, Subsurface Environmental Conditions by Universal Paragon Corporation and Burns & McDonnell Engineering Company, Inc., November 18, 2003.

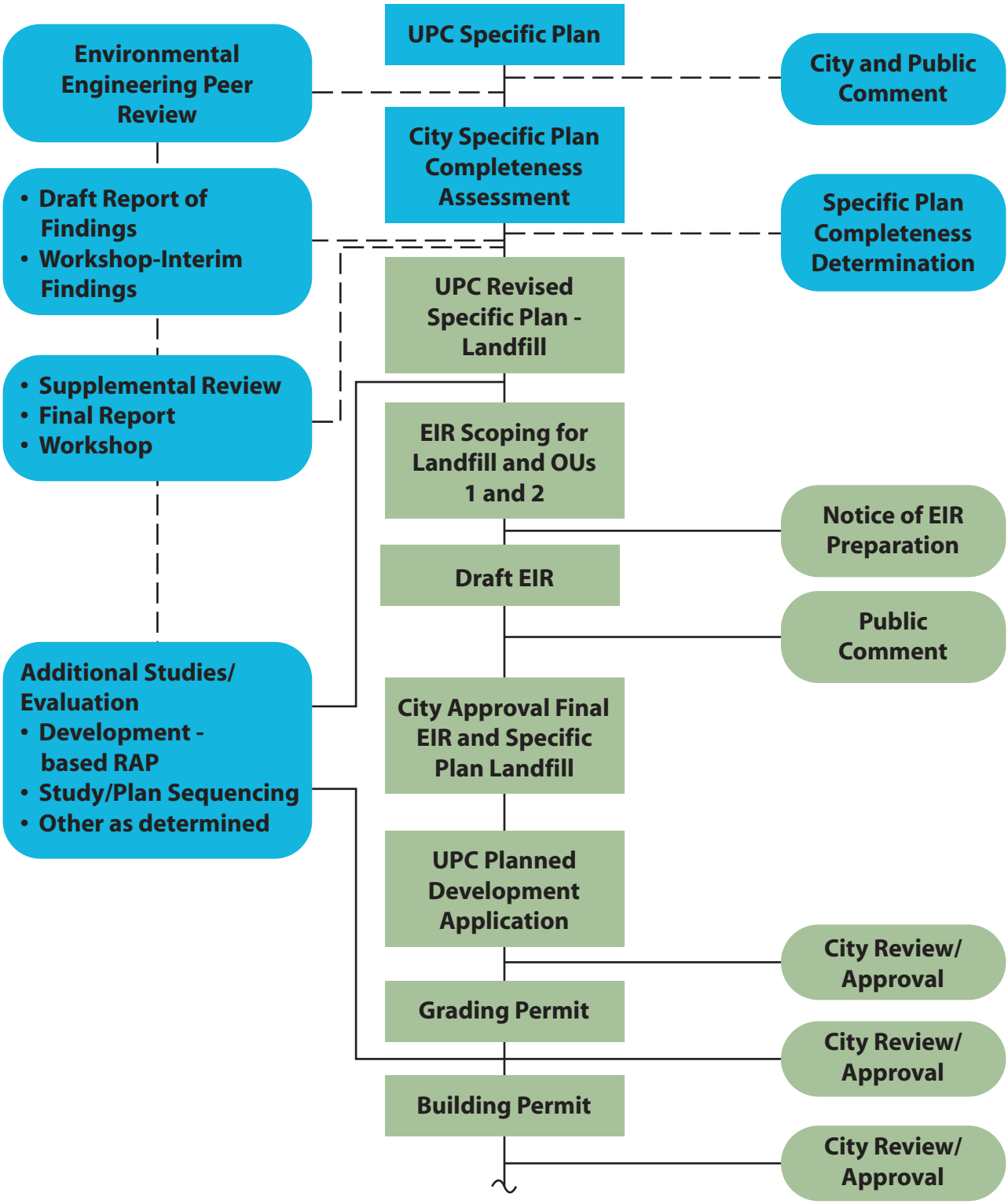


Figure 2
Phase I Baylands Planning Process
Environmental Engineering Peer Review
Baylands Remediation Effort
City of Brisbane, California

CDM

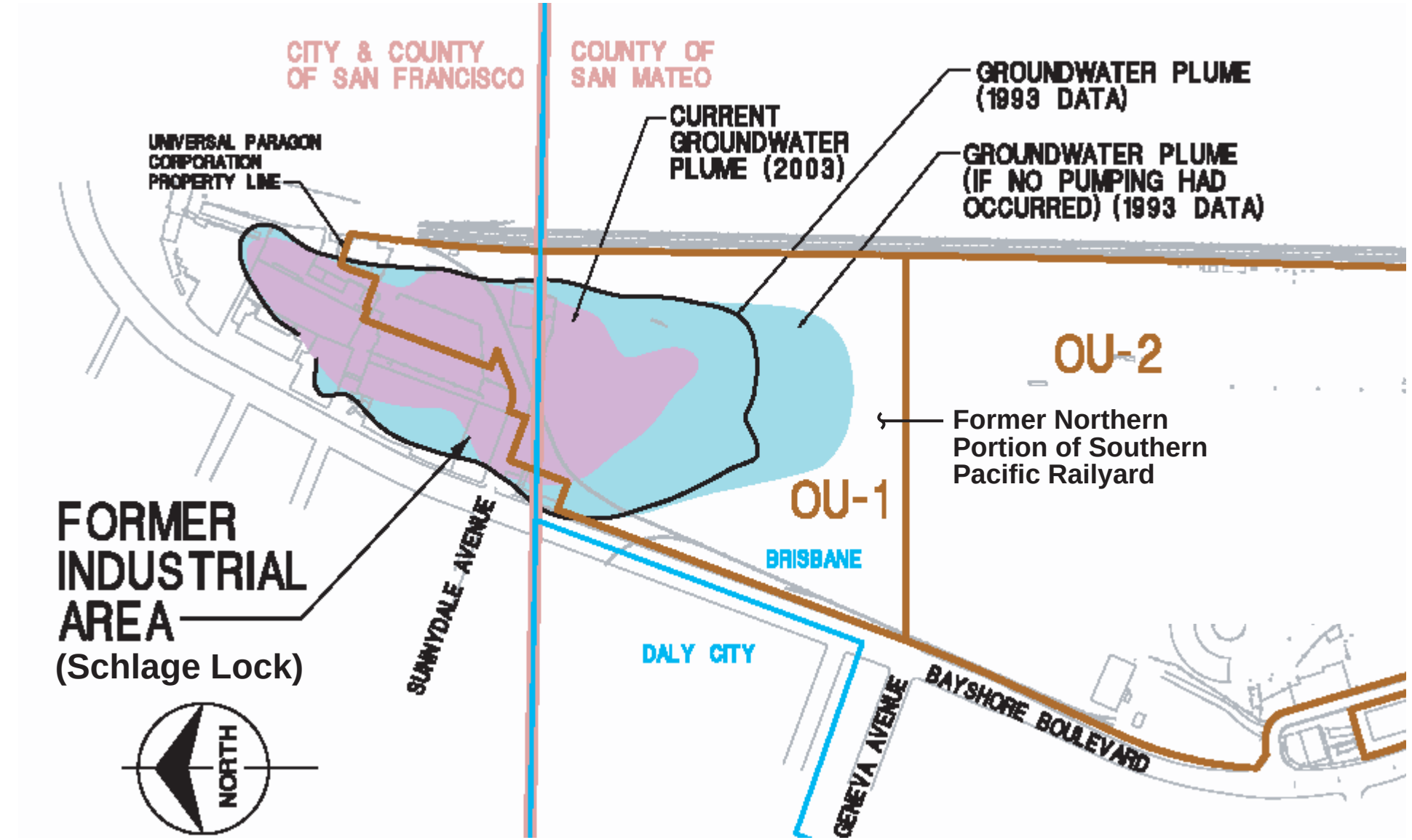


Figure 3
Site Map - OU-1
Environmental Engineering Peer Review
Baylands Remediation Effort
City of Brisbane

CDM

Modified from Workshop Presentation to the City of Brisbane, Brisbane Baylands, Subsurface Environmental Conditions by Universal Paragon Corporation and Burns & McDonnell Engineering Company, Inc., November 18, 2003.

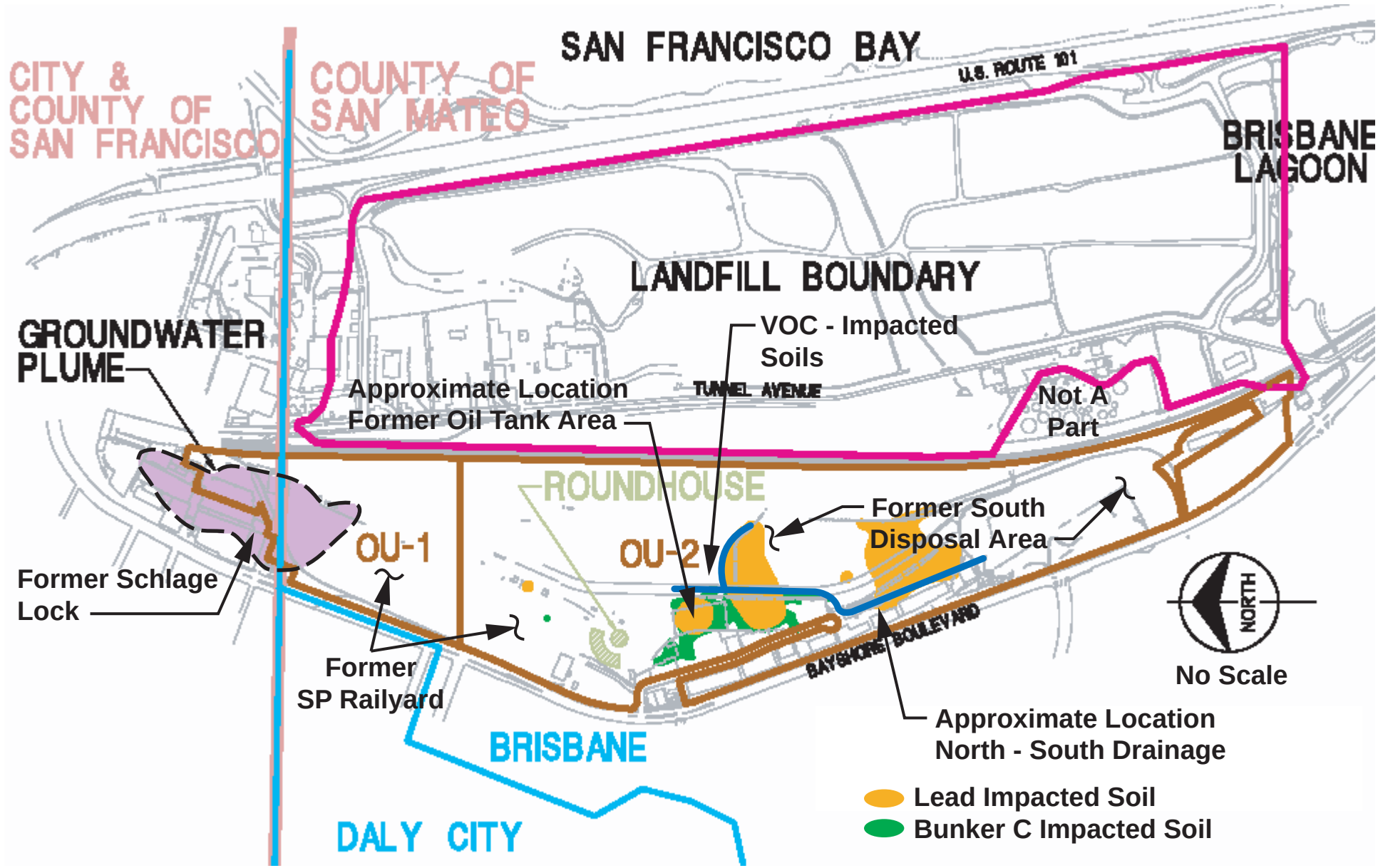


Figure 4
Generalized Site Contaminants for OU-1 and OU-2
Environmental Engineering Peer Review
Baylands Remediation Efforts
City of Brisbane

CDM

Modified from Workshop Presentation to the City of Brisbane, Brisbane Baylands, Subsurface Environmental Conditions by Universal Paragon Corporation and Burns & McDonnell Engineering Company, Inc., November 18, 2003.

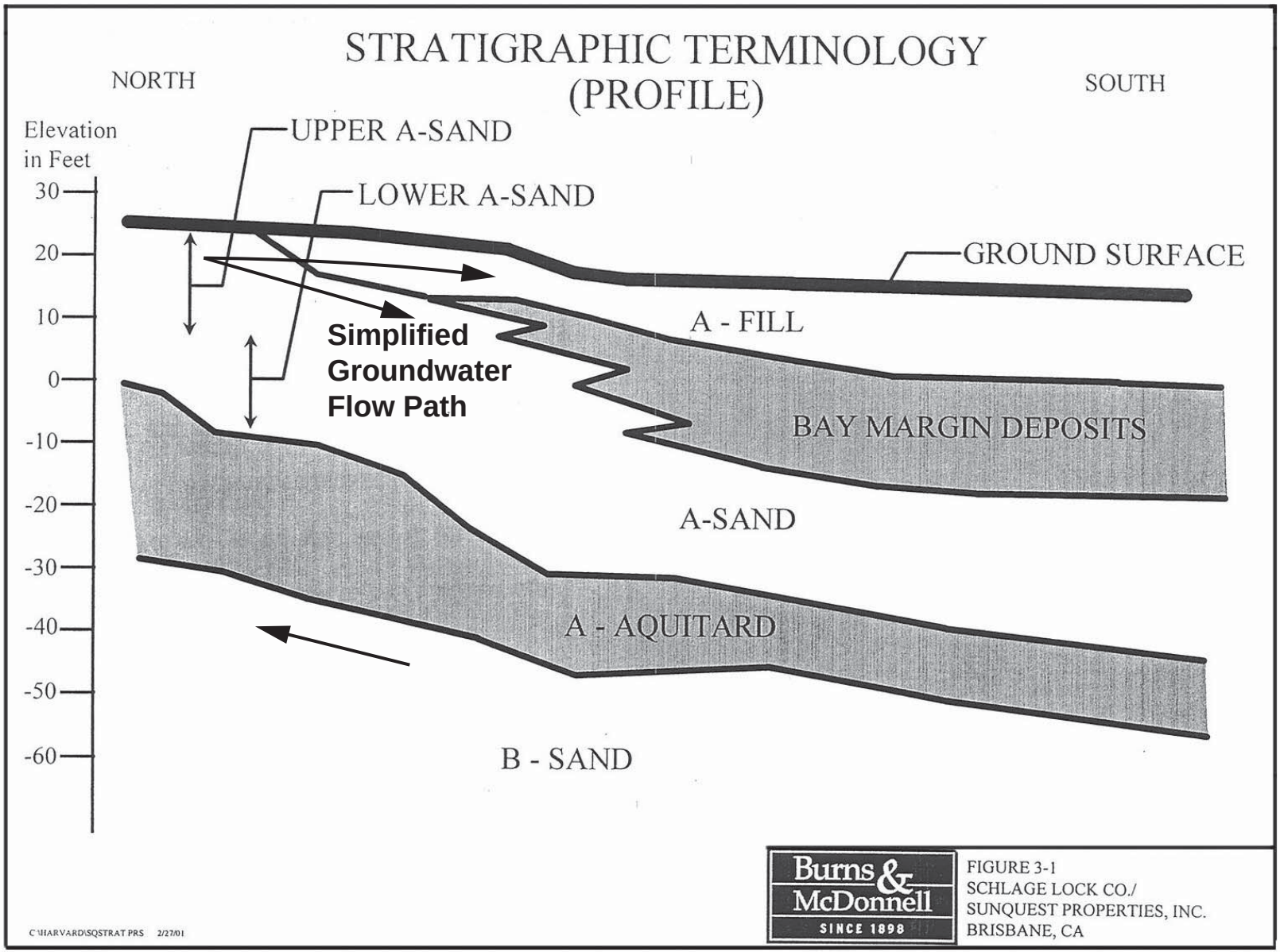
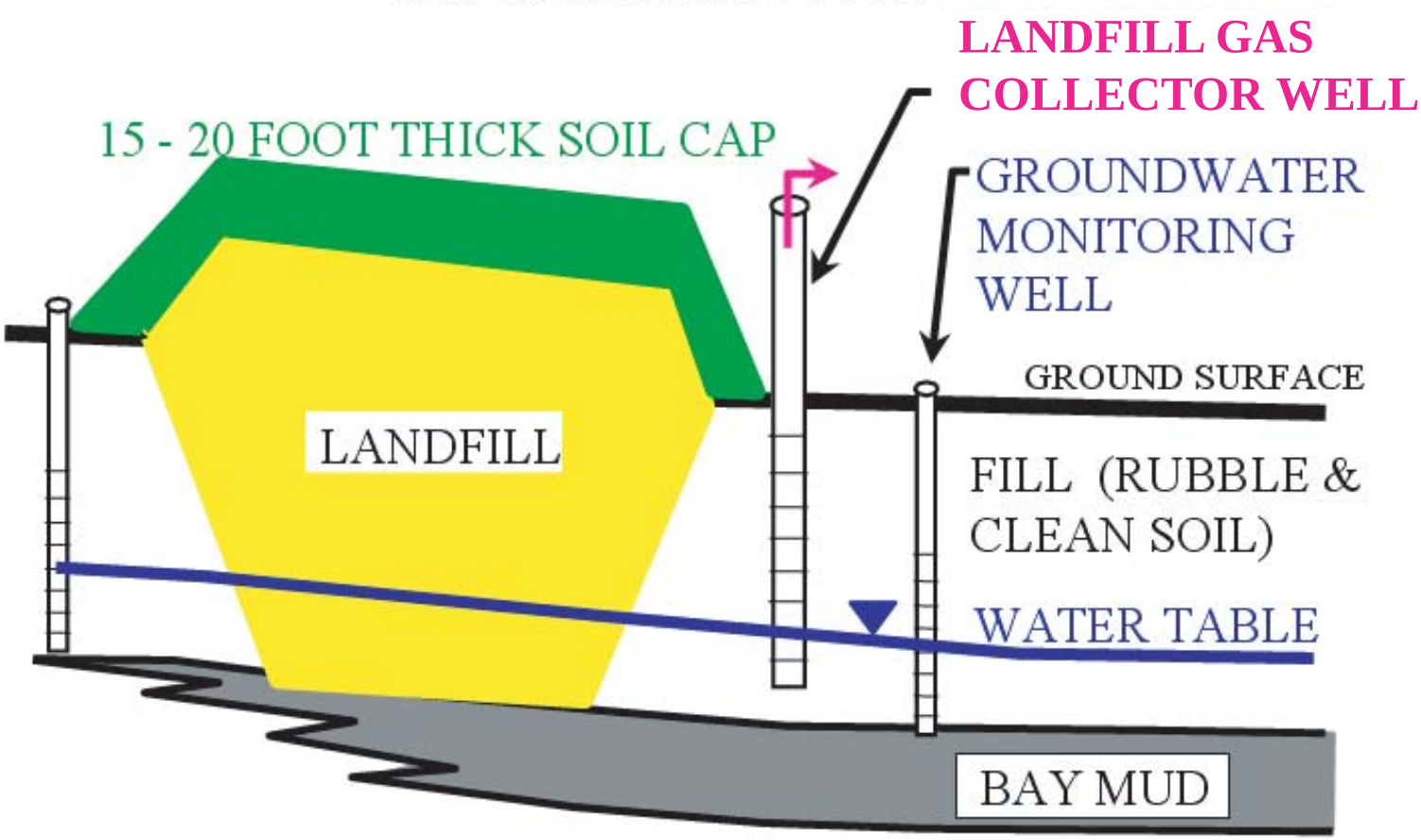


Figure 5
Stratigraphic Terminology
Environmental Engineering Peer Review
Baylands Remediation Efforts
City of Brisbane

CDM

Modified from Remedial Investigation Report, Joint Groundwater Operable Unit for Sunquest Properties, Inc. and Schlage Lock Company Brisbane and San Francisco, California by Treadwell & Rollo and Burns & McDonnell Engineering Company, Inc., April 2002.

CONCEPTUAL
CROSS SECTION VIEW



NO SCALE

Figure 6
Proposed Site Cleanup for Landfill
Environmental Engineering Peer Review
Baylands Remediation Efforts
City of Brisbane

CDM

Modified from Workshop Presentation to the City of Brisbane, Brisbane Baylands, Subsurface Environmental Conditions by Universal Paragon Corporation and Burns & McDonnell Engineering Company, Inc., November 18, 2003.

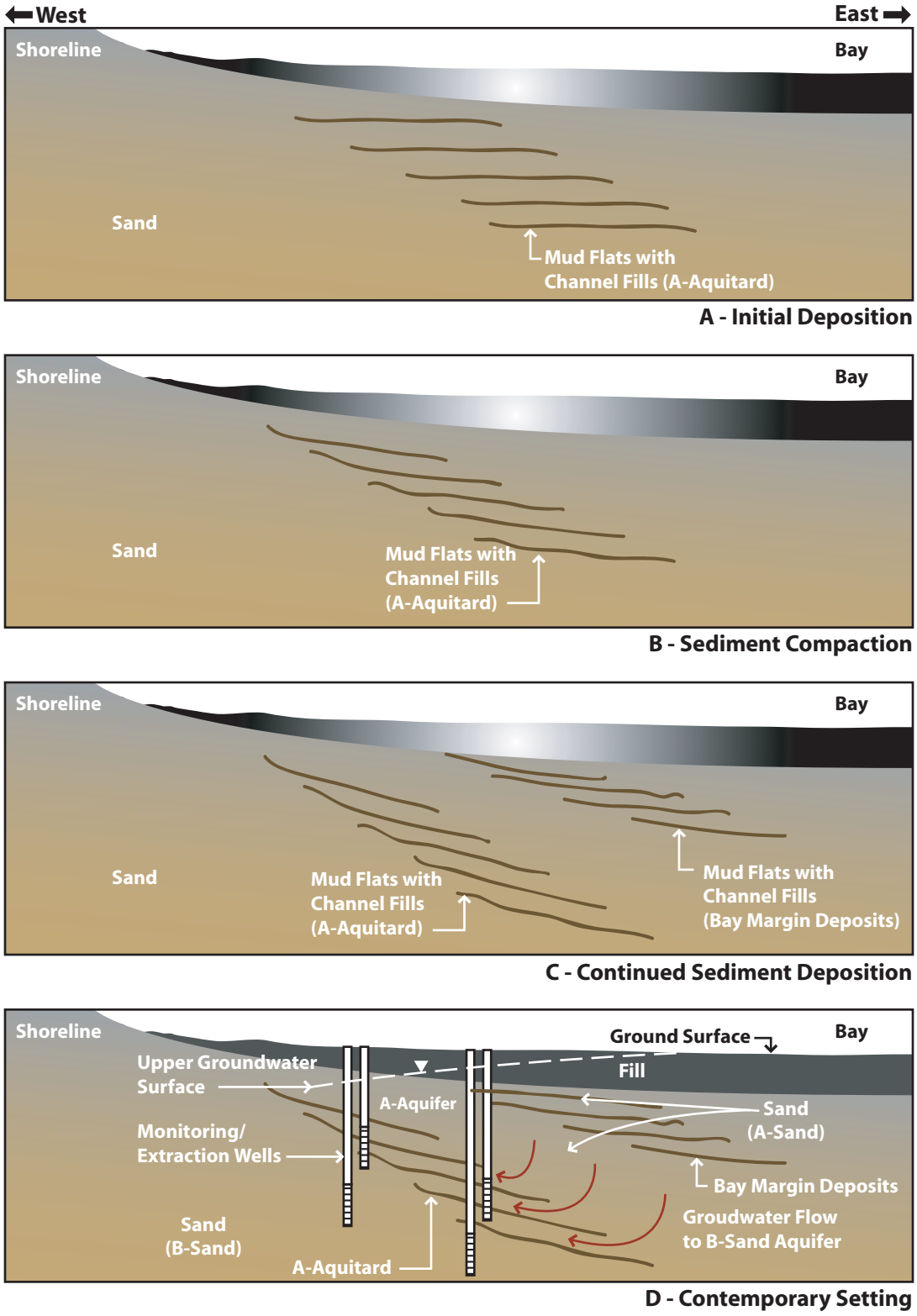


Figure 7
Simplified Conceptual Aquifer Development
Environmental Engineering Peer Review
Baylands Remediation Effort
City of Brisbane, California

CDM

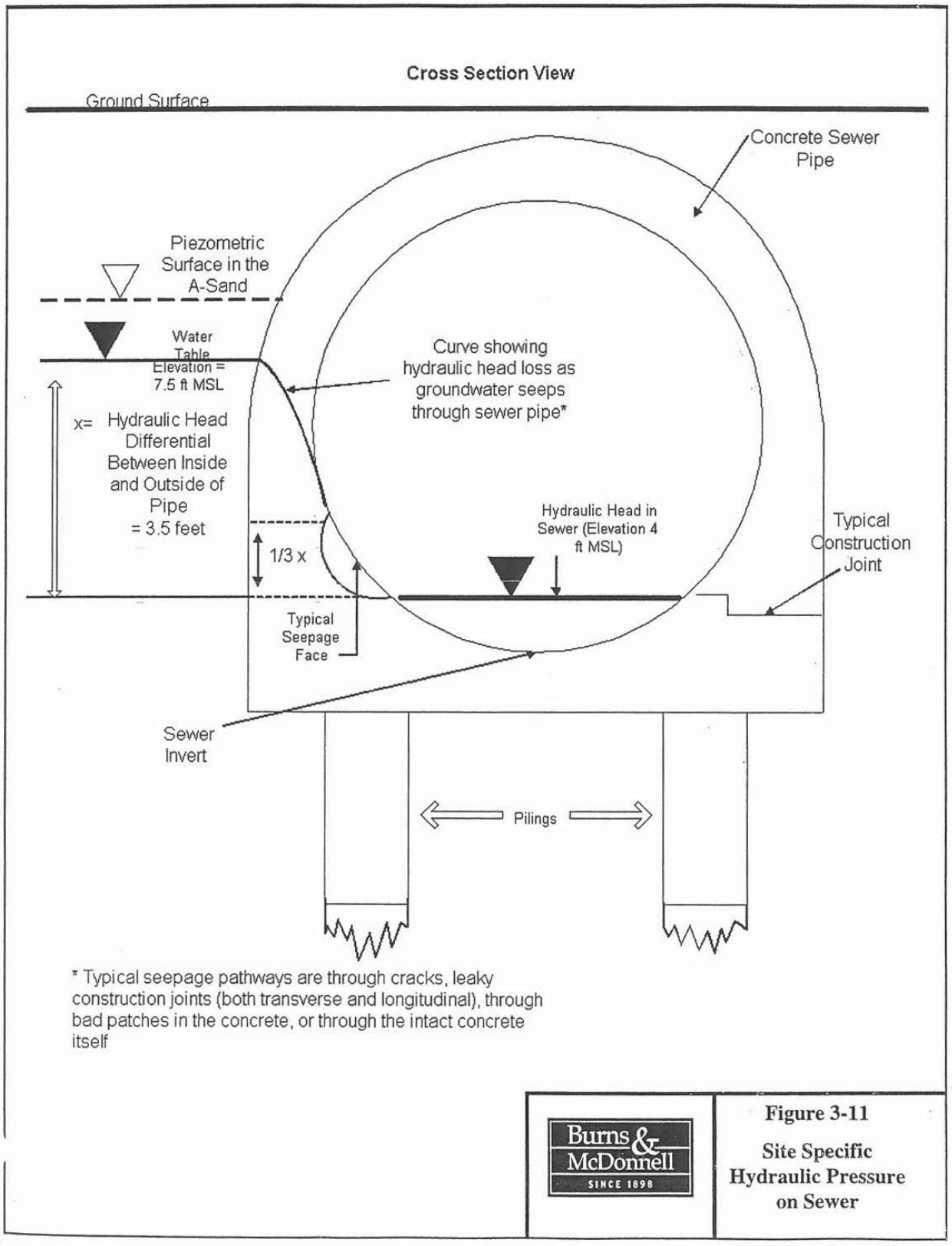


Figure 8
Site Specific Hydraulic Pressure on Sunnydale Avenue Sewer
Environmental Engineering Peer Review
Baylands Remediation Efforts
City of Brisbane

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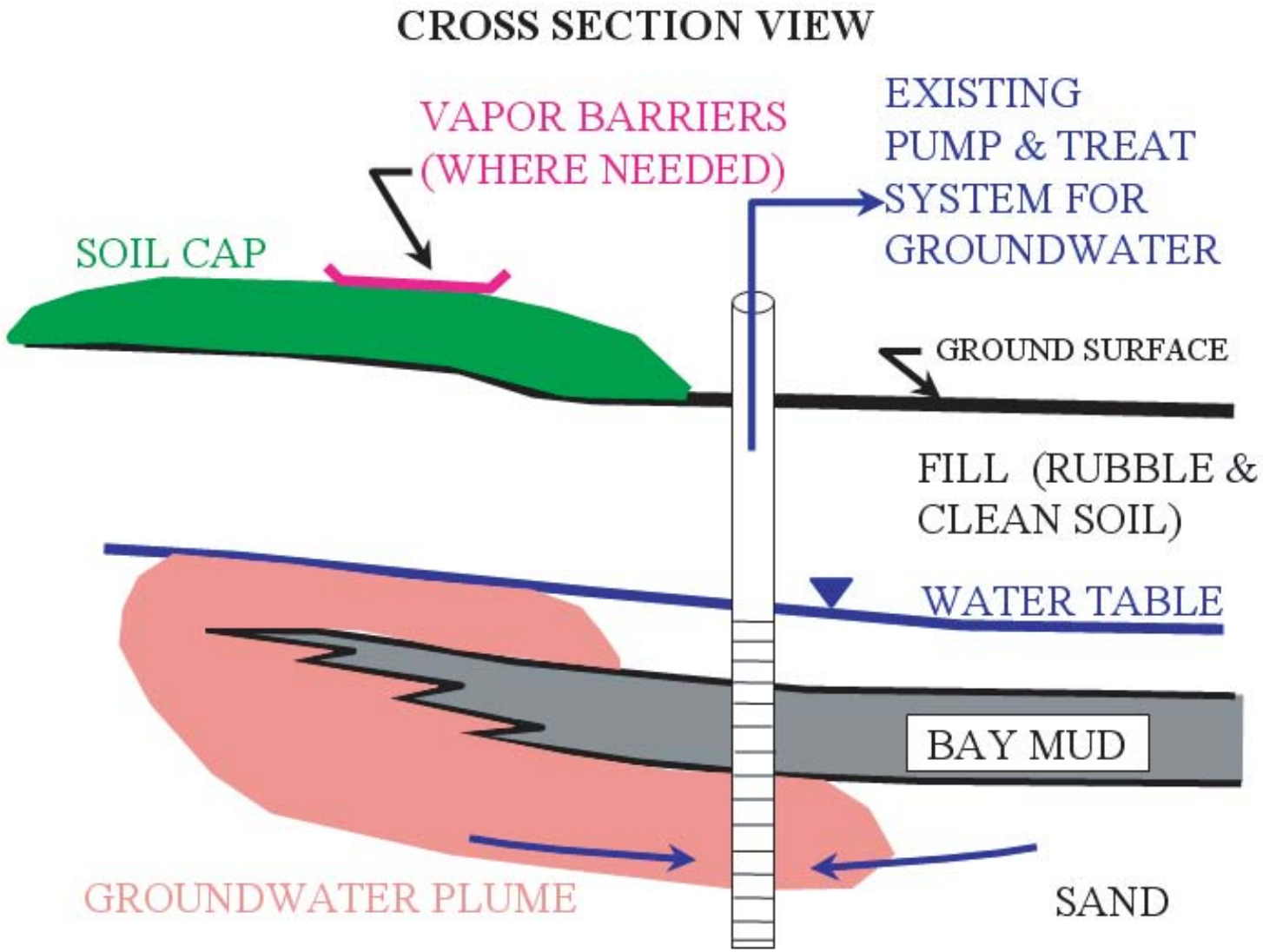
Modified from Remedial Investigation Report Joint Groundwater Operable Unit for Sunquest Properties, Inc. and Schlage Lock Company Brisbane and San Francisco, California by Treadwell & Rollo and Burns & McDonnell Engineering Company, Inc., April 2002.



NO SCALE

Figure 9
Proposed Remedial Action for OU-1
Environmental Engineering Peer Review
Baylands Remediation Efforts
City of Brisbane

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Modified from Workshop Presentation to the City of Brisbane, Brisbane Baylands, Subsurface Environmental Conditions by Universal Paragon Corporation and Burns & McDonnell Engineering Company, Inc., November 18, 2003.

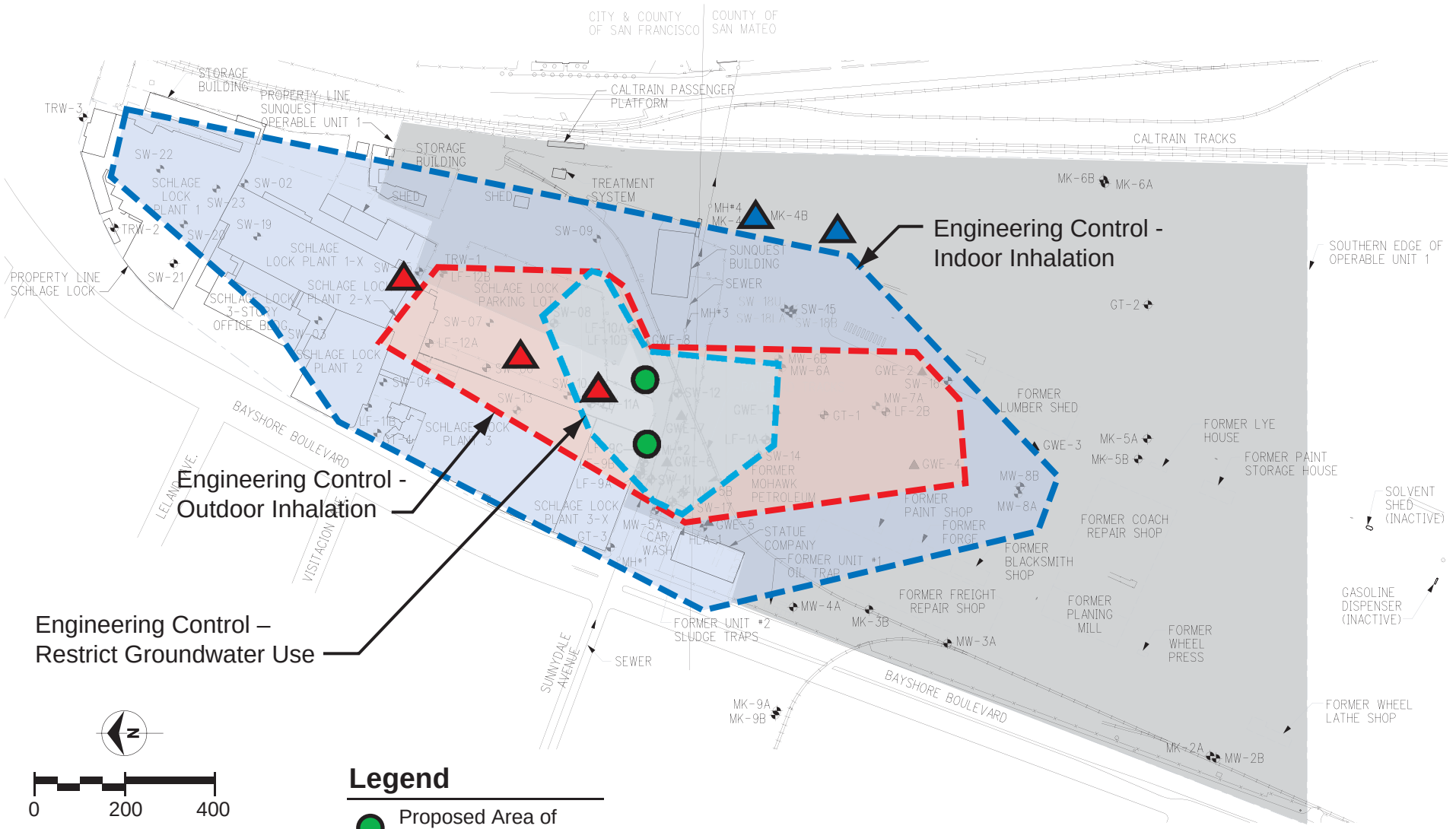

Figure 10
Proposed Areas of Engineering Controls for OU-1
Environmental Engineering Peer Review
Baylands Remediation Effort
City of Brisbane, California

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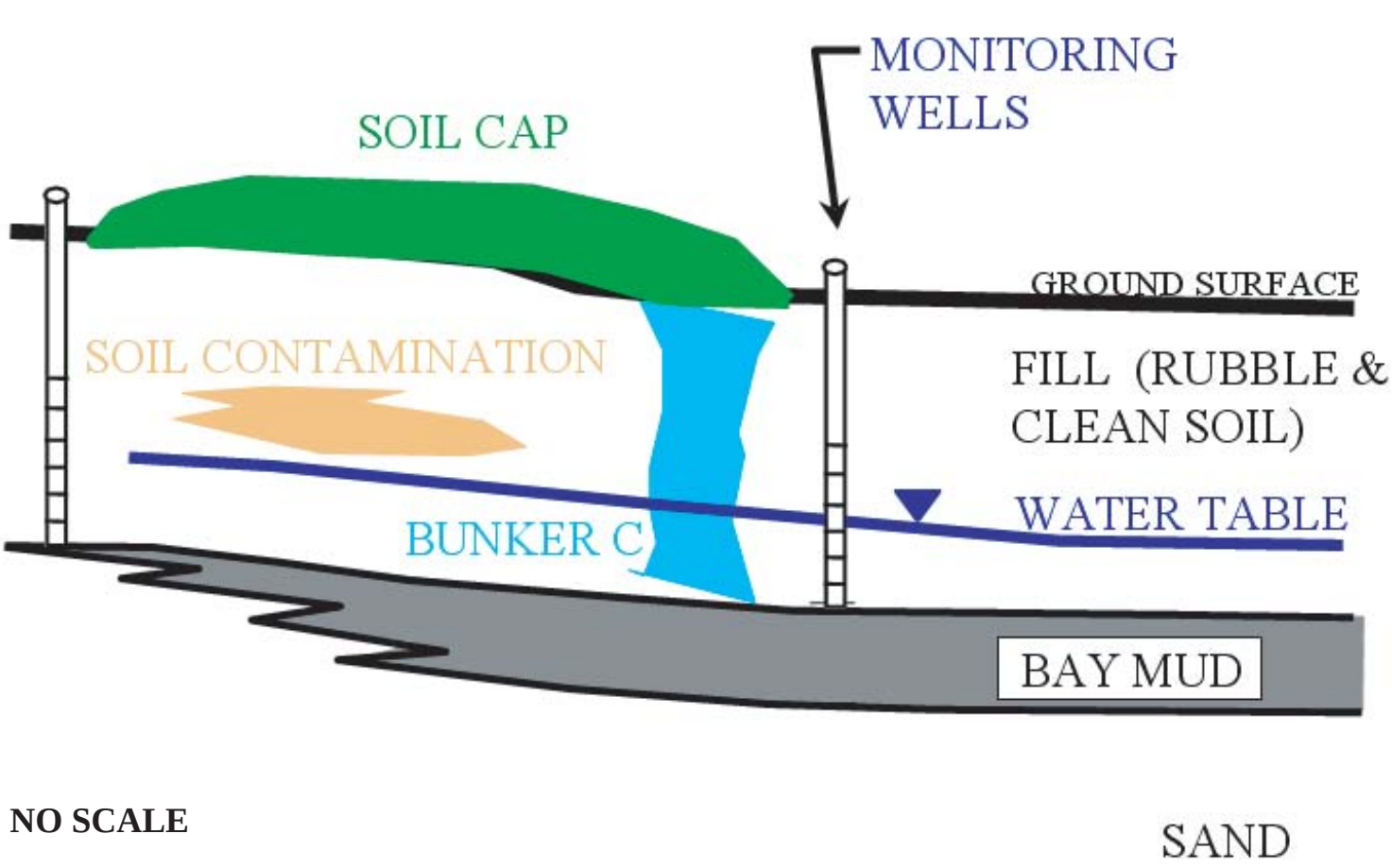
Modified from Burns & Mc Donnell, 2005

GENERALIZED CROSS SECTION VIEW



NO SCALE

Figure 11
Proposed Remedial Action for OU-2
Environmental Engineering Peer Review
Baylands Remediation Efforts
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