San Francisco and Northern San Mateo County Pilot Beneficial Use Designation Project

PART I: DRAFT STAFF REPORT

April 4, 1996

Groundwater Committee

San Francisco Bay Regional Water Quality Control Board

Table of Contents

List of Figures and Tables

NOTE: Figures are located at the end of the report, preceding the References. Tables follow their text reference within the report.

Executive Summary

A). The Report

This report was prepared by the in-house Groundwater Committee (Committee) for the San Francisco Regional Water Quality Control Board, other State and local agencies, and interested members of the public. The report summarizes a pilot project undertaken by the Committee between 1994 - 1996.

The report is organized in the format used for several other Water Quality Control Plan (Basin Plan) amendment staff reports that served as Functional Equivalent Documents (FED) under the California Environmental Quality Act. While the Committee does not propose a Basin Plan amendment at this time to address the policy issues raised herein, the Committee was interested in the FED format so that this report could be used in the future with a Basin Plan amendment.

Chapter I includes the introduction, project goals and objectives, and project organization. Chapter II provides background information about the regulatory context of this project. With this regulatory context as a backdrop, the Committee describes the implications of current regulations on cleanup of polluted sites in Chapter III. Chapter IV describes the hydrogeologic characteristics of the study area used in the project. A definition of this "project" in terms of CEQA and a consideration of the "issues" and "alternatives" comprises Chapter V. The report's conclusions are contained in Chapter VI. This Chapter pulls together the key findings that the Committee has made as a result of this project and identifies the next steps for action.

B. The Project

The goals of the project are to refine beneficial use designations for groundwater basins in San Francisco and Northern San Mateo County and to develop a regulatory management scheme for cleanup of groundwater pollution sites. The Committee chose the area to study based primarily on the availability of current information from the U.S. Geological Survey (USGS) and the San Francisco Water Department. In addition, the study area is similar to other urbanized areas in the Region in terms of pollution types and sources.

Beneficial use designations and water quality objectives are governed by the Water Code, the Basin Plan, and the State Board's "Sources of Drinking Water" Policy (Sources Policy). The Basin Plan sets forth beneficial use designations for each groundwater basin within the Region. A municipal/domestic beneficial use designation is given to all groundwater that meets the criteria set forth in the Sources Policy. Modification of a beneficial use designation requires a Basin Plan amendment. The Implementation Section of the Basin Plan recommends development of groundwater objectives for individual basins that have unique protection needs.

At the time of its adoption, the Sources Policy supported ongoing efforts to require dischargers to perform site characterization. Now, experience indicates it limits flexibility to set appropriate cleanup levels. In practice, none of the Sources Policy exemption criteria (except the salinity criteria) apply to the Region. The rigid application of drinking water criteria to all the Region's groundwaters fails to recognize many other factors that will realistically determine whether or not the waters will ever serve a beneficial use. This has been especially troublesome in shallow water bearing zones that are not hydraulically connected to productive aquifers. These "other factors" include general mineral quality, recharge rates, potential seawater intrusion, land subsidence, extraction costs, land use, and aquifer vulnerability to pollution. At the heart of the issue is a question: how probable is it that groundwater will be used for the beneficial uses that are currently designated in the Basin Plan?

Because of heavy reliance on imported surface water, many people may not consider the importance of groundwater resources in the Study Area. There are, however, seven groundwater basins in the Study Area identified by the USGS with varying degrees of groundwater development potential. For example, the Westside groundwater basin is currently a significant drinking water source for several Peninsula cities. Information from both the USGS and San Francisco Water Department assisted the Committee in determining the probability of future uses for the seven basins. Based upon this information, the Committee recommends how the current beneficial use designations and water quality objectives should be modified for the seven basins.

The Committee conducted the most comprehensive evaluation to date of how probability of use affects a groundwater beneficial use designation as municipal/domestic supply. Three alternative methodologies are identified:

The first alternative is the Tiered Approach, which utilizes a decision chart developed by the Committee. It is a structured decision making method in which the user evaluates basin characteristics to determine the probability of groundwater use. The method was subject to a pilot test involving 200 fuel leak cases. In addition, it was presented to the Executive Director of the State Board and the eight other Executive Officers. Written comments were received from four regional boards and are summarized.

The second alternative considers the Decision Science and Economic Evaluation method to identify probability of use. This approach provides a structured way to address the inherent uncertainty involved in assigning probability. It requires that outside experts and stakeholders be involved in the decision-making process. The Committee worked with a consultant to develop a pilot study proposal using this approach. Funding is still being sought to conduct this analysis.

The third alternative uses Hydrogeologic Framework, a method of subdividing groundwater basins and their use based on information about geologic materials, hydrogeologic properties, water use, and land use. The method uses a hydrogeologic classification scheme for the Coast Ranges originally outlined by Farrar and Bertoldi of the USGS (1988). The method identifies the following zones in the Study Area: non-water yielding bedrock zone, unconsolidated and poorly consolidated deposits zone, saltwater ecological protection zone, fresh water ecological protection zone, groundwater recharge zone, bay mud, and bay-front artificial fill. The method was used to propose modifications to beneficial uses. A map with these zones and the resulting beneficial use designation was developed using geographic information system (GIS) based data.

Chief among the Committee's findings based on the project are:

- The Sources Policy does not provide the flexibility needed to consider other factors for beneficial use designation;
- Considerable flexibility exists within the framework of the Water Code for modifying beneficial uses;
- No modification of the beneficial uses of the Study Area Groundwater Basins can be made until the Groundwater Master Plan has been finalized by the San Francisco Water Department.
- Three different methods for defining beneficial uses were evaluated. For groundwater basins in the Study Area, the Committee recommends Hydrogeologic Framework as the preferred alternative.

- For the Ocean Side Basins (Westside and Lobos), the Committee recommends aggressive restoration of the drinking water beneficial use of polluted groundwater, enhanced source controls and groundwater protection programs to prevent additional pollution, and groundwater basin management to prevent overdraft.

- For four of the Bay Side Basins (Visitacion Valley, South, Islais, and Marina), development potential appears low, and no current municipal or domestic use exists or is planned. The potential municipal and domestic beneficial use should be retained. However, the Committee recommends passive cleanup or containment zones in these basins to restore municipal and domestic water quality objectives as a long term goal.

- For the remainder of the Bay Side Basins, the Committee recommends removing the potential municipal and domestic supply beneficial use designations for the entire Downtown Basin, all Franciscan Complex Bedrock areas except the commercially bottled spring on the Hunters Point peninsula, the artificial fill and bay mud areas in the Bay Side Basins, and Treasure Island. Remediation efforts should be directed by the results of human health and ecological risk assessment. Sites within artificial fill and bay mud area should also evaluate the potential for vertical and horizontal migration to zones of beneficial use.

- The Downtown Basin and Treasure Island should retain the industrial and agricultural (irrigation) beneficial uses and water quality objectives.

- The project was successful in integrating new GIS data including groundwater resources, water quality, and land use.

This is a significant departure from the Basin Plan's global designation of all groundwaters as potential municipal and domestic supply. These recommended changes in beneficial use designations are firmly based on current information from the USGS, future groundwater development plans by the San Francisco Water Department, and Board staff's experience on hundreds of groundwater pollution sites in the Study Area. As a safeguard to these changes, the Committee recommends establishment of two protection zones, (1) a Potential Recharge Zone where pollution from bedrock sites could impact an aquifer, and (2) an Ecological Protection Zone where groundwater pollution could impact surface waters.

C. Next Steps

Although the Committee is not proposing Board action at this time, the Committee anticipates a Basin Plan amendment in the future. Therefore, early feedback on the alternatives is sought. The Committee has developed short-term and long-term follow up actions that bring this pilot project to a close. Short-term actions include completing this Staff Report by soliciting comments from the Board, State Board, other regional boards, and interested members of the public. The committee believes the best approach is to await the completion of the San Francisco Water Department's Groundwater Master Plan and the finalization of amendments to the State Board's Resolution No. 92-49 before proposing a Basin Plan amendment. Long-term actions include testing on Hydrogeologic Framework method in other basins and supporting groundwater protection efforts in the Westside and Lobos Basins.

The Committee welcomes your feedback on this Staff Report. You are encouraged to contact the Committee Chair, Linda Spencer at (510) 286-0789, or to send her your written comments at 2101 Webster Street, Suite 500, Oakland, 94612.

I. INTRODUCTION

The Groundwater Committee (Committee) of the San Francisco Bay Regional Water Quality Control Board (Board) recommends policy on groundwater issues, conveys and shares new information and events related to groundwater pollution cleanup, and fosters internal consensus on groundwater policy implementation. The Committee consists of Board staff representing line staff, supervisors, and managers, and all five staff divisions.

The Committee's first major project was preparing the Groundwater Amendment to the Region's Water Quality Control Plan (Basin Plan) adopted by the Board in 1992. Significant portions of this amendment have been used by the State Board and other regional boards in their basin plan updates. The amendment highlighted the Board's experience with groundwater cleanup since the early 1980's. The amendment included the Board's recommendation to evaluate the Board's existing approach to managing site cleanups. Such evaluation was to include a review of the groundwater beneficial use designations for groundwater in each of the Region's groundwater basins.

In 1994, the Committee conducted a survey among its members and other interested Board staff to identify the primary unresolved issues in dealing with groundwater pollution cleanup within the Region. The results of the survey identified inconsistencies in applying the State Board's "Sources of Drinking Water" Policy (Sources Policy) to groundwater pollution cleanup and the corresponding need for refinement of beneficial use designations for groundwater. This was similar to the Basin Plan's recommendation to streamline Board programs by developing "cleanup levels and policies for individual groundwater basins or sub-basins based on designated beneficial uses."

The *San Francisco and Northern San Mateo County Pilot Beneficial Use Designation Project* was developed by the Committee in response to the staff survey and basin plan recommendations. The Committee has determined that, based on the lack of complete groundwater data for all basins and perceived inconsistencies in the adoption of groundwater cleanup levels, an update and refinement of beneficial use designations for groundwater is appropriate for the entire region. It was agreed that the best way to start this update would be to focus on one specific geographic area, San Francisco and Northern San Mateo County (the Study Area), Figure 1. The Study Area is well suited for the initial beneficial use update and refinement project for the following reasons:

- The Basin Plan does not currently reflect all published information on the names, areal extent, depths of production, storage capacity and perennial yield of the groundwater basins in the Study Area,
- All groundwater beneficial use categories are present (municipal and domestic supply, industrial process and service supply, agricultural supply,

and freshwater replenishment) in the Study Area;
- A groundwater master plan for San Francisco is available;
- Additional groundwater use in San Francisco is presently being evaluated;
- A variety of groundwater pollution is present in the Study Area from a range of sources including fuel, Department of Defense, and industrial sites;
- Groundwater information exists in a geographic information system (GIS) that is compatible with the Regional Board's GIS; and,
- The San Francisco County Health Departments, the San Francisco Water Department (SF Water Department) and the San Francisco Public Works Department have expressed interest in participating in this project.

I.1 PROJECT GOALS AND OBJECTIVES:

The goals of this project are: to update and refine the beneficial use designations for groundwater in the Study Area that allows development of a corresponding regulatory management scheme for groundwater pollution cleanup sites, and 2) based on experience gained in the update and refinement, to develop a framework for applying this management scheme Region-wide. The project integrates recently available data for the Study Area including groundwater resources, water quality, geology, groundwater pollution cleanup sites and land use. Sources included the SF Water Department's Groundwater Master Plan and published GIS data from the U.S. Geological Survey (the USGS). Ultimate revision of beneficial use designations will involve close cooperation with local agencies and the public. The timing of this project with the development of the SF Water Department's Groundwater Master Plan has fostered close cooperation between agencies.

I.2 PROJECT ORGANIZATION

The Committee split into four task groups that primarily worked on specific tasks during the first year of the project. The members of the task groups are listed below. In addition, Committee members Larry Kolb, Shin-Roei Lee, Steve Morse, and Bruce Wolfe provided overall input.

1). Assemble geologic and water use information for the Study Area:
Greg Bartow (lead), John Kaiser, Cherie D'Andrea McCaulou (San Francisco County Health Department), Diane Mims, and Linda Spencer;

2). Transfer assembled information into the Board's GIS:
Linda Spencer and Carrie Salazar;

3). Research and recommend policy options for beneficial use designation
John Hillenbrand, Gina Kathuria (lead), and Wil Bruhns; and,

4). Develop applications for pollution site management and prioritization:
Ravi Arulanthum, Don Dalke, Roshy Mozafar, Vic Pal, and Eddy So (lead).

During the second year, Committee members worked together to develop the project report. Linda Spencer, Greg Bartow and Gina Kathuria prepared the written report, Committee members and Michael Carlin provided comments, and Bruce Wolfe supplied final editing.

The Committee thanks Chris Morioka from the San Francisco Water Department for her input and assistance. In addition, GIS data transfer was facilitated with help from Leslie Dumas, Tonianne Pezetti, and Nadeem Shauket of CH2M Hill. Finally, training and proposal development for the Decision Science and Economic Evaluation alternative was patiently provided by Doug Charlton of Charlton & Leach, Inc.

II. REGULATORY CONTEXT

The Committee evaluated relevant regulations and policies in order to better understand the context of the existing beneficial use designations for groundwater. Current groundwater beneficial uses and their associated water quality objectives in the Basin Plan have been established by the Board within the regulatory context of the Sources Policy. The following discussion highlights the basis for both groundwater beneficial use designations and water quality objectives.

II.1 BENEFICIAL USE DESIGNATIONS

The definition of beneficial uses in the Water Code (§ 13050.f) is as follows:

> "Beneficial uses of the waters of the state that may be protected against quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves."

Existing and potential beneficial uses applicable to groundwater in the Region, as defined by the Basin Plan (November 1995), are listed below.

(1) MUN = ***Municipal and domestic water supply*** : Uses for community, military water systems or individual water supply systems, including, but not limited to, drinking water supply.

(2) PROC = ***Industrial process water supply***: Uses of water for industrial activities that depend primarily on water quality.

(3) IND = ***Industrial service water supply*** : Uses of water for industrial activities that do not depend primarily on water quality, including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.

(4) AGR = ***Agricultural water supply*** : Uses of water for farming, horticulture, or ranching, including, but not limited to irrigation, stock watering, or support of vegetation for range grazing.

(5) FRESH = ***Freshwater replenishment to surface water*** : Designation will be determined at a later date; for the interim a site-by-site determination will be made. Provides a source of freshwater for replenishment of inland lakes and streams of varying salinities.

Another key component of beneficial use designations is the Sources Policy. The Sources Policy followed the passage of Proposition 65, which required public notification when specified cancer-causing chemicals were discharged into "sources of drinking water". The State Board defined "sources of drinking water" in its Resolution No. 88-63. The Board subsequently adopted the Sources Policy into the Basin Plan in Resolution No. 89-39. The Sources Policy specifies that "any body of water that is not currently designated as MUN but, in the opinion of the Regional

Board, is presently or potentially suitable for MUN, the Regional Board shall include MUN in the beneficial use designation." The Policy allows for exceptions if the Board has previously assigned specific designations or if specific exemption criteria are met. These exemption criteria are as follows:

- The total dissolved solids (TDS) exceed 3,000 mg/l (5,000 µS/cm, electrical conductivity) and it is not reasonably expected by the Board that the groundwater could supply a public water system; *or*,
- There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices; *or*,
- The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day; *or*,
- The aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 CFR Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR Section 261.3.

Basin Plan Table 2-9 (included as Table 1 of this report), updated by the Committee in 1992 applies the beneficial use designations to groundwaters. In this table, each of the Region's groundwater basins is identified, and their existing and potential beneficial uses are designated. Identification of the groundwater basins is based on the Department of Water Resources (DWR) Bulletin 118-80. In addition to these designations, the Basin Plan further states that all subsurface waters are considered suitable, or potentially suitable, for municipal or domestic supply. Therefore, groundwaters that fall outside of the identified groundwater basins are included within this designation.

II.2 WATER QUALITY OBJECTIVES

As with beneficial uses, water quality objectives are established in the Basin Plan based on Water Code definitions. Water Code §13000 states that the legislature finds:

> "the quality of the waters of the state shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible."

Water Code §13050.h defines water quality objectives as:

> "the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area. "

The Water Code (§13241) directs each regional board to establish water quality objectives in its basin plan that, in the judgement of the regional board, will:

> "ensure the reasonable protection of beneficial uses and the prevention of nuisance; however, it is recognized that it may be possible for the quality of water to be changed to some degree without unreasonably affecting beneficial uses. Factors to be considered by a regional board in established water quality objectives shall include, but not necessarily be limited to all of the following:
>
> (a). Past, present, and probable future beneficial use of water.
>
> (b). Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto.
>
> (c). Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.
>
> (d). Economic consideration.
>
> (e). The need for developing housing within the region.
>
> (f). The need to develop and use recycled water."

Groundwater objectives in the Region's Basin Plan consist primarily of narrative objectives combined with a limited number of numerical objectives. The primary objective is the maintenance of existing high quality of groundwater (i.e., 'background'), based on the directive from Resolution No. 68-16. Background is the lowest concentration limit required for groundwater protection. Chemical specific objectives for bacteria, organic and inorganic constituents, radioactivity, and taste and odor define the upper limit that is protective of beneficial uses. These objectives are based on Federal and State published standards and guidelines. Other site-specific limits are risk-based.

II.3 CURRENT DESIGNATIONS

Table 1 lists groundwater basins in the Study Area as described in the Basin Plan along with their current beneficial uses. Originally, five basins in the Study Area were identified in DWR Bulletin 118 (1980). However, recent studies conducted by Phillips (1993) have identified seven basins in the Study Area. The Committee concurs with the new USGS subdivisions. A comparison of the new USGS subdivisions and previous DWR subdivisions is shown on Table 2. In addition, Figures 2A and 2B show the groundwater basins listed in the Basin Plan and the groundwater basins delineated by the USGS, respectively.

TABLE 2-9 EXISTING AND POTENTIAL BENEFICIAL USES OF GROUNDWATER IN IDENTIFIED BASINS

	GROUNDWATER BASIN	COUNTY	DWR BASIN NO.	MUN(1)	PROC(2)	IND(3)	AGR(4)	FRESH(5)
	Alameda Creek (Niles Cone)	Alameda	2 - 9.01	E(6)	E	E	E	
	Castro Valley	Alameda	2 - 8	P(7)	P	P	P	
	East Bay Plain	Alameda	2 - 9.01	E	E	E	E	
	Livermore Valley	Alameda	2 - 10	E	E	E	E	
	Sunol Valley	Alameda	2 - 11	E	E	E	E	
	Arroyo Del Hambre Valley	Contra Costa	2 - 31	P	P	P	P	
	Clayton Valley	Contra Costa	2 - 5	E	P	P	P	
	Pittsburg Plain	Contra Costa	2 - 4	P	P	P	P	
	San Ramon Valley	Contra Costa	2 - 7	E	P	P	E	
	Ygnacio Valley	Contra Costa	2 - 6	P	P	P	P	
	Novato Valley	Marin	2 - 30	P	P	P	P	
	Sand Point Area	Marin	2 - 27	E	P	P	P	
	San Rafael	Marin	2 - 29	P	P	P	P	
	Ross Valley	Marin	2 - 28	E	P	P	E	
	Napa Valley	Napa	2.2 & 2 - 2.01	E	E	E	E	
*	Islais Valley	San Francisco	2 - 33	P	E	E	P	
*	Merced Valley (North)	San Francisco	2 - 35	P	P	P	E	
*	San Francisco Sands	San Francisco	2 - 34	E	P	P	E	
*	Visitation Valley	San Francisco	2 - 32	P	E	E	P	
	Half Moon Bay Terrace	San Mateo	2 - 22	E	P	P	E	
*	Merced Valley (South)	San Mateo	2 - 35A	E	P	P	E	
	Pescadero Valley	San Mateo	2 - 26	E	P	P	E	
	San Gregorio Valley	San Mateo	2 - 24	E	P	P	E	
	San Mateo Plain	San Mateo	2 - 9A	E	E	E	P	
	San Pedro Valley	San Mateo	2 - 36	P	P	P	P	
	Santa Clara Valley (& Coyote)	Santa Clara	2 - 9B	E	E	E	E	
	Suisun/Fairfield Valley	Solano	2 - 3	E	E	E	E	
	Kenwood Valley	Sonoma	2 - 19	E	P	P	E	
	Petaluma Valley	Sonoma	2 - 1	E	P	P	E	
	Sebastopol-Merced Fm. Highlands	Sonoma	2 - 25	E	P	P	E	
	Sonoma Valley	Sonoma	2 - 2.022	E	P	P	E	

NOTES:
(1) MUN = Municipal and domestic water supply
(2) PROC = Industrial process water supply
(3) IND = Industrial service water supply
(4) AGR = Agricultural water supply
(5) FRESH = Freshwater replenishment to surface water. (Designation will be determined at a later date, for the interim, a site-by-site determination will be made)
(6) E = Existing beneficial use, based on available information (see references listed in Table 2-8).
(7) P = Potential beneficial use, based on available information. There is no known use of the basin for this category; however, the basin could be used for this purpose (see references listed in Table 2-8)

*** = groundwater basins with the Study Area.**

Table 1. Basin Plan Table 2-9.

TABLE 2. COMPARISON OF THE USGS AND DWR SUBDIVISION OF GROUNDWATER BASINS LOCATED IN THE STUDY AREA

DWR BASINS (1995 Basin Plan)	USGS BASINS (Phillips, et al., 1993)
San Francisco Sands	Marina, Lobos, Downtown and northern portion of Westside
Merced Valley	Islais and central portion of Westside
Islais Valley	South
Visitation Valley	Visitation Valley
San Mateo Plain	Southern portion of Westside

II.4. CONTINUING PLANNING

The Implementation Plan section of the Basin Plan highlights specific areas for continuing planning and policy modification. There are two recommendations in the Implementation Plan that are relevant to the Committee's work and this project. Both recommendations call for the need to develop objectives for individual groundwater basins. The *San Francisco/Northern San Mateo County Beneficial Use Pilot Designation Project* is the first time that Board staff have directly addressed these recommendations.

1). "Groundwater objectives for individual basins may be developed in the future. As the Regional Board completes projects that provide more detailed delineation of beneficial uses within basins, revised objectives may be developed for portions of groundwater basins that have unique protection needs." (page 4-53)

2). Table 4-19, "Options for Future Management Strategies at Groundwater Cleanup Sites", includes options to "Streamline Existing Program". One option is to "develop cleanup-levels and policies for individual groundwater basins or sub-basins based on designated beneficial uses." (page 4-89)

In summary, groundwater beneficial use designations and water quality objectives are based on the Water Code, the Basin Plan, and the Sources Policy. Any change of a beneficial use designation requires a Basin Plan amendment that must be approved by the Board, the State Board, and the State Office of Administrative Law.

III. POLICY DISCUSSION

This Chapter highlights the implications of the regulatory context, described in Chapter II, for groundwater pollution cleanup sites. This discussion includes how policies are implemented in the Region, and why it is appropriate that these policies be modified.

After the State Board's adoption of the Sources Policy via its Resolution No. 88-63, all regional boards were to adopt the Sources Policy into their basin plans. Our Board did so by adopting Resolution No. 89-39. At the time of its adoption, the Sources Policy supported our ongoing efforts to require dischargers to perform pollution site characterization. In addition, the Sources Policy gave a MUN designation to areas not specifically designated by the Basin Plan. However, now our experience finds that it limits our flexibility to set appropriate cleanup levels. Board experience in implementing the Sources Policy indicates that nearly all groundwaters within the Region are designated as potential sources of drinking water, to be protected as potential sources of municipal and domestic supply.

As a result, most all groundwaters require protection to drinking water quality objectives. This uniform application of drinking water quality objectives is where the Sources Policy leads to inappropriate cleanup decisions. It does not allow the consideration of other factors when determining cleanup levels.

In examining the Sources Policy's exemption criteria (see Chapter II), with few exceptions, only the salinity exemption is relevant to groundwaters in the Region. The other exemption criteria generally do not apply. Although the Region has areas with existing pollution (related to sub-regional septage problems), most pollution is related to specific pollution incidents. The Region does not have aquifers regulated as geothermal sources. Subsurface waters with very low yields exist, but, in the absence of good "sustainable" yield methods, nearly all wells in the Region can produce enough to meet the minimum yield criteria of 200 gallons per day. What does exist in the Region are a few areas of concentrated salts in groundwater that exceed the TDS level. These areas are evaluated on a case-by-case basis to determine what appropriate cleanup objectives should be.

Since the Sources Policy exemption criteria have only limited application in the Region, the consequence is that the Policy casts the net far and wide as to what must be protected as a source of drinking water. The Policy compromises the Board's ability to deviate from drinking water standards in the pollution cleanup and protection of potential beneficial uses in "marginal" groundwater areas, and provides greater rationale to those who question the State's antidegradation policy.

Experience implementing the Sources Policy demonstrates that the water yield criteria has been especially troublesome. The Policy defines a source of drinking water as any water bearing zone where a single well is "capable of producing an average, sustained yield of 200 gallons per day" or more. Such yields are likely only

to support individual domestic users, not municipal suppliers. Within the Region, nearly any geologic material that is saturated can meet this minimum yield criteria. For example, based on this criteria, fine grained silts and clays are designated as sources of drinking water. Thus groundwater cleanup to drinking water standards must be required in such areas. In the Region, many urban and industrial areas are extremely unlikely to be utilized as domestic drinking water source(s). Yet the Policy does not distinguish between domestic and municipal beneficial uses; therefore, every groundwater basin is treated as potentially useable if it meets the minimum yield criteria.

At the heart of this uniform application of drinking water quality objectives is the inability to apply other considerations when determining cleanup levels. For example, how probable is domestic use in some areas of the Region? Furthermore, how probable is groundwater use for any purpose in certain areas? As an example, the downtown portions of San Francisco, Oakland, and Emeryville would support the 200 gallons-per-day yield criteria, and are thus currently designated as potential sources of drinking water, yet, how probable is that use? Similarly, shallow perched aquifer zones, where pollution is common from a variety of sources, are also designated as potential sources of drinking water, even when it is extremely unlikely they will be used for such.

The Committee focused on this issue by evaluating the latest information available on existing and future water resource development in the Study Area. Published information from the USGS and the draft SF Water Department's Groundwater Master Plan provided information on the viability of the Study Area's groundwater basins for sustained groundwater production. The beneficial use designations in the current Basin Plan do not reflect this updated type of approach. Using this information, however, the Committee has evaluated the probability of future groundwater use in the Study Area.

In the process of this evaluation, it became clear that the Sources Policy's exemptions are only a subset of the types of factors that water management agencies consider when evaluating the viability of a water resource. In addition to TDS and yield, these other factors include: general mineral quality, physical constraints such as recharge rates, seawater intrusion and subsidence, and economic factors relating to extraction costs and treatment, and pollution factors related to land use, widespread pollution, and aquifer vulnerability. Based on this evaluation it appears that the Sources Policy can be used to define <u>potential</u> MUN beneficial use, but it provides an incomplete picture when evaluating the <u>probability</u> of actual future use.

Under Water Code Section §13240, the Board is required to exercise its judgement to "ensure the *reasonable* protection of the beneficial uses" (emphasis added). The Water Code identifies "economic considerations" and "probable future use" as factors that the Board must consider when making such judgements. However, the Sources Policy effectively designates groundwater as a potential drinking water

source without providing guidance on how to consider its probability of future use or economics. As such, the procedure for designating beneficial uses of groundwater needs to be refined to consider all relevant factors rather than just salinity and yield.

To begin exploring resolution of this issue, the Committee decided to use San Francisco and Northern San Mateo County as the Study Area to review designation of beneficial uses of the Area's groundwater. This effort is significant in that it can systematically address all factors, e.g., economics, hydrogeology, and probability of future beneficial uses, which can be used to set more appropriate water quality objectives and site-specific cleanup goals.

IV. GEOLOGIC AND WATER USE INFORMATION FOR STUDY AREA

This Chapter includes the Committee's compilation of background information that forms the basis for future updates of the beneficial use designations of groundwater to the Study Area. Two primary sources of such information were the draft San Francisco Groundwater Master Plan (San Francisco Water Department, 1995) and the USGS (Phillips, et al., 1993). In addition, the Committee received GIS data coverages of the Study Area from the San Francisco Water Department's consultant, CH2M HiLL. Over 40 GIS coverages in Arc/Info format were available to the Committee to evaluate such information as the distribution of water wells, geology, historic shoreline, and extent of artificial fill (CH2M Hill, 1995).

A summary of the Study Area's groundwater basins as subdivided by the USGS (see also Table 3), is included IV.1. For a more complete description of basin characteristics, please refer to Appendix D. Based on this information, the Committee grouped the basins in IV.2 on the basis of their geologic characteristics and developed recommendations in IV.3 for beneficial use designations.

IV.1 GROUNDWATER BASINS

Downtown Groundwater Basin: The areal extent of this basin is approximately 7,500 acres. Downtown Basin is open to San Francisco Bay to the east side and encompasses the Mission Creek and North Beach districts. It is separated from Marina Basin by a bedrock ridge that extends southwest through Russian Hill and Pacific Heights. The ridge continues south to Twin Peaks, separating Downtown Basin from Lobos and Westside Basins.

Downtown Basin is horizontally bounded by bedrock; thickness of unconsolidated sediments range from 0 to 200 feet. The unconsolidated sediments are made up of Colma sands, dune sands, artificial fill and bay mud. The majority of Downtown Basin is made up of Quaternary alluvium (Qal), consisting of unconsolidated to weakly consolidated silt, sand and gravel. It includes minor deposits of Holocene and late Pleistocene beach and dune sand, and marine terrace deposits. The Basin generally overlies bedrock in valleys and canyons of upland areas. Underlying the Qal, and in some localities, outcropping at the land surface, are remnants of the Franciscan Complex bedrock, generally highly deformed and sheared in response to severe folding and faulting.

Groundwater flow in the Basin is from bedrock ridges to historic creek beds and then to the Bay (Phillips, et al., 1993). The annual recharge is estimated at 5900 acre-feet per year (acft/yr) which is the largest amount of any Bay Side basin. The USGS estimated that over half of the total Basin recharge is from leaking water and sewer pipes. Thus, it can be assumed that recharge from this source will decrease in the future as pipe repairs are made.

TABLE 3. SUMMARY OF SAN FRANCISCO AND NORTHERN SAN MATEO GROUNDWATER BASIN HYDROGEOLOGIC CHARACTERISTICS

Basin	Acres	Est. Annual Recharge ac-ft (1993)[a,b]	Development Potential (reason)	Likely Groundwater Quality[c]	Amount of Groundwater Extracted from Basin (1993)[d]	Number of Fuel Leak Cases[f]
Westside	24,500	14,800	High (north of Lake Merced, conjunctive use potential)	Potable	~ 13,800	44
Lobos	2,379	1,600	Medium (conjunctive use potential)	Potable	2,300	21
Marina	2,224	1,300	Low (high subsidence potential)	Unknown	Unknown	236 (210 in Presidio)
Downtown	7,512	5,900	Medium-Low (high water levels, high subsidence potential)	Non-Potable	800-5,600[e]	26
Isalis	5,000	1,800	Insufficient data	Unknown	Unknown	336
South	2,130	700	Insufficient data	Unknown	200	11
Visitacion Valley	5100	unknown	Insufficient data	Unknown	Unknown	66
Treasure Island	575	unknown	Low (high saltwater intrusion potential)	Limited Potable	0	36

All data from SF Water Department Draft Groundwater Master Plan (1995) unless otherwise shown.

[a] Recharge estimates are based on USGS data (Phillips et al., 1993), except for data from the portion of the Westside Basin south of the county line. USGS data were collected for 1987 and 1988, the first years of a 6-year drought. Recharge estimates have been rounded to nearest 100 acre-feet.

[b] Recharge includes leakage from underground sewer and water pipes which has not been specifically quantified. It can be assumed that recharge from this source will decrease in the future as repairs to the system are made.

[c] Potential sources of groundwater contamination exist in each basin. Where groundwater quality conditions are known, a preliminary assessment of the water quality is shown (From SFPUC, 1995)

[d] Estimates may be low because no requirement for reporting pumping volumes exists.

[e] Groundwater extracted in the Downtown Basin is assumed to be for dewatering. 880 ac-ft/yr are known to be extracted, but the San Francisco Department of Public Works estimates that an average of 5,600 ac-ft/yr of dewatering water is added to the sewer system.

[f] From RWQCB, Leaking Underground Fuel Tanks Data Base.

[g] Data on Treasure Island from unpublished studies conducted by PRC for the U.S. Navy as part of base closure program.

The SF Water Department's Groundwater Master Plan indicates that Downtown Basin is being considered for nonpotable uses only (i.e., toilet flushing, irrigation, and climate control) because of the historic industrial development and the density of identified hazardous waste sites. There are a reported 336 fuel leak cases in the Basin, which account for nearly half of the fuel leak cases in the Study Area. Analysis of 20 water samples from the Basin in 1993 showed that 19 of 20 wells contained water suitable for selected nonpotable municipal and industrial development uses without treatment. Only five of these samples met CCR Title 22 Drinking Water Standards (Title 22 Standards) for bacteriological, general physical, general mineral, and inorganic analyses.

In contrast, nearly the entire Basin meets the definition of a drinking water supply when evaluated against the Sources Policy. Limited TDS groundwater data indicates that the 3000 mg/l level is only exceeded at sites very close to the Bay. Pumping rates also meet the Policy's minimum yield criteria.

Westside Groundwater Basin: Westside Basin is an elongated trough - approximately two miles wide and 11 miles in length - that ranges in depth between 500 feet in Golden Gate Park to about 3,500 feet near Daly City. The Basin is bounded to the north by a northwest trending bedrock ridge northeast of Golden Gate Park, to the east by a bedrock ridge including Twin Peaks, Sutro Tower, Mt. Davidson and San Bruno Mountain, and to the west by the San Andreas Fault. The southern boundary of the Basin is uncertain, but is assumed to be the southern extent of the Colma Formation - south of the City of San Bruno.

The Basin had prime water bearing formations. Geologically, the Basin consists of the Merced Formation overlain by the Colma Formation further overlain by dune sands. North of Lake Merced, the groundwater flow is toward the ocean (toward the west). South of Lake Merced the flow is toward pumping zones further south. Groundwater is unconfined in the Colma Formation. Moving south into the Lake Merced area, a confining clay layer at about 90 feet is present. In this area, groundwater occurs in confined conditions in both the Colma and Merced Formations.

Groundwater resources are overdrafted in the vicinity and to the south of Lake Merced as evidenced by drops in the static water level of the Lake. However, in the Golden Gate Park and Sunset areas more extraction is possible, although ultimately limited by the potential of sea water intrusion. The Basin meets Title 22 Standards although some areas contain elevated levels of nitrates. In the San Bruno area, chloride concentrations have been increasing in wells over the past 20 years.

Computer simulations have been performed by CH2M Hill to evaluate potential land subsidence due to groundwater pumping in the Basin. The modeling was performed using the PRESS (predictions relating to effective stress and subsidence) Model. The basin was divided into four areas with a typical clay-dominant well log

developed for each. South of the Lake Merced area, no clay layers were found, therefore subsidence is not expected in that area. The area north of Lake Merced, where more clays are present, had the most potential subsidence with a maximum of 1.4 feet possible after five years of pumping.

The development potential for groundwater in the Westside Basin, north of Lake Merced, is high. Groundwater quality is good; therefore, potable uses could be supported. (SF Water Dept., 1995)

Visitacion Valley Groundwater Basin: Visitacion Valley Basin is located on the south east side of San Francisco and encompasses 5,100 acres of which 4,100 acres are located within San Mateo County. Surface water and groundwater drain typically to the east towards the Bay. Franciscan complex bedrock is exposed at the surfaces along the northern and western edges of the Basin. Alluvial deposits overlie the bedrock and increase in thickness towards the Bay, where the alluvium reaches a maximum thickness of approximately 200 feet. The alluvium along the Bay consists primarily of sands interbedded with discontinuous silt and clay layers.

Recharge occurs in the northern portion of the Basin with groundwater flowing generally towards the Bay. The total volume of water within the Basin is estimated at 20,000 acre-feet, of which 12,000 is available for development. Only one active well presently exists within the San Francisco side of the Basin. In the past there have been up to 30 wells, of which two had pumping rates greater than 50,000 gallons per day. Two locations have been sampled for general water quality, and have been found to meet primary and secondary drinking water standards. Most of the groundwater pollution cleanup sites are concentrated on the lowland or Bay side of this Basin. They include several state superfund sites, the southern half of Hunters Point Naval Shipyard, and many fuel leak cases.

There is insufficient data available for the Basin to adequately evaluate its development potential. The general mineral quality it not known well enough to evaluate whether the Basin meets Title 22 Standards and could provide a potable drinking water source (SF Water Dept., 1995).

South Groundwater Basin: South Basin is located on the south east side of San Francisco and encompasses 2,100 acres. Surface water drainage is typically to the east, from San Bruno Mountain, towards the Bay. Historically, the area was drained by two creeks which have since been filled. Groundwater flow direction is east towards the Bay. The Basin is almost completely bounded by bedrock of the Franciscan complex which surfaces on the north, west, and south sides of the Basin to create an eastward trending trough. On the west side, the bedrock is overlain by ravine deposits which range from 50 to 100 feet in thickness but can be as great as 200 feet thick. The eastern Bay side area consists primarily of reclaimed Bay lands. In this area, fill material is up to 140 feet thick and is underlain by bay mud, up to 60 feet thick.

The groundwater recharge rate is the smallest of the basins studied, approximately 700 acre-feet per year. The total volume of water within the Basin is estimated at 5,000 acre-feet. There are three active residential wells within the Basin. Historically there were 71 wells and four springs as of 1913. Three locations have been sampled for general water quality. Hardness was found to be greater than 200 mg/l CaCO3 (exceeding Title 22 standards) and two of the locations had exceedences of nitrates. Most groundwater pollution sites are concentrated on the eastern lowland or Bay side of the basin, most noteworthy of which is the western half of Hunters Point Naval Shipyard.

Approximately 25 percent of the Basin is overlain by artificial fill. Water quality along the eastern margin appears to be of poor quality. Salt water intrusion from the Bay and pollution from groundwater pollution sites may hinder future groundwater development. Overall, however, the development potential of South Basin has been labeled as "unknown" due to insufficient data (SF Water Dept., 1995).

Islais Groundwater Basin: Isalis Basin encompasses about 5000 acres in San Francisco and 600 acres in San Mateo County. It is bounded laterally by bedrock except to the east where it is open to the Bay. Sediments filling the Basin consist of the Colma Formation, alluvium, and, to the east towards the Bay, artificial fill and bay mud. Surficial deposits are made up of a combination of Colma Formation sediments and undifferentiated alluvial deposits. To the east, particularly east of Highway 101 are deposits of artificial fill and, underneath them, extensive deposits of bay mud. The main water bearing units are the Colma Formation, with thicknesses up to 100 feet, and the overlying undifferentiated alluvium, with thicknesses up to 60 feet.

With the exception of areas east of Highway 101, TDS in groundwater is less than 3000 mg/l. Apparently, based on historical information, some wells in the eastern portion of the Basin experienced an increase in chloride content because of saltwater intrusion problems. Shallow groundwater quality tends to be questionable east of Highway 101, as it is largely located within the artificial fill of an industrial area nearer the Bay margin. Further, in this area pollutants such as metals, solvents, petroleum hydrocarbons, and nitrates have been reported. There are presently 54 known fuel leak cases in the Basin of which eleven have been closed.

Albion Water Company collects and bottles spring water from a Franciscan Complex bedrock source to the west, and upgradient, of Hunters Point Naval Ship Yard. Approximately 2000 gallons per day of spring water is collected at the site (personal communication, Mr. Mike Mee, Vice President, Albion Water Co.).

Lobos Groundwater Basin: Lobos Basin encompasses approximately 2,400 acres in the northwestern corner of San Francisco and lies under a portion of the Presidio. It is separated from Westside Basin to the south and Marina Basin to the north by bedrock ridges. Lobos Basin has a low to moderate potential for development as a

groundwater supply. Water bearing sediments in the Basin consist of dune sands and Colma Formation sediments. The Colma Formation sediments are usually reddish-brown fine grained sands with intermixed silts and clays. The Colma Formation in Lobos Basin appears to have a greater percentage of clays than the Colma Formation in the Westside Basin. Dune sands vary in thickness from 0 to 140 feet, but are generally between 40 and 80 feet.

Along the Lobos Creek channel, it appears that high conductivity sediments exist. Groundwater flow seems to be towards Lobos Creek and then towards the ocean. Lobos Creek is thought to be entirely fed by groundwater seepage. Currently, the entire flow is diverted to the Presidio water treatment plant. Approximately 70 percent of the Creek is used for both municipal and irrigation purposes while the remainder is discharged to the ocean. The flow rate though Lobos Creek was estimated at 1.6 million gallons per day. Several small capacity wells are located throughout Lobos Basin for irrigation and as part of an emergency fire suppression system.

TDS ranges from 309 mg/l to 4000 mg/l. High levels of nitrates were found in three of eight water samples taken. Few groundwater pollution sites are located in Lobos Basin, with most groundwater pollution associated with the Presidio. In 1989, one well in the Presidio was shut down because of the presence of solvents in the groundwater. There does not appear to be any evidence that sea water intrusion is occurring; bedrock along the eastern portion of Lobos Basin is possibly acting as a barrier.

Groundwater sampled, in general, met Title 22 Drinking Water Standards. Groundwater wells from the Presidio are being used for drinking water without treatment. Treated water from Lobos Creek is also currently being used as a drinking water supply. Groundwater recharge and discharge appear to balance. Overall, Lobos Basin is considered a potable groundwater resource, with medium development potential (SF Water Dept., 1995).

Marina Groundwater Basin: Marina Basin, at 2200 acres in size, is the smallest of the seven groundwater basins in the Study Area. It is bounded by the Bay to the north and by a bedrock ridge that runs through the Presidio to the south and through Pacific Heights and Russian Hill to the south and west.

The northern Marina Basin consists primarily alluvial deposits overlain by bay mud, further overlain by artificial fill. To the south it consists of undivided surficial deposits overlying the Colma and/or Franciscan Complex. The thickness of the Basin fill deposits varies from 0-200 feet. Due to the thickness of bay mud, there is a potential for subsidence of the ground surface if groundwater pumping creates pressure on the bay mud.

Basin recharge is estimated at 1341 acft/yr (Phillips, et al., 1993). No groundwater pumping other than for cleanup purposes is known to occur at this time. There are

approximately 236 fuel leak cases in the Basin, including 210 located in the Presidio. Since there are only minor groundwater withdrawals, Basin recharge likely equals discharge to the Bay. The only relevant water quality data for the Basin is from investigations at the Presidio (Dames & Moore, 1995) which overlies the western quarter of the Basin. Groundwater investigations at the Presidio have found that TDS and electrical conductivity levels increase toward the Bay. When compared to the Sources Policy's exemption criteria, small isolated areas exceed the 3000 mg/l TDS level. However, electrical conductivity levels exceed the 5000 uS/cm level in a 600 feet wide band in the Crissy Field area of the basin. Thus, the Sources Policy would not apply to a portion of the Basin.

No water quality data was located for the portion of the Marina Basin east of Crissy Field. An initial review of fuel leak case files was not useful because the case data exists for fuel constituents only. A proposed Marina Groundwater Sampling Project to be undertaken by Board staff, is outlined in Appendix A. The potential for the Basin to provide a potable groundwater source is unknown, due to a lack of available data. However, the overall development potential for this basin is considered "low" due to the high potential for land subsidence (SF Water Dept., 1995).

Other Basins: Treasure Island and Yerba Buena Island are within San Francisco County. Due to limited current use and demand for future use of groundwater on the Islands, they were not considered a part of the Study Area. However, because new information about the Islands' groundwater became available during the Committee's compilation of groundwater basin information, that information is included below. This information also provides a basis for considering how the Sources Policy addresses the beneficial use of the Islands' groundwater.

Treasure Island (TI) encompasses approximately 445 acres and is enveloped by the Bay. TI is a man-made island consisting primarily of sand sediments dredged from the Bay. The depth of the dredged sand sediments (fill) extends to approximately 16 to 28 feet below ground surface (bgs).

The groundwater at TI is under unconfined conditions at an average depth of approximately five feet. Groundwater recharge occurs primarily from landscape irrigation and leaking storm drains. There are no known residential, municipal or industrial groundwater wells on TI. There are 87 shallow groundwater monitoring wells which yield more than 200 gallons per day, the Sources Policy's minimum yield criteria. Using the Sources Policy TDS level of 3,000 mg/l, the depth of potentially suitable drinking water is estimated to extend 25 feet bgs. However, the use of groundwater for domestic or municipal water supply would be limited by the following factors: 1) the small total volume of fresh groundwater available, 2) the likelihood of saltwater intrusion, and 3) future ground improvements (e.g., stone columns and dynamic compaction) needed as part of earthquake preparedness.

Yerba Buena Island (YBI), located adjacent to TI in the middle of the Bay, is approximately 130 acres. Unlike TI, YBI is a natural island consisting of four geologic units: landslide debris, artificial fill, the Colma formation and the Franciscan assemblage. During geotechnical and environmental investigations, the Sources Policy's minimum yield criteria was not met except in the area composed of artificial fill. Artificial fill is present along the eastern shoreline of YBI, in the area known as the YBI Landfill.

In the area of the YBI Landfill, groundwater characteristics are similar to those of TI. Groundwater recharge in this area is primarily from infiltration of precipitation, with some contribution from landscape irrigation and leaking storm drains. Laterally, shallow TDS concentrations in the groundwater at the YBI Landfill range from 759 mg/l (100 feet from the Bay) to 3,010 mg/l near the shoreline (50 feet from the Bay). The use of groundwater in the area of the YBI Landfill would be limited by the following factors: 1) the small total volume of fresh groundwater available, 2) the likelihood of saltwater intrusion, and 3) containment and capping of the Landfill will be the likely landfill closure and pollution cleanup alternative, which may prohibit the pumping of groundwater for drinking water purposes.

IV.2 WATER SUPPLY DEVELOPMENT COMPARISON OF THE OCEAN SIDE AND BAY SIDE BASINS.

The seven Study Area groundwater basins can be divided into two groups: the Ocean Side Basins (Westside and Lobos Basins) and the Bay Side Basins (Marina, Downtown, Islais, South, and Visitacion Valley Basins). All basins are shown in Figure 2B for location. Table 4, below, summarizes the major differences between the Ocean Side and Bay Side Basins. An additional comparison of the Ocean Side versus Bay Side Basins is shown on Figure 5 which is a geologic cross section through the West Side and Downtown Basins.

According to the USGS (Phillips, et al., 1993), leakage from water and sewer pipes provides a significant amount of recharge to the Study Area's basins. Using a conservative four percent leakage rate, it was estimated that leakage from water and sewer pipes accounts for 34 percent of groundwater recharge on the Ocean Side and about 64 percent of that on the Bay Side. This difference is due to the higher population densities and older pipes on the Bay Side, which coincides with greater water use and sewer flows. In addition, there is a greater amount of impervious surfaces on the Bay Side which results in reduced natural recharge.

TABLE 4. COMPARISON OF THE OCEAN SIDE AND BAY SIDE GROUNDWATER BASINS

Characteristic	Ocean Side Basins (Westside and Lobos)	Bay Side Basins (Marina, Downtown, Islais, South, Visitacion Valley)
Geology	Dune sand, Colma and Merced Sands	Colma Sands, bay mud, artificial fill,
Grain Size	generally coarser than Bay Side	generally finer than Ocean Side
Alluvial Thickness	300-3000 ft.	less than 300 ft.
Water Levels (relative)	deep	shallow
Cleanup Sites	few	many
Water Use	current MUN use in Presidio & south of San Francisco City Limits; AG use in SF	no current[1] MUN use (except Albion Water Company)
Pumpage	12,000 acft/yr MUN and AG in Westside	5600 acft/yr pumped for dewatering in Downtown.

[1] In the early 1900's, about 6900 acft/yr was withdrawn from Bay Side Basins, which caused significant drawdown and possible seawater intrusion.

In evaluating the potential for groundwater development, the USGS observes:

> "The thickness of unconsolidated alluvial deposits in a groundwater basin is a primary factor that controls the potential for groundwater development. These groundwater basins have a relatively low storage capacity and provide a minimal buffer zone between the screens of production wells and shallow groundwater that is susceptible to surface contamination. " (Phillips, et al., 1993)

The USGS makes further reference to the development potential of the Bay Side of San Francisco:

" the relatively thin groundwater basins on the east side of San Francisco do not preclude groundwater development in this area. In the early 1900's, about 6,900 acft/yr was withdrawn from east side groundwater basins. This level of development was not without problems because drawdown was significant in some areas, and high chloride concentrations in at least two wells may indicate seawater intrusion (Bartell, 1913)." (Phillips, et al., 1993)

The five Bay Side Basins (Downtown, Visitacion Valley, South, Islais and Marina Basins) do, in parts, contain developable groundwater that meets drinking water standards. However, development of these basins is complicated by the following factors:

- A shallow alluvial section (less than 200 feet thick) that provides little protection from pollution sources;
- A high density of existing groundwater pollution sites (Downtown Basin, and east of Highway 101 for Visitacion Valley, South, and Islais Basins);
- Potential saltwater intrusion;
- Potential for subsidence (Marina, Islais); and,
- High TDS levels and the considerable amount of artificial fill along areas near the Bay margin, such that local groundwater does not meet drinking water standards or yield criteria.

In summary, existing information indicates future groundwater development/use in the Ocean Side Basins is likely. Bay Side Basins are unlikely to be developed for drinking water, however, Downtown Basin is proposed for additional non-potable groundwater use.

IV.3 RECOMMENDATIONS

Based on the analysis of the Study Area's groundwater basins, the Committee recommends the following:

1). Maintain the beneficial use designations of MUN, PROC/IND, and AG in Westside and Lobos Basins. The Board should support full protection and restoration of these valuable basins. This includes aggressive remediation of the polluted groundwater, enhanced source control and groundwater protection to prevent additional pollution, and groundwater basin management to prevent overdraft.

2). Better define water quality objectives and corresponding pollution cleanup levels in areas where probable future use of groundwater for drinking water is unlikely.

3). Consider the Bay front area of the Bay Side basins as a whole to facilitate establishment of an area where non-Sources Policy-based cleanup levels (e.g., risk-based and/or ecological-based) can be considered.

4). Downtown Basin as a whole, is also a candidate for considering non-Sources policy - based cleanup because it is unlikely that groundwater will be used for municipal purposes. It is inappropriate for cleanup levels for groundwater pollution sites in this Basin to be based solely on drinking water standards. Rather, the determination of cleanup levels should be largely based on potential nonpotable uses.

5). Marina Basin is another candidate for considering non-Sources Policy - based cleanup levels because it is unlikely that groundwater will be used for municipal purposes. However, any determination of cleanup levels needs to consider what effect this may have on groundwater pollution cleanup at the Presidio. In addition,

more water samples need to be collected to determine background water quality. There are several fuel leak cases with background wells that would be appropriate for this purpose.

6). The project has been successful in producing GIS - generated maps that integrate new groundwater resources, water quality, and land use data. However, geology data needs modification so that a GIS - generated map may better depict the historic shoreline and corresponding areas of artificial fill.

V. CONSIDERATION OF ALTERNATIVES

This Chapter identifies the project and possible alternatives. In accordance with the California Environmental Quality Act (CEQA), a discussion of the project and associated environmental issues and alternatives is required as part of a Basin Plan amendment. At present, the Committee is not proposing a Basin Plan amendment. However, issues and alternatives have been identified, and are included herein to complete the project and to provide interested parties with a basis for further comments.

V.1 PROJECT DEFINITION

This project evaluated alternatives for updating beneficial uses for groundwaters using current geologic and water use information. The project determined how these alternatives would be applied to groundwaters in San Francisco and Northern San Mateo Counties. The result is proposed revisions to groundwater beneficial use categories. These revisions can be part of a future Basin Plan amendment. In defining and evaluating this project, the following issues and alternatives have been identified.

V.2 ISSUES and ALTERNATIVES

Issue #1: Update Groundwater Beneficial Use Designations to Reflect Currently Available Information:

a). No action
Keep existing designations. They provide the most conservative groundwater protection since almost all Regional groundwaters are designated as suitable or potentially suitable for MUN under the Sources Policy. However, current Basin Plan designations are highly generalized and do not reflect currently available information on individual basins or sub-basins (e.g., information from the USGS, Groundwater Master Plans, County General Plans, and Water District Programs). Through individual groundwater pollution site investigations, decisions can be made regarding whether the current MUN designations, based on the Sources Policy, are appropriate for the Study Area. This may create "pockets" of non-MUN areas, due to localized salinity or low yields, within otherwise highly usable groundwater basins.

b). Develop a process for updating beneficial use designations on a site-specific basis
This process was proposed to the State Board by the Central Valley Regional Board in a July 18, 1995 memorandum (see Appendix E). The proposal addresses the problem that certain groundwaters, currently designated as MUN, do not meet the exemption criteria of the Sources Policy. As a solution, it is suggested that these groundwaters' designations do not need to be formally changed through the basin planning process, because their designations are factually inappropriate. Rather, site-specific applications of the Sources Policy would be made by regional board-

adopted Cleanup and Abatement Orders and Waste Discharge Requirements. The process acknowledges that basin planning resources are insufficient at most regional boards to gather the detailed information necessary to make the appropriate updates.

In response to this proposal, the State Board's Executive Director wrote a letter to the Central Valley Region dated September 22, 1995 (Appendix E). The letter states that the proposal does not appear to be consistent with the Sources Policy or with how it has been interpreted. The letter further states that the proposal "underscores our concern that the broad application of Municipal Use designation for groundwater basins is limiting a more reasoned approach to site cleanup."

c). Update designations basin by basin through the basin planning process
Develop a process for updating basin plan beneficial uses for groundwater, starting with a pilot project in a focused geographic area as a first step. Groundwater basins on the San Francisco Peninsula would be appropriate for the initial focused geographic area. Utilize a committee composed of staff from outside agencies and all Board divisions to augment limited basin planning resources. Apply for outside grant monies, as appropriate, to fund those alternatives that are beyond the current resources of the Board and participating outside agencies. Develop a Basin Plan amendment using the pilot study area as an example of the new process.

Issue #2. Integrate Probability of MUN Groundwater Use Into the Sources Policy:

a). No action
Work within the existing framework, changing the designation of those portions of basins that do not meet the Sources Policy's exemption criteria. Current beneficial use categories recognize "potential" and "existing" uses. The designation process is straight-forward: a groundwater's beneficial use as MUN is considered "existing" if the groundwater is being used as MUN within the basin, its use is "potential" if the groundwater meets the Sources Policy's exemption criteria, or, if neither applies, the groundwater is not designated as MUN. Within many regions of the State, there are areas of potential groundwater use (i.e., where the Sources Policy applies) that, thus, must meet drinking water quality objectives. However, the probability of use of these areas of currently unused groundwater varies considerably. Some have virtually no probability of future use, while others are already planned for use in the near future. Of the factors that determine this probability of use, the Sources Policy's exemption criteria are only a small subset.

b). Revise the Sources Policy to integrate the probability of groundwater use
The Sources Policy would be revised to integrate probability of use. Board staff could work with State Board staff to develop the appropriate amendments and supporting environmental documents to accomplish this revision. This alternative hinges on statewide interest to revise the Policy. Currently, State Board staff have been assigned to update State Board Resolution No. 92-49, which sets policy for waterbody investigation and cleanup. It is likely that this update would have to be completed prior to initiating any new groundwater policy revisions. The need for revision of

the Sources Policy has been raised by many people who prepared white papers for the Senate Bill 1764 committee. The process set in motion by the Senate Bill 1764 committee could perhaps lead to a statewide effort to amend the Sources Policy.

c). Amend Basin Plan to include a new beneficial use category
Working within the current statewide regulatory framework, modify beneficial use designations to include a new category, "probability of use", as a sub-set of "potential" use. The basis for this category would be Water Code Section 13241 which calls for the establishment of water quality objectives that include "Past, present, and probable future beneficial use of water." In addition, the MUN category could be revised to distinguish municipal and domestic supply. Areas with potential domestic use could be designated DOM while those with potential municipal supply could be designated MUN.

d). Create a new state policy to address probability of use
Work with the State and other regional boards to determine interest in creating a new policy to address probably of use's impact on beneficial use designations. This work could coincide with the upcoming Leaking Underground Storage Tank manual revision.

Issue #3: Definition of Probability of Use as MUN:

a). Use the Tiered Approach
The Tiered Approach is a structured decision making method in which the user evaluates basin characteristics to determine the probability of groundwater use as MUN. It uses a flow chart with a set of "yes"/"no" questions to assign probability of use into "high", "limited", "low" and "non-drinking water". Such a flow chart, as developed by the Committee, is shown in Figure 7.

The Tiered Approach is intended for the evaluation of entire groundwater basins for use as public water supplies. Furthermore, it is intended to be conservative. The most conservative cleanup levels would be maintained unless sufficient information is available at any tier to support less protective levels. The Approach is not applicable to basins that have an existing use of groundwater as a drinking water supply.

A trial run of the Tiered Approach was conducted on 200 fuel leak cases in the San Francisco portion of the Study Area. The objective was to determine whether local agency and Board staff could use site-specific information, make the decisions required on the chart, and identify the corresponding probability of groundwater use as MUN at the site. The Approach was difficult to implement because key data was lacking and how to make the decisions required on the chart was confusing. Most fuel leak cases did not have TDS or yield data. This made it difficult for staff to advance beyond the first decision required on the chart. An evaluation of this test run on the Tiered Approach is included in Appendix C.

A draft copy of the Tiered Approach was presented to the Executive Director of the State Board and the eight Executive Officers of other regions. Written comments were received from four regional boards (Appendix F) and are summarized as follows:

Lahontan Region (Chris Maxwell and Ranjit Gill)
1). Some terms on the decision chart need to be defined (e.g., subsidence, economics of water use, and geothermal source).
2). If less protective cleanup levels are established, there will be heavy reliance on natural processes to restore the groundwater basin. These natural processes are complex and dependent on site-specific conditions. The long term goal should continue to be restoration of degraded groundwater basins to their appropriate use.
3). The Tiered Approach concept has potential.

Central Valley Region (Bill Crooks)
1). It makes more sense to designate beneficial uses based on potential use rather than probable use in the Central Valley. This is due to the lack of site-specific knowledge of use patterns along with the high potential for changing use patterns in the Central Valley.
2). State Board staff should develop a mechanism for regional boards to remove unrealistic beneficial use designations through site-specific board orders.
3). If potential use exists, cleanup levels must comply with water quality objectives for that use. Latitude exists in establishing time schedules for cleanup to account for cases where groundwaters have a lower probability of use.

Colorado River Basin Region (Robert Perdue and Abdi Haile)
1). The approach makes sense for urbanized groundwater basins such as in the Silicon Valley. However, for protecting the bulk of California's groundwater, this approach is usually not feasible or fitting.
2). In rural areas, pollution is the exception, pristine conditions predominate, and there is a dearth of socioeconomic and technical data for the majority of groundwater resources.
3). Deciding yes or no at the majority of the decision boxes is not possible for the vast majority of California aquifers.

Central Coast Region (Roger Briggs and Diane Nork)
1). The title suggests that only MUN beneficial uses are addressed. It is acceptable if meant to deal more practically with the Sources Policy. However, we should use this type of evaluation to address all beneficial uses.
2). In terms of implementation, it is cumbersome to amend the Basin Plan to address the considerations outlined in the tiered chart. After State Board Resolution No. 92-49 is in place, the Tiered Approach should be formally proposed as statewide guidance to ensure consistent application of containment zones. Perhaps guidance could be issued by the State Board's Office of Statewide Consistency with public comment obtained by issuing a first draft.
3). How is certainty of supply to be determined?

This Region has also proposed an approach to developing groundwater categories in a March 14, 1994 letter to the State Office of Program Evaluation (Appendix F).

b). Decision Science and Economic Evaluation

Decision Science and Economic Evaluation is a methodology that develops models which incorporate relevant technical and nontechnical parameters and assigns probability to these parameters. To develop these models, the basic steps include: 1) defining the problem, 2) structuring uncertainties, 3) building a quantitative model, and 4) testing the model (as this is an iterative process). The methodology requires coordination with all stakeholders within a study area, including Board staff, outside agencies, industry, environmental groups, and the public as a "project team." Subject matter experts assist as needed. A "decision team", representing those in leadership roles from industry, government, and the Board, would review the results and provide feedback.

The Committee has determined that a demonstration project should be developed that uses a generic formula for classifying groundwater resources based on their overall values, using Decision Science and Economic Evaluation methodology. The model would be tested using the Study Area. If successful, an amendment to the Basin Plan would be prepared, using this method to designate groundwater beneficial uses, set water quality objectives, and establish site-specific cleanup levels.

The expected outcome of a project using Decision Science and Economic Evaluation would be the development of a reasonable, structured, and scientifically defensible method for designating beneficial uses of groundwaters in the Region that incorporates economics and probabilistic analysis into the designation process. In order to pursue such a project, the Committee found that outside funding would be required. This methodology was presented to the Board as an information item on August 23, 1995. The agenda item is included in Appendix G.

c). Hydrogeologic framework

Hydrogeologic Framework is a method of subdividing groundwater basins and their use based on information about geologic materials, hydrogeologic properties and local land use. The method's product would be a map at a scale of 1:24,000 showing the various basin subdivisions along with explanatory text. An October 25, 1995 memo by Board staff discusses this method in greater detail (Appendix B).

1). Information about geologic materials and hydrogeologic properties: Subdividing basins is based on such information uses. The method uses a hydrogeologic classification scheme for the Coast Ranges originally outlined by Farrar and Bertoldi (1988). It subdivides Coast Range geology into two broad groups: 1) consolidated rocks and 2) unconsolidated and poorly consolidated deposits. As discussed by Farrar and Bertoldi,

"[the] consolidated rocks include the sedimentary and low-grade metamorphic rocks of the Franciscan Complex, crystalline rocks of the Salinian block, and the Cenozoic Marine sedimentary rocks. The consolidated rocks are exposed over about 80% of the Coast Ranges and make up the mountain terrain. The unconsolidated deposits are restricted to narrow coastal terraces and valley floors and margins. These deposits consist primarily of uncemented Pleistocene and Holocene alluvial deposits and loosely cemented Pliocene and Pleistocene sediments.

The difference in hydrologic properties between the two groups approach the extremes found in nature. In most areas, the low porosity and permeability of the consolidated rocks so limit their capacity to store or transmit groundwater that, in a hydrogeologic sense, they are more important as barriers to the movement of groundwater and for providing boundaries for sediment filled basins within them. However, because of the diverse lithologies included in this group and the common occurrence of fractured zones associated with faulting, locally the consolidated rocks do contain groundwater that can be extracted from carefully placed wells. The poorly consolidated and unconsolidated deposits are porous and contain saturated sections below generally shallow water tables".

Expanding upon Farrar and Bertoldi's work, the Committee divided the Study Area into hydrogeologic zones as follows: non-water yielding bedrock, unconsolidated deposits and poorly consolidated deposits, bay mud, bay-front artificial fill deposits, and two transition zones identified to protect: 1) potential recharge from bedrock to groundwater basins and 2) ecological impacts to fresh and/or marine surface waters. These areas were delineated on maps using existing GIS coverages obtained from the San Francisco Water Department, the USGS, and the Board. GIS data layers for the following zones are shown on Figure 6 and described below:

Non-Water Yielding Bedrock Zone: This is consolidated rock with low porosity and low permeability. In the Study Area, Franciscan Complex bedrock is the main example of this Zone and consists of consolidated and fractured sandstone, shale, chert, greenstone and serpentine. The Franciscan Complex is highly unlikely to be used as water supply in the Study Area due to: low well yields, the heavily urbanized setting, and the existing availability of a public water supply. Most Franciscan bedrock outcrops currently are not designated as having any existing or potential groundwater beneficial uses. In fact, future development as a municipal supply is so unlikely that the Zone was not even considered as a potential source during detailed studies by the USGS and the San Francisco Water Department. However, to protect the aquifers in the Study Area from migration of pollution from groundwater pollution sites in the Zone, the Committee recommends establishment of a "Potential Recharge Zone" along the alluvial/bedrock boundary, further described below.

Unconsolidated and Poorly Consolidated Deposits Zone: This is the primary water-bearing zone in the Study Area. It consists of uncemented Pleistocene and Holocene alluvial deposits and loosely cemented Pliocene and Pleistocene sediments. This Zone includes the Merced and Colma Formations and undivided surficial deposits that serve as the primary aquifers in the Study Area.

Saltwater Ecological Protection Zone: This Zone would protect the Bay or ocean from discharge of groundwater to surface waters or sensitive habitats, such as wetlands. The Zone is envisioned to be similar to the 300-foot wide Ecological Protection Zone adopted in Board Order No. 95-136, Site Cleanup Requirements for the San Francisco International Airport.

Freshwater Ecological Protection Zone: Same as the Saltwater Ecological Protection Zone above, only for freshwater (e.g., lakes, streams and wetlands).

Potential Recharge Zone: Defined as a potential groundwater recharge zone within the Non-Water Yielding Bedrock Unit adjacent to a water yielding zone. Groundwater pollution cleanup sites located within this Zone would be required to investigate whether pollution from the bedrock site could significantly impact adjacent water yielding zones. The width of this Zone would vary on a site-specific basis.

Bay Mud: Bay mud is a plastic silty clay with some lenses of sand, peat, and shell fragments that extends beneath and along the margin of the Bay (Schlocker, 1974). In the Study Area, the maximum thickness of bay mud is approximately 80 feet (McDonald, et al., 1978). While the bay mud meets the overall definition of unconsolidated deposits as defined above, it does not represent a potential source of municipal, industrial or agricultural water supply for the following reasons: 1) bay mud has an overall low hydraulic conductivity that limits its ability to transmit significant quantities of water to wells, 2) there is a potential for land subsidence if groundwater pumping creates pressure on the bay mud, 3) bay mud areas are, by definition, near the Bay; thus groundwater extraction could cause saltwater intrusion, and 4) from a practical stand point, the bay mud areas have historically been the site of heavy industry, artificial fill and significant sub-regional pollution.

Bay-Front Artificial Fill: Artificial fill is predominantly dune sand but includes silt, clay, rock waste from excavations, man-made debris, and organic waste. The maximum thickness of the artificial fill is approximately 60 feet (Schlocker, 1974). While the artificial fill meets the overall definition of an unconsolidated deposit as defined above, it does not represent a potential source of municipal, industrial or agricultural water supply for the following reasons: 1) the fill itself commonly contains low levels of pollutants, 2) by definition, the fill is near the Bay and thus groundwater extraction could cause saltwater intrusion, and 3) from a practical stand point, the Bay-front artificial fill areas have historically been the site of heavy industry and can contain significant sub-regional pollution.

2). Information about land use: Local planning information can help further refinement of groundwater beneficial use designations. For example, recommendations from the SF Water Department's Groundwater Master Plan directly addressed future uses of the some of the Study Area's groundwater basins. Downtown Basin is being considered for nonpotable uses only (i.e., toilet flushing,

irrigation, and climate control) because of the historic industrial development and the density of identified groundwater pollution cleanup sites located there. The other four Bay Side Basins are not considered for near-term potable use in the Master Plan. However, such use in the future is not ruled out.

In addition, Treasure Island is not considered a source of drinking water because of the limited volume of freshwater associated with its artificial fill (PRC, 1996). Indeed, the areal extent of freshwater is less than 420 acres and the depth to the saltwater/freshwater interface is only 30 feet below ground surface.

Application of Hydrologic Framework to Beneficial Use Designations and Groundwater Remediation

Utilizing the above information provides the basis for the following beneficial use designations and corresponding groundwater remediation management schemes:

Ocean Side Basins: The Westside and Lobos Basins contain significant quantities of high quality water. Full protection of all groundwater beneficial uses for these two basins should be supported. This includes aggressive restoration of the drinking water beneficial use of polluted groundwaters, enhanced source controls and groundwater protection programs to prevent additional pollution, and groundwater basin management to prevent overdraft.

Bay Side Basins: The beneficial uses of groundwater in Downtown Basin should be changed to remove the potential MUN designation while retaining the PROC/IND and AG designations. This is based on the overall poor water quality, the presence of numerous groundwater pollution cleanup sites, and the SF Water Department's Groundwater Master Plan recommendation that the Basin be used for nonpotable uses only. Groundwater remediation efforts should reflect the need to restore groundwater to PROC, IND and AG water quality objectives.

The other four East Side basins (Visitacion Valley, South, Islais, and Marina), contain developable groundwater that generally meets drinking water standards. However, development is complicated by various factors. These factors include the numerous groundwater pollution cleanup sites, the potential for pumping-induced subsidence and saltwater intrusion, and the relatively thin section of alluvial aquifer material. These factors especially constrain water use in the zone along the shoreline. From the Committee's perspective, future development potential appears low. The San Francisco Water Department, however, has not ruled out potable uses in these basins. On the other hand, no current municipal or domestic use exists or is planned. Therefore, managed, passive cleanup or containment zones that restore municipal and domestic use in these basins should be supported as a long term goal.

Non-Water Yielding Bedrock Zone: The potential MUN beneficial uses of groundwater in this Zone should be changed in areas where Franciscan Complex bedrock is exposed at the surface (except the source area for Albion Water Company located near Hunter's Point). Albion Water Company bottles approximately 2000 gallons per day of water from a Franciscan Complex spring located near Hunter's Point. The source area for the bottled water should not be changed. This source area is thus proposed to include the Franciscan Complex above elevation 150 feet within the Hunters Point Peninsula.

The Committee also recognizes that this Zone is potentially capable of yielding small quantities of water suitable for domestic supply. Indeed, in the rural portions of the Region, such use no doubt exists. Thus, this recommendation applies only to the Study Area and should not be expanded to other portions of the Region without adequate study.

Bay Mud: The potential beneficial uses of groundwater for bay mud deposits should be changed because of the generally low yields and potential for pumping-induced land subsidence and saltwater intrusion. Although there is no beneficial use of the groundwater, human health and ecological exposure pathways should be considered when evaluating the need for groundwater remediation. In addition, the potential for vertical and horizontal migration to zones with designated beneficial uses must be evaluated. For example, in Visitacion Valley, bay muds are underlain by alluvial deposits with some water bearing potential. As stated above, passive cleanup or containment zones are recommended for Visitacion Valley alluvium. Groundwater remediation efforts should be guided by the results of an appropriate risk assessment.

Bay-Front Artificial Fill: All potential beneficial uses of groundwater for Bay-front artificial fill should be changed because the artificial fill commonly contains low-level pollution and pumping can induce saltwater intrusion. In addition, from a practical stand point, the artificial fill is frequently located in areas of heavy industry that can contain significant sub-regional pollution. Although there is no beneficial use of the groundwater, human health and ecological exposure pathways should be considered when evaluating the need for groundwater remediation. In addition, the potential for vertical and horizontal migration to zones with designated beneficial uses must be evaluated. Groundwater remediation efforts should be guided by the results of an appropriate risk assessment.

Treasure Island: The beneficial uses of groundwater at TI should be revised to change the MUN designation while retaining the potential PROC/IND and AG designations. TI is a man-made island consisting primarily of sand sediments dredged from the Bay. Future use of groundwater as MUN is

limited because only a small zone less than 30 feet below ground surface contains potable groundwater and any significant pumping of this zone could induce saltwater intrusion. Remediation efforts should reflect the need to restore groundwater to the PROC, IND, and AG water quality objectives.

Incorporating the above recommendations into Table 2-9 of the Basin Plan would result in the following:

TABLE 5. SUGGESTED REVISIONS TO 1995 BASIN PLAN, TABLE 2-9 BASED ON HYDROGEOLOGIC FRAMEWORK

Groundwater Basin	County	MUN	PROC / IND	AG	FRESH
Downtown[3]	SF	C	E	P	TBD
Marina[3]	SF	P	P	P	TBD
Islais	SF & SM	P	E	P	TBD
Lobos	SF	E	P	E	TBD
Westside	SF & SM	E	P	E	TBD
Visitacion Valley	SF & SM	P	E	P	TBD
South	SF	P	P	P	TBD
Treasure Island	SF	C	P	P	TBD
Non-Water Yielding Bedrock	SF & NSM[1]	C[2]	C	C	TBD
Bay Mud and Artificial Fill	SF & NSM[1]	C	C	C	TBD

Notes:
Beneficial Uses:
C - Changed/listed as no use E - Existing P - Potential
MUN - Municipal and Domestic Water Supply PROC/IND - Process and Industrial Supply
AG - Agricultural Supply FRESH - Freshwater Replenishment to Surface Water
[1]Applies to Study Area Only, See Figure 1.
[2]Except Albion Water Company source area (proposed to include the Franciscan Complex above elevation 150 ft. within Hunters Point Peninsula).
[3]Previously this basin was part of the "San Francisco Sands" Basin. This basin has no existing MUN beneficial uses.

Thus, Hydrogeologic Framework is based on a relatively simple method of using information on existing geology and local land use to form the basis for groundwater beneficial use designations. A GIS-derived map at a scale of 1:24,000 has been prepared that illustrates the proposed beneficial use designations based on Hydrologic Framework applied to the Study Area. A reduced map is shown in Figure 6.

In summary, three different methods for defining beneficial uses were considered: the Tiered Approach, Decision Science and Economic Evaluation, and Hydrogeologic Framework. All three alternatives have advantages and disadvantages, and are summarized on Table 6. For the groundwater basins in the Study Area, Hydrogeologic Framework is the preferred alternative.

Table 6. COMPARISON OF METHODS FOR BETTER DEFINING BENEFICIAL USES

Alternative	Advantage	Disadvantage
1. Hydrogeologic Framework	Relatively simple approach that is based on generally available data set.	Width of Ecological Protection Zones and Potential Recharge Zones will vary. Caution should be exercised in changing MUN for non-water bearing bedrock when applied to rural areas where domestic wells tap bedrock water sources.
2. Tired Approach	Considers a wide range of hydrogeologic, water quality, and land use parameters.	Some input parameters are not commonly available (e.g., TDS) or are subjective (e.g., certainty of existing supply).
3. Decision Science	May provide most accurate beneficial use determination.	Requires major commitment of staff time and outside resources to develop.

Issue #4: Establishing Water Quality Objectives:

a). Narrative objectives: Continue to utilize qualitative descriptions for water quality objectives. For example if a basin was designated with an agricultural supply or industrial supply designation, the narrative objectives currently provided in the Basin Plan are:

- "Groundwaters with a beneficial use of agricultural supply shall not contain concentrations of chemicals constituents in amounts that adversely affect such beneficial use..."
- "Groundwater with a beneficial use of industrial service supply or industrial process supply shall not contain pollutant levels that impair current or potential industrial uses."

b). Numeric objectives: Build upon the existing narrative objectives to specify actual numeric pollutant concentration levels that would be acceptable. The Basin Plan has some numeric objectives for groundwaters. However, there are no numeric objectives for agricultural or industrial beneficial uses. The Basin Plan has incorporated by reference the following references for "relevant and scientifically valid water quality goals" for agricultural beneficial uses: the Food and Agricultural Organizations of the United Nations, the UC Cooperatives Extensions, Committee of Experts, and McKee and Wolf's "Water Quality Criteria".

c). Framework for developing site specific numeric objectives: Provide guidance on what factors should be considered in developing numeric objectives. Develop a matrix on probable exposure pathways for agricultural and industrial beneficial uses. Indicate methodologies that are available for determining objectives such as ASTM Risk Based Corrective Action. Developing numeric objectives in this way may require more resources than are available in the basin planning process.

VI. CONCLUSIONS

This report summarizes work conducted by the Committee between 1994 and 1996. The report includes an overview of the regulatory context and its policy implications for groundwater beneficial use designations. Based on these implications, the Committee pursued a pilot project to investigate alternatives to the current ways in which beneficial uses are designated. The pilot project was conducted in a Study Area consisting of the San Francisco/Northern San Mateo County groundwater basins. Hydrogeologic and water use information was assimilated by the Committee, and formed the basis for developing groundwater beneficial use designation alternatives.

VI.I FINDINGS

Based on the work conducted for this project, the Committee made the following findings.

1. The Sources Policy addresses groundwater TDS and minimum yield, but does not provide the flexibility needed to consider other factors for beneficial use designation. These factors include: physical constraints (subsidence, sea water intrusion, surface water levels), institutional factors (such as ordinances, economics of use, capacity, and recharge), and susceptibility to pollution.

2. Considerable flexibility is provided in the Water Code for designating beneficial uses.

3. The Basin Plan's basin identification within the Study Area should be modified to correspond to the recent USGS study (Phillips, et al., 1993).

4. Three different methods for defining beneficial uses were evaluated: the Tiered Approach, Hydrogeologic Framework, and Decision Science and Economic Evaluation. All three alternatives have advantages and disadvantages. For the groundwater basins in the Study Area, the Committee recommends Hydrogeologic Framework as the preferred alternative.

5. Hydrogeologic Framework is a method using existing geologic studies and local planning information to form the basis for groundwater basin beneficial use designations. The Committee used Hydrogeologic Framework to develop the following recommended beneficial use designations and corresponding groundwater remediation schemes (also shown on Figure 6):

   Ocean Side Basins: The Westside and Lobos Basins contain significant quantities of high quality water. Full protection of all groundwater beneficial uses for these two basins should be supported. This includes aggressive restoration of the drinking water beneficial use of polluted groundwater,

enhanced source controls and groundwater protection programs to prevent additional pollution, and groundwater basin management to prevent overdraft.

Bay Side Basins: The beneficial uses of groundwater in Downtown Basin should be changed to remove the potential MUN designation while retaining the PROC/IND and AG designations and water quality objectives. This is based on the overall poor water quality, the presence of numerous groundwater pollution cleanup sites, along with the SF Water Department's Groundwater Master Plan recommendation that the basin be used for nonpotable uses only.

No changes in beneficial uses are recommended for the other Bay Side Basins (Visitacion Valley, South, Islais, and Marina). Therefore, managed, passive cleanup or containment zones that restore municipal and domestic use in these basins should be supported as a long term goal.

Non-Water Yielding Bedrock Zone: The potential MUN beneficial uses of groundwater in this Zone should be changed in areas where Franciscan Complex bedrock is exposed at the surface (except the source area for Albion Water Company located near Hunter's Point). The Committee also recognizes that bedrock, such as the Franciscan Complex, is potentially capable of yielding small quantities of water suitable for domestic supply. Thus, this recommendation applies only to the Study Area and should not be expanded to other portions of the Region without adequate study.

Bay Mud: The potential beneficial uses of groundwater for bay mud deposits should be changed because of the generally low yields and potential for pumping induced land subsidence and saltwater intrusion. Groundwater remediation should be driven by risk assessment that evaluates human health and ecological exposure pathways and vertical/horizontal migration to zones of beneficial use.

Bay-Front Artificial Fill: All potential beneficial uses of groundwater for Bay-front artificial fill should be changed because the artificial fill commonly contains low-level pollution and pumping can induce saltwater intrusion. Groundwater remediation should be driven by risk assessment that evaluates human health and ecological exposure pathways and vertical/horizontal migration to underlying zones of beneficial use.

Treasure Island: The beneficial uses of groundwater at TI should be revised to change MUN while retaining the potential PROC/IND and AG designations and water quality objectives. Future use of groundwater at TI as MUN is limited because only a small zone less than 30 feet below ground surface contains potable groundwater and any significant pumping of this zone could induce saltwater intrusion.

6. As a safeguard to protect the beneficial uses of surface water, the Committee recommends establishment of an Ecological Protection Zone. This Zone would protect the Bay or ocean from discharge of groundwater to surface waters or sensitive habitats, such as wetlands. The Zone is envisioned to be similar to the 300-foot wide Ecological Protection Zone adopted in Board Order No. 95-136, Site Cleanup Requirements for the San Francisco International Airport .

7. As a safeguard to protect the beneficial uses of aquifers from impacts of bedrock groundwater pollution, the Committee recommends establishment of a Potential Recharge Zone. Groundwater pollution cleanup sites located within this Zone would be required to investigate whether pollution from the bedrock site could significantly impact adjacent water yielding zones. The width of this Zone would vary on a site-specific basis.

8. The geology GIS data needs modification so that the map more accurately depicts the historic shoreline and corresponding areas of artificial fill.

9. The project has been successful in integrating new data contained in GIS coverages including data on groundwater resources, water quality, and land use. Similar work should be conducted in other groundwater basins in the Region. Although the Committee-structure worked well for the pilot project, it will be more efficient to assign specific staff to conduct similar work on subsequent basins.

10. A Basin Plan amendment proposing changes to the beneficial uses of San Francisco/ Northern San Mateo County Groundwater Basins should be made after the SF Water Department's Groundwater Master Plan's EIR has been completed.

VI.2 NEXT STEPS

Based on the experience gained on this project, the Committee developed the following actions. These are immediate, short-term steps that are planned for the balance of 1996 and long-term steps that should follow after 1996.

Short term:

- Present draft staff report as an information item to the Board
- Place the draft staff report on the Board's Bulletin Board System and distribute copies to interested members of the public
- Provide copies to State Board and other Regional Boards

- Consider comments and make appropriate revisions

- Track the progress of the SF Water Department's Groundwater Master Plan's EIR

- Develop recommended alternatives and prepare environmental checklist

Long term

- Develop a pilot study to provide closure criteria for Bay Side groundwater basins which do not have MUN beneficial uses.

- Expand the pilot study to other basins with different geology and water use patterns to further test the Hydrogeologic Framework method. The Committee believes that the Framework may have limited application in rural areas supplied by domestic wells. The Framework should also be tested in areas where there is vertical separation of shallow and deep water bearing zones. Figure 8 illustrates basins within the Region that the Committee recommends as appropriate for this evaluation.

- Support local agency efforts for groundwater protection in Westside and Lobos Basin. This may include Board staff participation in the development of an AB3030 groundwater management zone for the Westside Basin.

- Conduct a pilot Decision Science evaluation to compare the method with Hydrogeologic Framework.

- Amend the Basin Plan and/or the Sources Policy.

FIGURES

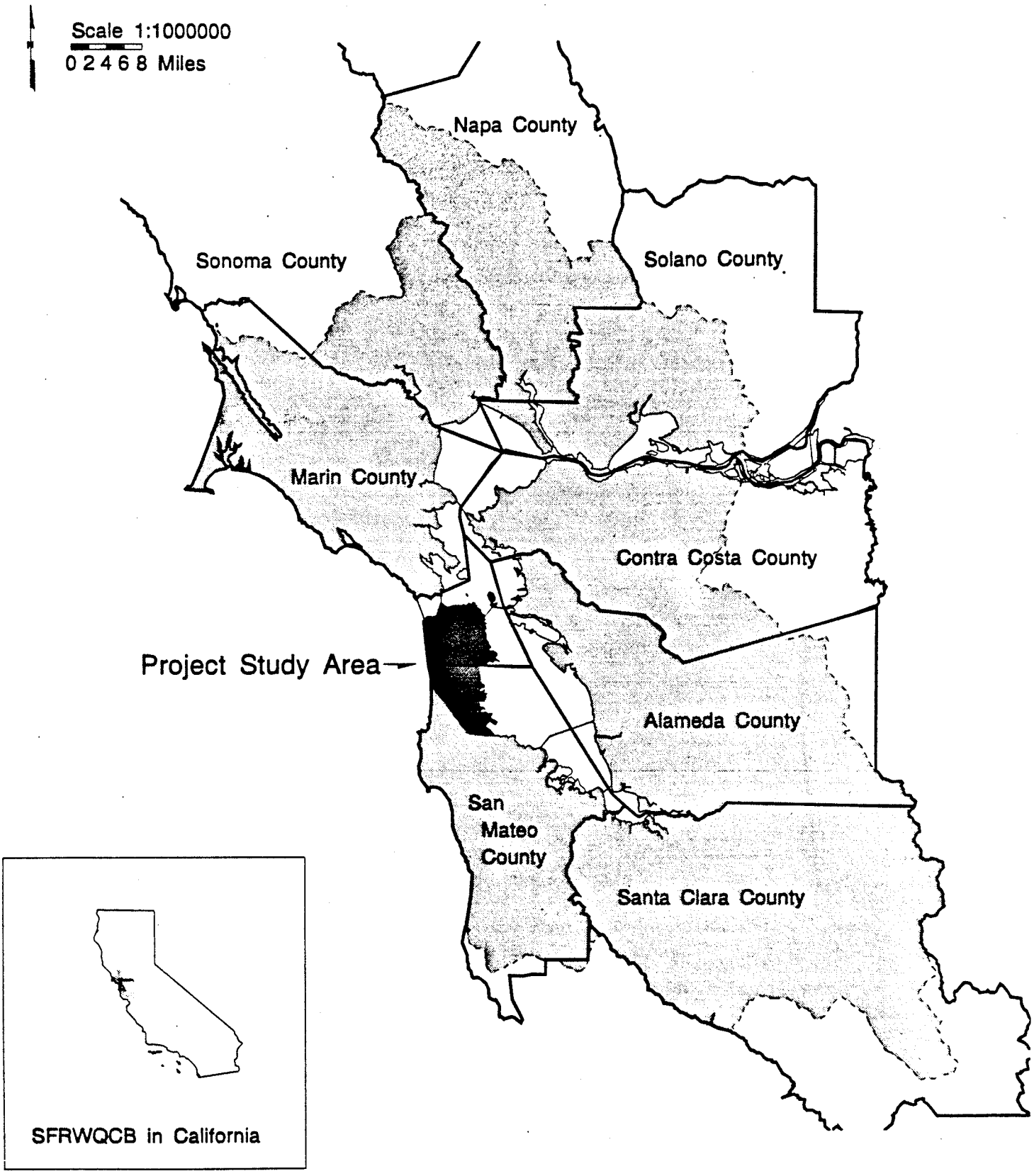

Figure 1: Location Map

Source: Census, REGIS
Maps: Basins, Counties

SFRWQCB February 1996

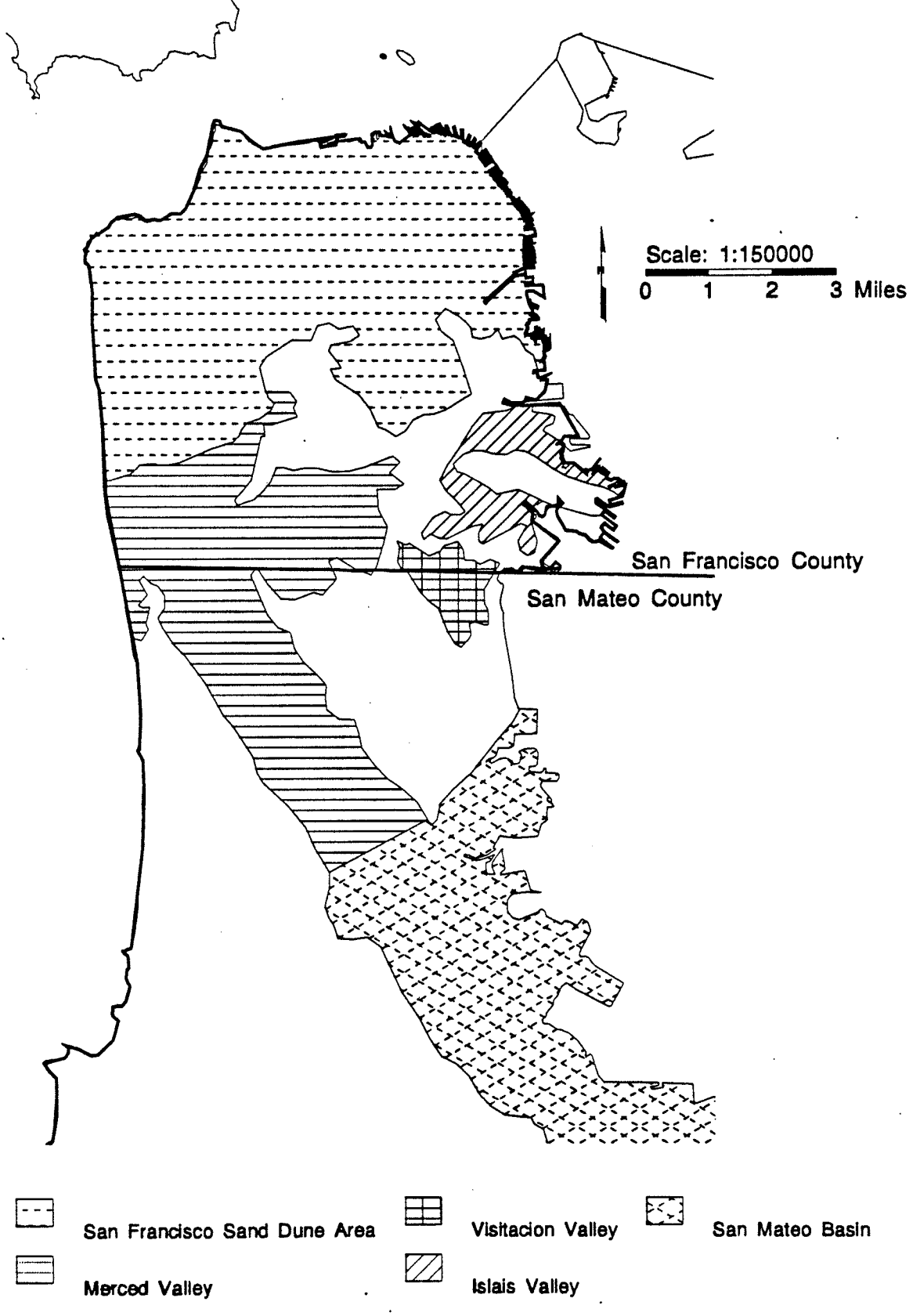

Figure 2A. Groundwater Basins in Basin Plan

Source: DWR
Maps: Groundwater, Sf_cty, Sm_cnty

SFRWQCB February 1996

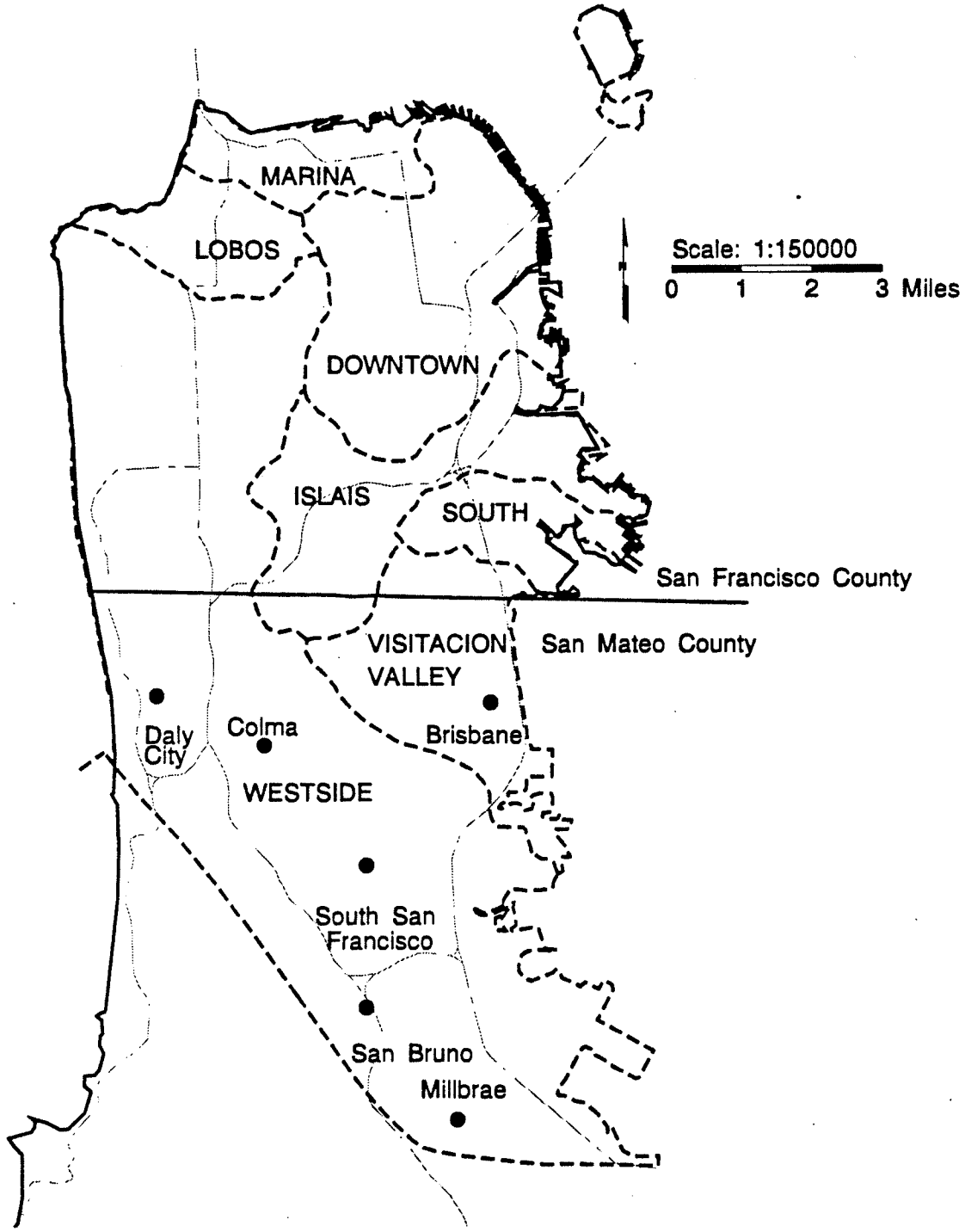

Figure 2B. Proposed Groundwater Basins in San Francisco & Northern San Mateo County (after USGS 1993)

Source: USGS SFRWQCB February 1996

Maps: Groundwater, Sf_cty, Sm_cnty

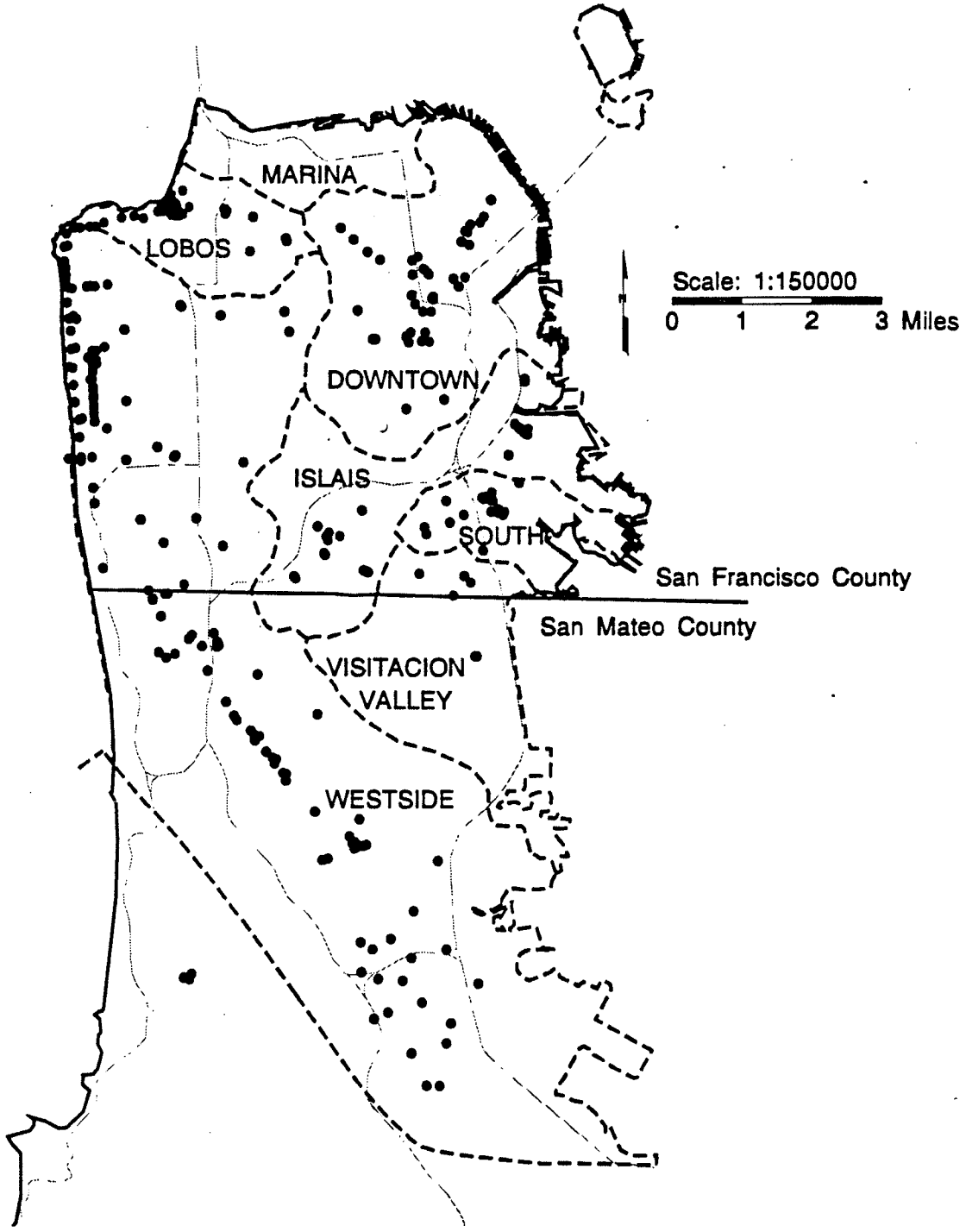

Figure 3. San Francisco Area Groundwater Basins and Well Sites

Source: CH2MHill, USGS
Maps: Basins, Sf_cty, Sm_cnty, Wells

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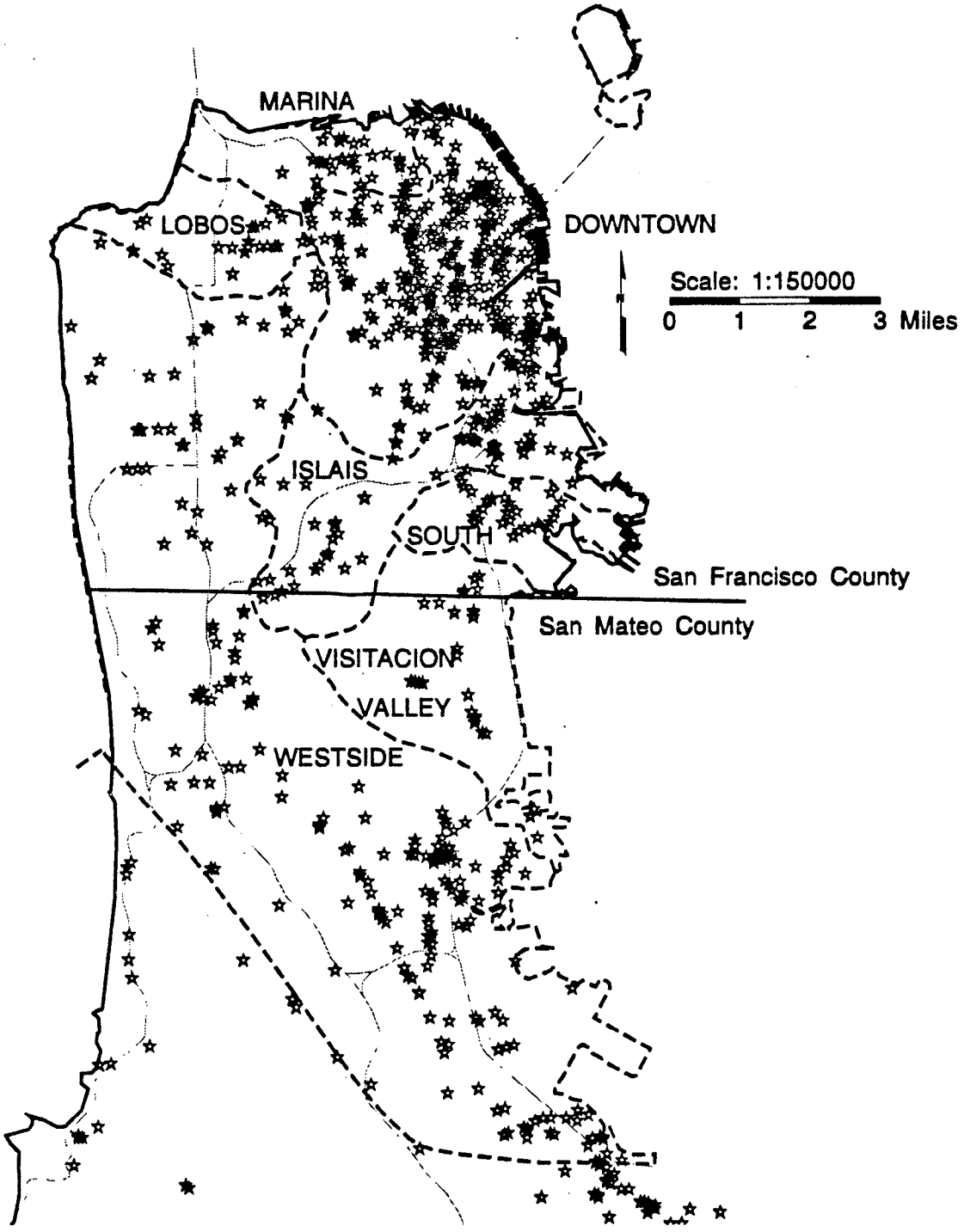
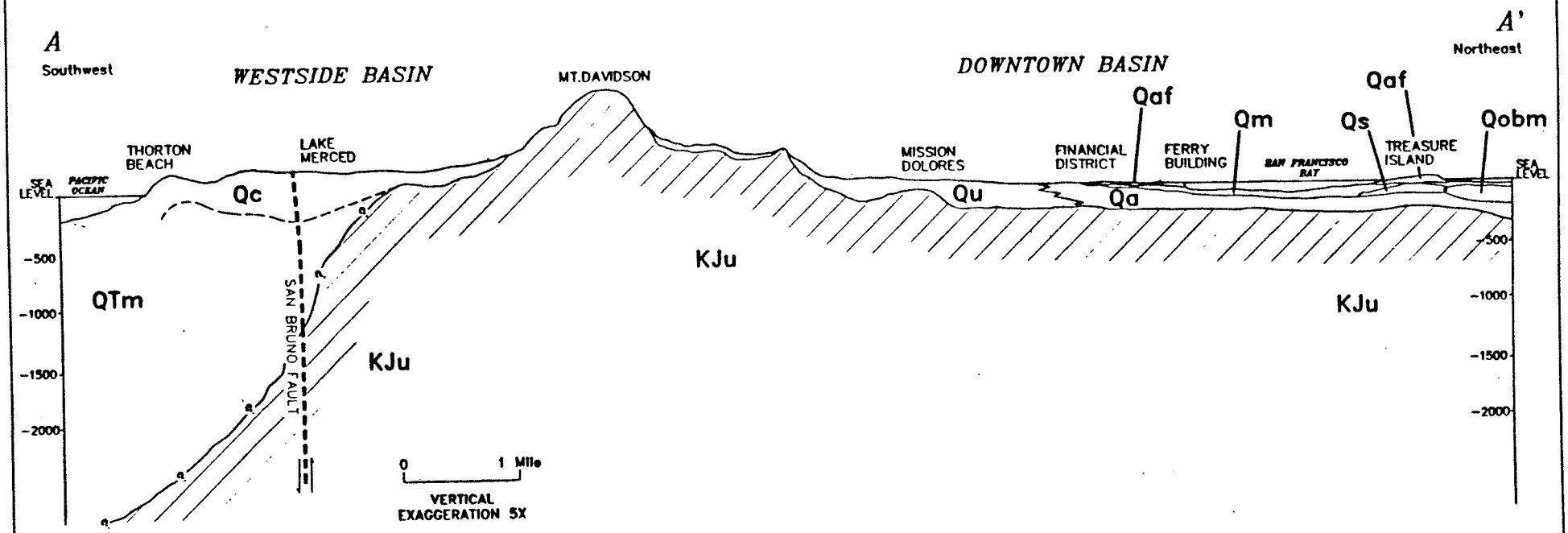
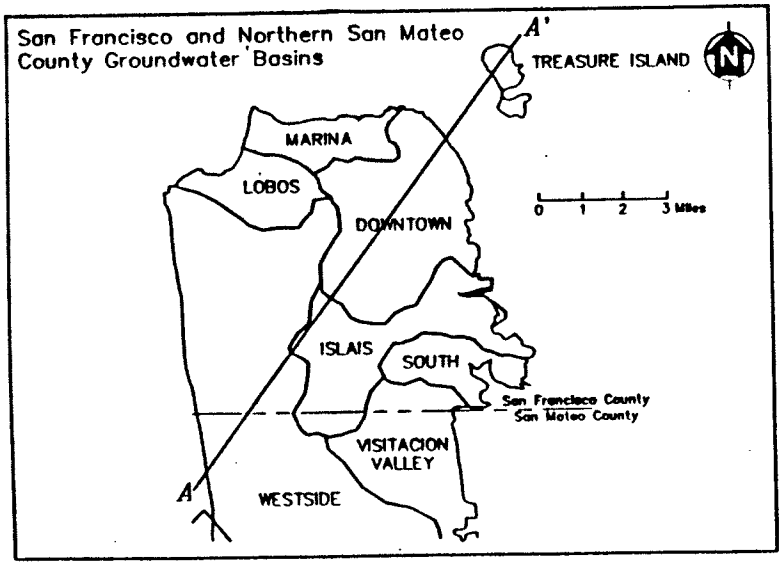


Figure 4. San Francisco Area Groundwater Basins and LUST Sites

Source: CH2MHill, USGS
Maps: Basins, Sf_cty, Sm_cnty, Lust

SFRWQCB February 1996





EXPLANATION

Qaf	ARTIFICIAL FILL
Qm	BAY MUD AND CLAY
Qs	SHORELINE DEPOSITS
Qu	SURFICIAL DEPOSITS, UNDIVIDED
Qc	COLMA FORMATION
Qobm	OLDER BAY MUD
Qa	ALAMEDA FORMATION
QTm	MERCED FORMATION
KJu	FRANCISCAN COMPLEX
	CONTACT

Compiled by Gregory Bartow, C.E.G. from references cited

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California Regional Water Quality Control Board, San Francisco Bay region

Figure 5.

GEOLOGIC CROSS SECTION THROUGH SAN FRANCISCO AND TREASURE ISLAND

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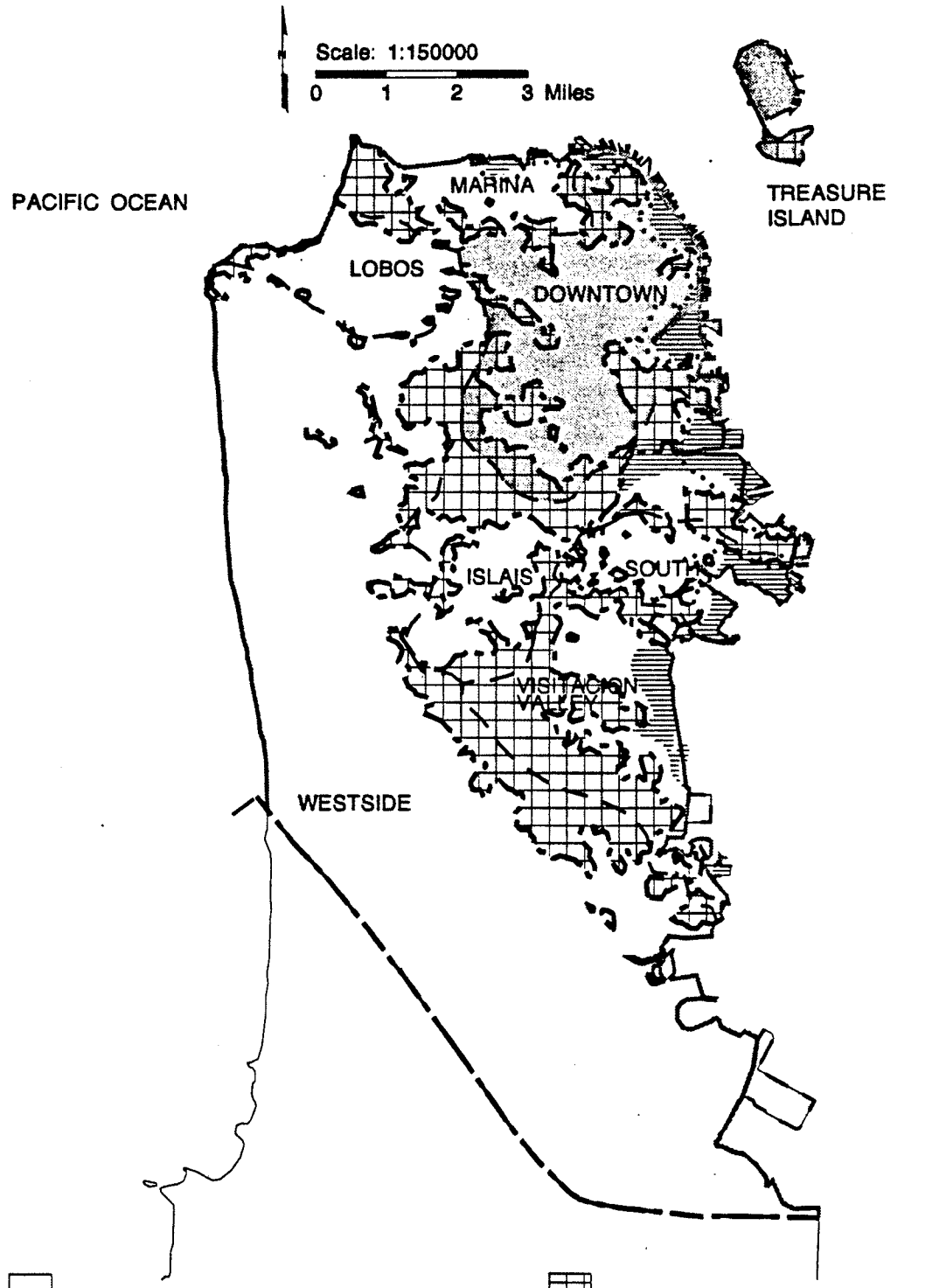
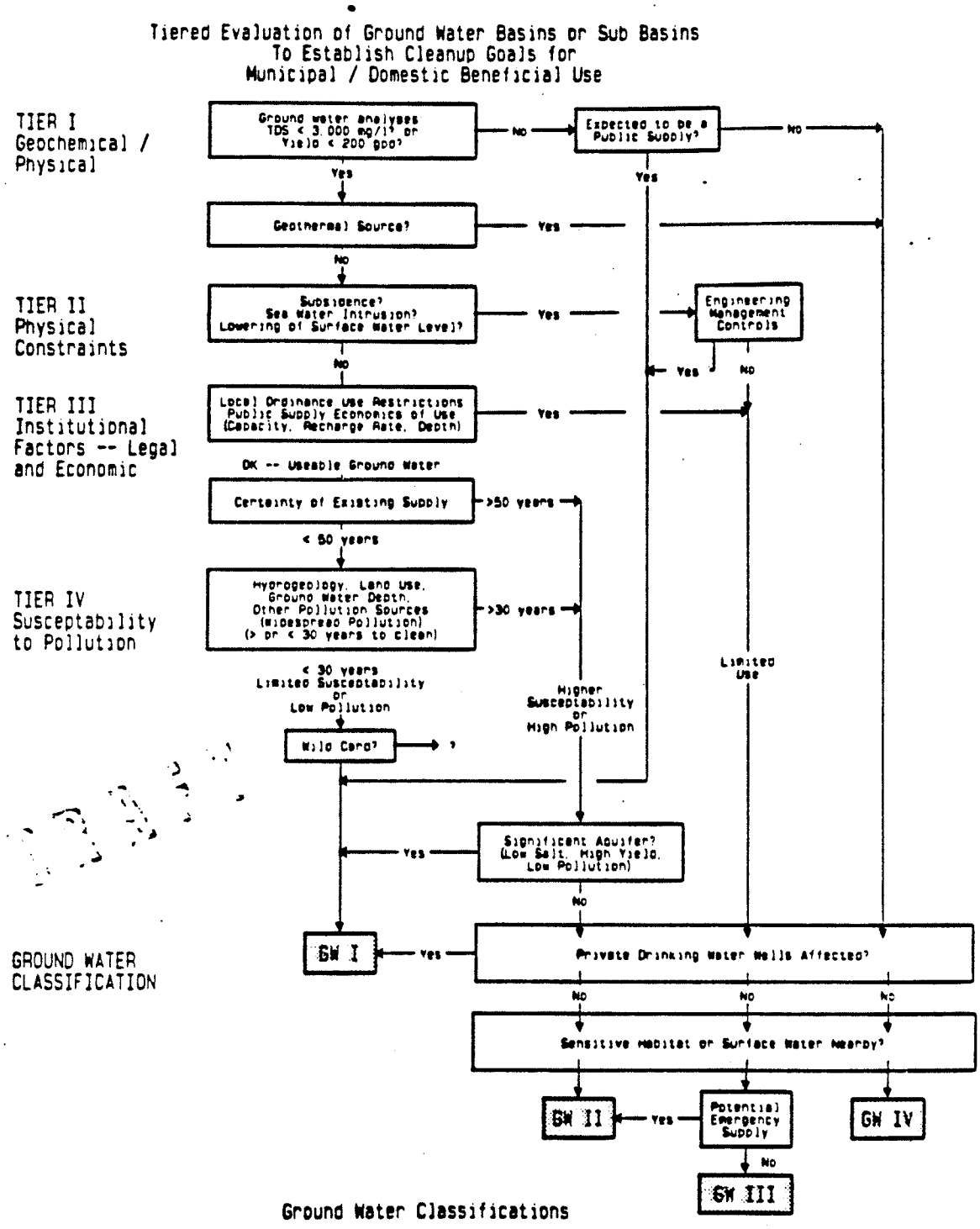


Figure 6: Hydrogeologic Framework

Source: CH2MHill, USGS

SFRWQCB February 1996

Maps: Basins, Bedrock, Shoreline, Mudpoly



Ground Water Classifications

GW I	Currently used or high probability of use -- meets water quality objectives of Basin Plan
GW II	Limited probability of use -- source removal, plume containment, cleanup levels _____
GW III	Low probability of use -- source removal, plume containment, cleanup levels _____
GW IV	Non-drinking water -- source removal.

Notes: For all sites, must meet requirements of higher class if probable pollutant migration to higher class ground waters, and must evaluate impacts on surface water and sensitive habitat.
Revised R2 Ground Water Committee 3/1/95

Figure 7. The Tiered Approach

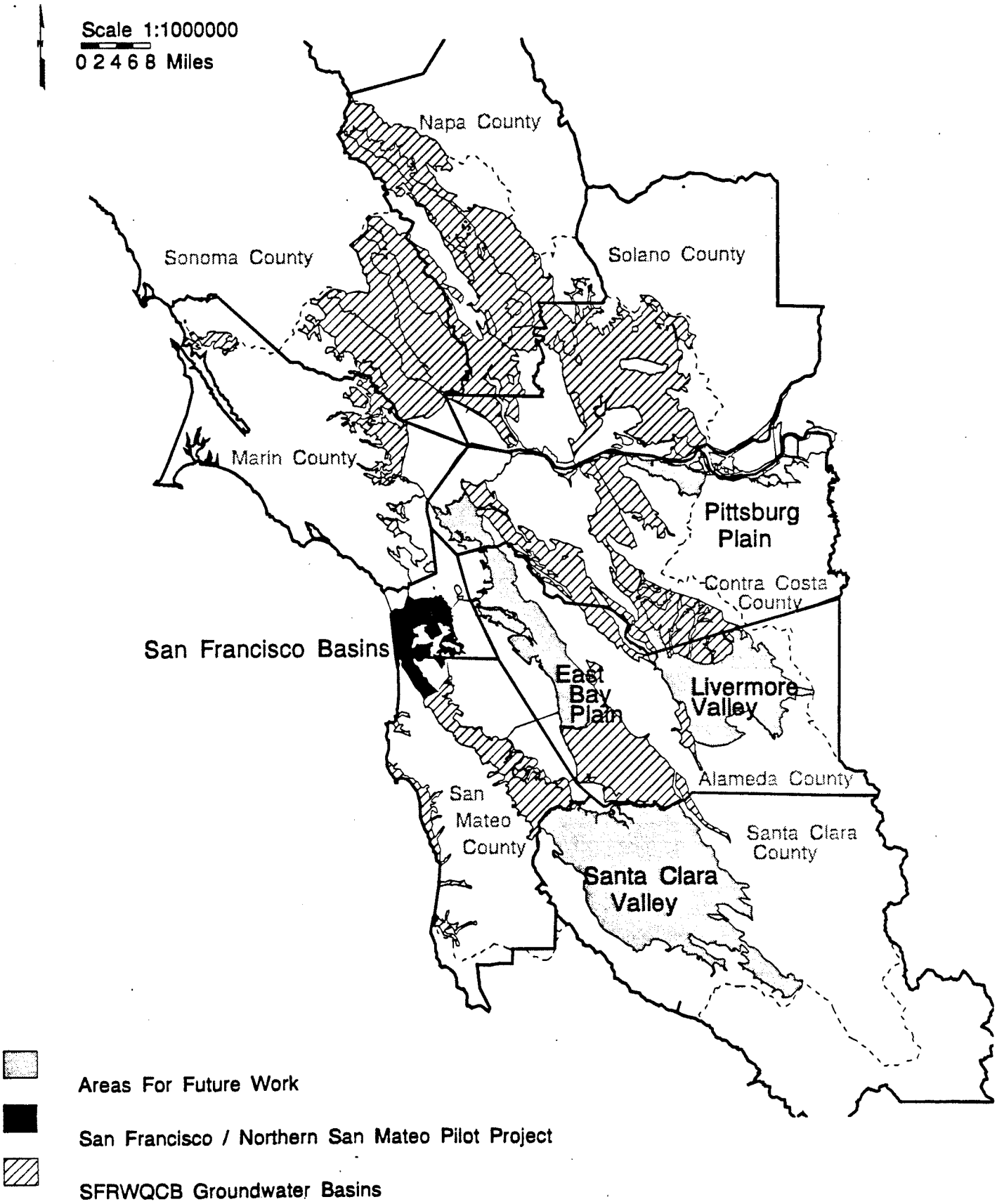


Figure 8. Areas for Future Application of Pilot Project

Source: Census, REGIS, DWR
Maps: Groundwater, Counties

SFRWQCB February 1996

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San Francisco and Northern San Mateo County Pilot Beneficial Use Designation Project

PART II: Appendices

April 4, 1996

Groundwater Committee

San Francisco Bay Regional Water Quality Control Board

San Francisco and Northern San Mateo County Pilot Beneficial Use Designation Project

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TABLE OF CONTENTS

Part II: Appendices

Appendix A. Proposed Marina Groundwater Sampling Project

DRAFT

Proposed Marina Groundwater Sampling Project (6/95)

Problem: No water quality data is available for Marina Basin. Data is needed to support RWQCB Beneficial Use Project. Data may also be useful to City of SF for Masterplan.

Goal: Collect Background Water Quality Data From Marina Groundwater Basin.

Project Description:

Collect samples from clean wells at fuel leak sites for Title 22 analysis (general minerals, general physical parameters, inorganics). Coordinate sampling with regular site sampling. Compile data and write short staff report.

RWQCB Support

- $2000 from lab budget (approx. $260 per Title 22 analysis)
- Staff support for field sampling and data compilation: two associate level staff (approx. 6 total days) and one student (5-10 total days)

Proposed Sites (from Bob Winslow, Pacific Environmental): only two so far ...

Arco 1304 LOP# 10058, well A8, address 2 Richardson Ave. at Lombard St.

Unocal 5469 LOP# 10047 Wells U1,U3, and U4, located at Bay & Taylor.

Appendix B. Memorandum dated October 25, 1995 describing a Hydrogeologic Framework for Better Defining Beneficial Uses of Groundwater

State of California

Memorandum

DRAFT

To: Ground Water Committee - LLS, RA, GK, JEK, DM, SIM, RM, ES, BHW, VBP, VP, WKB & Cherie D'Andrea (City of San Francisco-LOP)

Date: August 29, 1995
Rev. October 25, 1995

Gregory W. Bartow
Associate Engineering Geologist

From: **REGIONAL WATER QUALITY CONTROL BOARD**
San Francisco Bay Region
2101 Webster St., Suite 500
Oakland, CA 94612
TEL: 510-286-0741

SUBJECT: **Groundwater Committee's San Francisco/San Mateo County Pilot Study for Classifying Beneficial Uses of Groundwater**

This memo describes another proposed method for better defining beneficial uses of groundwater. The proposal is basically a method of subdividing groundwater basins based on geologic materials and is an outgrowth of the Groundwater Committee's San Francisco/San Mateo County Pilot Study for Classifying Beneficial Uses of Groundwater. The final product would be a map at a scale of 1"=2000' showing the various subdivisions along with explanatory text.

PROBLEM STATEMENT: The problem we are trying to address is that based on current policy, nearly all areas of the Region qualifies as a municipal or domestic drinking water supply[1]. This causes most groundwater contamination sites to be regulated similarly without respect to geology or probable future use. From a regulatory perspective, it would be helpful if we could create a map that showed areas where groundwater occurs in sufficient quantities to be reasonable considered exists

BACKGROUND: The San Francisco/San Mateo County Project area provides a microcosm of geologic settings found throughout the Bay Area. In addition, the recent work in this area by the USGS (Phillips, et.al., 1993) and the City and County of San Francisco, Public Utility Commission (CH2M Hill, 1993), has provided an excellent data base for the foundation of this project.

The proposed concept is relatively simple and is based a geohydrologic classification scheme for the Coast Ranges originally outlined by Farrar and Bertoldi (1988) that subdivides the rocks and sediments of the Coast Ranges into two broad groups: (1) consolidated rocks and (2) unconsolidated and poorly consolidated deposits). As discussed by Farrar and Bertoldi, "[the] consolidated rocks include the sedimentary and low-grade metamorphic rocks of the

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[1]State Board Resolution No. 88-63 specifies that all groundwaters of the state are suitable, or potentially suitable, for municipal or domestic water supply unless the total dissolved solids exceed 3000 mg/l or the average sustained yield is less than 200 gallons per day.

Franciscan Complex, crystalline rocks of the Salinian block, and the Cenozoic Marine sedimentary rocks. The consolidated rocks are exposed over about 80% of the Coast Ranges and make up the mountain terrain. The unconsolidated deposits are restricted to narrow coastal terraces and valley floors and margins. These deposits consist primarily of uncemented Pleistocene and Holocene alluvial deposits and loosely cemented Pliocene and Pleistocene sediments. The difference in hydrologic properties between the two groups approach the extremes found in nature. In most areas, the low porosity and permeability of the consolidated rocks so limit their capacity to store or transmit groundwater that, in a hydrogeologic sense, they are more important as barriers to the movement of groundwater and for providing boundaries for sediment filled basins within them. However, because of the diverse lithologies included in this group and the common occurrence of fractured zones associated with faulting, locally the consolidated rocks do contain groundwater that can be extracted from carefully placed wells... The poorly consolidated and unconsolidated deposits are porous and contain saturated sections below generally shallow water tables".

PROPOSED SUBDIVISION: Further expanding on Farrar and Bertoldi's work, I purpose to initially divide the area into groups based on hydrogeologic information as follows: Non Water Yielding Bedrock, Unconsolidated deposits (including poorly consolidated deposits), and Bay Front Areas with significant bay mud and/or artificial fill deposits. In addition, two transition zones are identified to protect (1) potential recharge from bedrock to groundwater basins and (2) ecological impacts to fresh water and salt water.

The following GIS data layers are used to construct the map:

Non-Water Yielding Bedrock: As discussed by Farrar and Bertoldi, "in most areas the low porosity and permeability of the consolidated rocks so limit their capacity to store or transmit groundwater that, in a hydrogeologic sense, they are more important as barriers to the movement of groundwater and for providing boundaries for sediment filled basins within them." In the San Francisco/San Mateo County Project Area the Franciscan Complex is an excellent example of this group. However, there are some exceptions to the premise that the consolidated rock does not yield water significant volumes of water. For example, the Black Mountain Spring Water Company located near Hunters Point bottles commercial volumes of spring water that occur in the Franciscan Complex. from . is

Unconsolidated and Poorly Consolidated Sediments: For example Dune Deposits in the West Side Basin and Alluvial Deposits in the South Basin.

Saltwater Ecological Protection Zone: This zone would be to protect the bay or ocean from discharge from groundwater to surface waters. The zone is envisioned to be similar to the 300-foot wide Ecological Protection Zone adopted in the San Francisco Airport Order.

Fresh Ecological Protection Zone: Same as above only for fresh water (e.g., lakes and streams).

Groundwater Recharge Zone: This is a potential recharge zone within the Non-Water Yielding Bedrock Unit adjacent to a Water Yielding Zone. Sites located within this zone would need to access whether groundwater is recharging adjacent Water Yielding Zones. The width of this zone would vary

Bay Mud: Bay Mud does not represent a potential municipal supply areas for the following reasons: (1) There is a potential for land subsidence if groundwater pumping creates pressure on the Bay Mud, (2) Bay Mud areas are, by definition, near the bay; thus groundwater extraction could cause saltwater intrusion and (3) from a practical stand point the Bay Mud areas have historically been the site of heavy industry, artificial fill and significant sub-regional contamination.

Bay-Front Artificial Fill: Artificial fill is unlikely to represent potential municipal supply areas for the following reasons: (1) the fill itself commonly contains low levels of contaminants, (2) by definition, the fill is near the Bay and thus groundwater extraction could cause saltwater intrusion and (3) from a practical stand point the Bay-Front Artificial Fill areas have historically been the site of heavy industry, are generally underlain by Bay Mud and contain significant sub-regional contamination.

Local Planning Information: Finally, by overlaying information in the City of San Francisco's Masterplan, we can further refine our update by incorporating the City's groundwater development plans. For example, the City of San Francisco's Master Plan does not consider either the Downtown of Marina Groundwater Basins to be a potential Municipal Drinking Water Supply. The basis for this determination is summarized in our June 1995 memo.

Utilizing the above layers, a strong case can be made for the following subdivision:

- Current or Probable Municipal Drinking water (e.g., West Side Basin)
- Potential Municipal Drinking Water (e.g., Isalis and South Basins upgradient of Bay Mud)
- Industrial/Ag Use Only: (e.g., Downtown Basin)
- Non municipal drinking water (e.g., Nonwater-yielding bedrock and Bay Mud Areas)

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Appendix C. Pilot Survey of Tiered Beneficial Use Evaluation Methodology

Issues and Suggestions concerning the Tiered Evaluation of Ground Water Basins and Sub Basins

Evaluation: Staff reviewed approximately 200 reports as pilot case studies All the cases were targeted in three basins in the San Francisco County - Los Lobos Basin, Marina Basin, and Downtown Basin. The objective of the study was to determine the effectiveness of the tiered evaluation flowchart. By taking actual cases and going thru the flowchart, staff was able to pinpoint inherent problems with the tiered evaluation process. Staff have made some recommendations on how to remodel the flowchart to be more indicative of actual case management practices.

Tier 1 - Geochemical/ Physical:

Findings/ Problems: 1. As part of the 200 cases reviewed, only 40 cases contained any information on TDS values. Of those 40 cases, 32 cases reported TDS values below 3000 and only 8 cases reported TDS values greater than 3000.

2. TDS values below 3000 is to broad of a definition. A case which has a value of 2800 perhaps should not be classified the same as a case which has a TDS value of 250.

3. Cases which provided values on conductivity did not necessarily correlate with the TDS values also listed from the same monitoring well and sampling.

4. The box containing "Expected to be a public supply?" appears to be a subjective question and needs further clarification. Should the decision be based on qualitative or quantitative reasoning.

Suggestions: 1. Have counties require TDS information.

2. Divide TDS values into further classifications.

** Note - The box containing yield less than 200 gpd should be changed to greater than 200 gpd. **

Tier 2 - Physical Constraints:

Findings/ Problems: 6.The question addressing sea water intrusion was difficult toanswer due to lack of technical information. According to a study of Long Island, sea water intrusion did not occur when ground water was pumped at a distance greater then400 feet away

The contaminatiom from the shoreline. In the Central Coast sea water intrusion has been known to occur up to a 1/2 mile from the shoreline. Further investigation needs to be conducted for the San Francisco Bay.

Suggestions:

5. Divide the flow chart box into separate questions.

Tier 3 - Institutional Factors -- Legal and Economic:

Findings/ Problems:

7. The box containing "local ordinance use restrictions..." needs further clarification. Does "capacity, recharge rate, and depth" imply whether a site is considered economically and physically feasible to supply a region with water, i.e. is there a sufficient amount of ground water to meet the specified regions demand and is it cost effective?

8. How do we evaluate the "certainty of existing supply" based on the information within the reports. The question appears to be subjective. How do we address the number of years in order to be considered certain?

9. There is an inconsistency in terms of number of yearswhen addressing the certainty of existing supply (50 yrs.)with that of hydrogeology (30 yrs.). The time frame being used is to large. It seems to difficult to determine a level of certainty that far in advance.

Suggestions:

7. Divide the flowchart box containing (local ordinance use restrictions..." into separate boxes. We may want the certainty of existing supply and susceptibility of pollution to be judged within the same time frame.

8. Should questions 7 and 8 in the findings and problems section above pertain to only local water departments and districts.

Tier 4 - Susceptibility to Pollution:

Findings/ Problems:

10. The main criteria for answering the question of "significant aquifer" is based on yield, but this information is not available in the reports.

11. What are some items that can be considered "wild card".

Ground Water Classification:

Findings/ Problems:

12. The box containing "sensitive habitat or surface water nearby" needs further clarification. What constitutes a sensitive habitat, how do we judge the sensitivity, and what is considered nearby for surface water?

14. The difference between GW I and GW II is fairly subjective, yet the clean up standards between the two are quite distinct and drastic.

15. Is the evaluation for ground water only suppose to account for drinking water standards or other possible uses?

General Problems and Scenarios

1. The overall flowchart is inconsistent. Some boxes ask specific technical questions while other boxes are subjective and biased. We need to develop a method to make the flowchart uniform.

2. The flowchart is too flexible. For instance, if a case reported a value of 3200 TDS and was not expected to be a public source of supply, the region would be classified as a GW IV. However, if a case reported a value of 2800 TDS and it was expected to be a public supply, the area would be classified as a GW I. The difference between TDS values is relatively small, yet the difference in ground water classifications is quite large in terms of use and clean up costs. Although a flexible flowchart can be applied to a wider array of cases, the flowchart looses its rigidity and does not accurately depict the appropriate ground water classification which seems to defeat the purpose of the evaluation. It may be possible to classify the ground water into 3 classes instead of 4. This would simplify and minimize the subjectivity of the user of the flowchart and create more consistent results. A balance however, needs to be created between the flexibility and rigidity of this flowchart. The flowchart issue is something that still needs to be addressed.

Appendix D. Basin Characteristics

Basin Characteristics

Introduction

This was report was prepared as part of the Groundwater Committee's *San Francisco/San Mateo County Project - A Pilot Study for Classifying Beneficial Uses of Groundwater. Following is the results of the Task 1 Work Group:*

Background

As part of the San Francisco Regional Water Quality Control Board's efforts to establish a more detailed yet more workable approach in addressing the Board's concerns to the maintenance and protection of the groundwaters of this region, a data gathering effort has been made, paralleling San Francisco's Water Department's Groundwater Master Plan Project. It is the hope of Board staff that this study will assist us in being able to identify an appropriate strategy in dealing with the rest of the region's various groundwater basins.

Task 1 Assemble geologic and water use information.

Seven basins have been identified in San Francisco (See Figure 1). These basins are known as the Downtown Basin, West Side Basin, Visitacion Basin, South Basin, Islais Basin, Lobos Basin, and Marina Basin. Staff members that worked on

Cherie D'Andrea (City of San Francisco-Local Oversight Program)	Downtown Basin
Linda Spencer (Committee Chair)	West Side Basin
Diane Mims	Visitacion Valley and South Basins
John Kaiser	Islais Basin
Vic Pal	Lobos Basin
Greg Bartow (Task 1 Leader)	Marina Basin

The following is a summary of each basin:

Downtown Groundwater Basin Characteristics

Depositional Environment - Along the shoreline of the Downtown Basin, artificial fill from the 1906 earthquake is encountered from the ground surface to a depth of approximately 10 to 20 feet, underlain by Bay Muds (10 to 80 feet thick), underlain by Colma Formation sands (40 feet thick).

The majority of the Downtown Basin consists of Quaternary alluvium (Qal), consisting of unconsolidated to weakly consolidated silt, sand and gravel. It includes minor deposits of

Holocene and late Pleistocene beach and dune sand, and marine terrace deposits (0 to 50 m thick), and generally overlies bedrock in valleys and canyons of upland areas. Underlying the Qal and in some localities, outcropping at the land surface is remnants of the Franciscan Formation, basement complex, generally highly deformed and sheared, in response to severe folding and faulting in the Cretaceous period.

According to a geotechnical report for a site in the south of market area of downtown basin, this area occupies a portion of the western slope of a deep buried Franciscan bedrock canyon. This canyon was eroded into the bedrock of the Pleistocene Epoch when sea level was at least 300 feet below its present elevation. The bedrock consists of weathered and fractured sandstone and shale, an it lies approximately 220 feet below the ground surface. Overlying the bedrock are layers of slope debris, sandy marine clay, and thick alluvial sand. A thin marsh deposit overlies the alluvial sand throughout most of the South of Market area. The marsh deposit forms a shallow trough that slopes to the southwest. Wind blown sand (Dune Sand) covers the marsh layer and extends to within approximately 10 feet of the surface.

Basin Boundaries - Areal extent is approximately 7,500 acres. The Downtown Basin is open to San Francisco Bay to the east side and encompasses the Mission Creek and North Beach districts It is separated by the Marina Basin by a bedrock ridge that extends southwest through Russian Hill and Pacific Heights. The ridge continues south to Twin Peaks separating Downtown Basins from the Lobos and Westside Basins. Downtown Basin is horizontally bounded by bedrock; thickness of unconsolidated sediment range form 0 to 200 feet. The unconsolidated sediments are made up of Colma sands, dune sands, artificial fill and bay mud.

Drainage - Historic drainage of the Downtown Basin was likely a creek system. There is evidence of at least two drainage valleys, The unconsolidated sediments in these valleys are likely to be course grained materials.

Toxics - Highest density of HVOCs, TPH, Oil and Grease, PNAs. TPH and nitrate are high. Chloride concentrations are all below secondary drinking water standards. Over 300 Leaking Underground Storage Tank Sites (LUST in Downtown Basin). Hard water > 200 mg/l as $CaCO_3$.
Faults - None reported within basin.

Ground water Flow - From bedrock ridges to historic creek beds and then to the Bay. 5900 af/y (largest amount of any east side basin).

Dewatering - 5600 af/y to sewer flow. 95% of recharged water is pumped for dewatering through the sewer system. San Francisco's sewer system is a combined stormwater/wastewater system.

Water Quality - Seventeen of 21 wells exceeded some or all title 22 standards (total coliform, aluminum, iron, lead, magnesium, manganese, pH, electric conductivity, total dissolved

solids, turbidity. Four wells exceeded standard for bacteriology. PH = 7 to 8.

Transmissivity - 4,900 ft^2/day based on constant pump rate of 35 gpm at 1440 minutes. Results indicate primary water-bearing sediments are hydraulically confined (Yerba Buena Well).

Storage - the volume of water stored is estimated to be 59,500 acre-feet (based on an aquifer porosity of 20%).

Ground Water Resource Potential - Moderate potential for development. Water bearing sediments are relatively thin with maximum saturation.

Ground Water Use - total ground water use = 838 af/y. Powell St. Bart and the new San Francisco library dewatering are discharging 726 of the 838 af/y to the sewer/storm system.

Future Plans - the San Francisco Master Plan proposes (San Francisco Water Department and CH_2M Hill) more detailed studies to evaluate the potential for using the Downtown Basin's ground water for non-potable uses.

Westside Ground Water Basin Characteristics

The Basin is an elongated trough - two miles wide and approx. 11 miles long. Ranging in depth between 500 in Golden Gate Park to about 3,500 feet near Daly City.

Boundaries:
North - Northwest Trending bedrock ridge through NE of Golden Gate Park
East - Bedrock ridge including @ Twin Peaks, Sutro Tower, Mt. Davidson & San Bruno
West - San Andreas Fault
South - uncertain, but taken to be southern extent of Colma formation - south of San Bruno

Drainage:
Surface water - drainage to north, then to ocean in the part of the basin north of a saddle (where coastal hills merge with San Bruno Mountains); south of the saddle drainage is toward the bay

General Geology and Hydrology:
Merced formation overlain by Colma formation overlain by dune sands. The Merced formation ranges in thickness from 0 to 3,000 feet consisting of shallow marine and estuarine deposits with thin layers of mud and peat (10 to 60 feet). The Colma formation ranges in thickness from 0 to 300 feet and is a fine-grained sand and silty sand with some clay (up to 5 feet thick); deposited in shallow marine, estuarine, and eolian. The Dune sands are clean, well-sorted, fine to medium grained sands.

North of Lake Merced the groundwater flow is toward the ocean (toward the west). South of

Lake Merced the flow is toward pumping zones to the south.

Depth to bedrock in the Sunset area is about 390 feet (Bedrock is a weathered siltstone with sand lenses). Primary water bearing zone are between 140 and 330 feet bls. in the Sunset .

Ground water is unconfined in the Colma formation. Moving south into the Lake Merced "district a confining clay layer at about 90 feet is present. The Colma and Merced formations ground water are confined in this area.

Pumpage: (by districts)
Wells generally sustain a rate of 300 to 500 gallons per minute. Two wells in the GG Park area pump > 1,000 gpm.

Golden Gate Park: more extraction possible
Sunset Area: no pumpage - more possible depending on sea water intrusion
Lake Merced: in overdraft condition
So. of Lake Merced: 800 ac-ft/year deficit in deep confined aquifer.

Municipal - 236 acft/yr (Daly City, Cal Water Service, San Bruno)
Golf Courses - 520
Cemeteries/Nurseries - 665
Rec & Park - 425
Total - 3,896 mg/yr (11,957 ac-ft/year)

Water Quality:
Westside Basin meets CCR Title 22 Standards. Hardness > 200 mg/l $CaCO_3$ (some locations greater than 500 mg/l)
some areas of high nitrates; San Bruno has had increasing chloride in wells over past 20 years.

Other Information:
Subsidence modeling using PRESS (predictions relating to effective stress and subsidence). The basin was divided into four areas with a typical clay-dominant well log developed for each. Note that South of the Lake Merced area, no clay layers were found, therefore subsidence is not expected. The Lake Merced north area had the most subsidence with a max of 1.4 feet after 5 years of pumping.

Visitation Valley
Ground Water Basin Characteristics

Aerial Size & Location: The Basin is located on the south east side of the city and county of San Francisco and extends into the San Mateo County. The Basin encompasses 5,100 acres of which 4,100 acres are located within San Mateo County.

Boundaries:
Northern Boundary: Candlestick Park
Southern Boundary: Middle of San Bruno Mountain (on the south west side)/ Oyster Point (south east side)
Western Boundary: John McClaren Park and San Bruno Mountain
Eastern Boundary: San Francisco Bay

Drainage: Surface water drainage is typically to the east towards the bay.

General Groundwater Flow Direction: To the east toward San Francisco Bay.

General Geology: The Basin consists of the Franciscan and Great Valley formations. The bedrock surfaces on the northern boundary and west side of the Basin as San Bruno mountain. The bedrock is overlain by alluvial deposits which tend to increase as they approach the bay. The alluvium begins at the base of San Bruno Mountain and increases from 0 to 200 feet in thickness as it approaches the east or bay side of the Basin. The alluvium along the bay side consist of primarily sands and discontinuous clay layers.

Hydrogeology: Recharge occurs in the northern portion of the basin at a rate of approximately 269 acre feet per year. The groundwater flow is generally towards the bay.

The total volume of water within the Basin is estimated at 20,000 acre-feet of which 12,000 is available for development.

Wells (Historic and Present): There is only one active well within the San Francisco side of the Basin. Historically there have been up to 30 wells of which two had pumping rates greater than 50,000 gallons per day.

Water Quality: There have been two locations sampled for general water quality. Both locations sampled met both primary and secondary MCLs.

Toxics: Most of the toxics sites are concentrated on the lowland or bay side of the Basin. They include several state superfund sites and one Military base (Hunters Point) as well as many USTs sites.

Comments: Additional information is needed with regard to the interconnections between the upper and lower zones. As a first glance, the Basin appears to have potential for future development due to the good water quality (below primary and secondary MCLs) although toxics and recharge must be considered.

South Ground Water Basin Characteristics

Basin Characteristics:
Aerial Size & Location: The Basin is located on the south east side of the City and County of San Francisco. The basin encompasses 2,100 acres.

Boundaries:
North: Hunters Point
South: Candlestick Point
West: John McClaren Park
East: San Francisco Bay

Drainage: Surface water drainage is typically to the east, from San Bruno Mountain, to the east towards the bay. The area historically was drained by two creeks which have been filled and no longer exist.

Groundwater Flow Direction: To the east toward San Francisco Bay.

Geology: The Basin is almost completely bounded by rocks of the Franciscan formation. The bedrock surfaces on the north, west, and south sides of the Basin create a trough which open toward the east. On the west side, the bedrock is overlain by ravine deposits which generally range from 50 to 100 feet in thickness but can be as great as 200 feet thick. The east bay side is primarily reclaimed bay lands. Fill material is up to 140 feet thick and is underlain by bay mud. The bay mud is up to 60 feet thick.

Hydrogeology: There is very little recharge into the South Basin due to rejection or outflow to the bay. It has the smallest recharge rate of the seven basins approximately 700 acre feet per year. The groundwater is very shallow and generally flows towards the bay.
The total volume of water within the basin is estimated at 5,000 acre-feet with an estimated annual recharge rate of 700 acre-feet/year. There are no hydraulic conductivity measurements available, although they are assumed to be similar to the Islais Basin which is estimated at 230 ft/day.

Wells: There are three active residential wells within the Basin. Historically there were 71 wells and 4 springs as of 1913. The average yield was estimated at 538,000 gallons per day. Four of these wells had a pumping rate greater than 50,000 gallons per day.

Water Quality: There have been three locations sampled for general water quality. Hardness was greater than 200 mg/l $CACO_3$ (Title 22 criteria). Two of the locations sampled had exceedences of nitrates.

Toxics: Most of the toxics site are concentrated on the lowland or bay side of the basin. The most noteworthy is the Hunters Point Shipyard.

Comments: The Basin has been used in the past for municipal supply, although the recharge rate appears to be relatively low and the water dose exceed Title 22 for hardness and nitrate. It appears too have some potential in the western portion. Approximately 25% of the basin is overlain by artificial fill. The water quality along the eastern margin appears of poor quality. Furthermore, salt water intrusion from the bay and contamination from toxic sites may hinder future groundwater development.

Islais Valley Groundwater Basin Characteristics

Topographic Boundaries

Within the County of San Francisco the Islais Valley Groundwater Basin occupies about 5000 acres. It extends southwestward into San Mateo County for another 600 acres. Its "U-shaped" northern extent runs along a continuous bedrock ridge beginning in the east from Potrero Point (adjacent the San Francisco Bay) through Bernal Heights, southwest ward then north-west ward through Diamond Heights, and onward to Twin Peaks. Its southern extent, beginning again with a bedrock ridge from the east and running west-northwest ward, begins at Hunter's Point to as far west as Highway 280, where it then changes course southward to the northern edge of the San Bruno Mountains where it follows the mountains' margin westward. The western portion of the basin is defined by the bedrock ridge running northward through Mt. Davidson onward to Twin Peaks. The eastern border of the basin is open to San Francisco Bay.

Geologic Boundaries

The basin is bounded laterally by bedrock with the exception of its eastern extent, which opens to San Francisco Bay. Sediments filing the basin consist of the Colma Formation, alluvium, and to the east towards the Bay, artificial fill and Bay Mud.

Surficial Deposits

The surficial deposits are made up of a combination of Colma Formation sediments and undifferentiated alluvial deposits. To the east, particularly east of Highway 101 are deposits of artificial fill and, underneath them, extensive deposits of Bay Mud.

Colma Formation

This formation, particularly within and to the west of the basin, apparently overlies the consolidated rocks of the Franciscan Complex and/or those of the Great Valley Sequence. The Colma Formation, probably composed of largely reworked materials from the Merced Formation present in the west, consists of flat lying fine grained sand, silty sand, and occasional beds of clay. Within the basin, this formation may reach as much as 100 feet in thickness.

Alluvial Deposits

Within this basin, apparently the alluvial materials which overly the Colma consist primarily of slope debris, and ravine fill. The alluvium in this basin appears to reach a thickness of 60 feet.

Artificial Fill

East of Highway 101 are significant deposits of artificial fill. The thickness of this fill can range in thickness up to 60 feet. The fill contains silt, sand, clay, other natural material and manmade debris both from industrial activity and fill consequent from demolition during the 1906 earthquake. The artificial fill typically overlies the Bay Mud, discussed below.

Bay Mud

The Bay Mud consists of unconsolidated estuarine silty to sandy clays. It reaches thicknesses of up to 60 feet in the eastern portion of the basin. The bay mud extends landward to just east of Highway 101 adjacent to the Bay.

The Franciscan Complex

Although not entirely clear by research of the literature it appears that these rocks are those which constitute the bulk of what can be construed as bedrock within this basin. This complex consists of clastic sedimentary rocks, greenstone, radiolarian chert, metamorphic rocks, and sheared, deformed rocks.

The Great Valley Sequence

This rock sequence consists of sandstones and can be distinguished from the Franciscan Complex by the lesser amount of shearing, and the absence of chert and greenstone. The data reviewed does not clearly indicate the role of this sequence as bedrock in the area.

The basin is dissected in the west by the northwestward trending City College Shear Zone and in the basins eastern extent by Islais Creek Channel the similarly and parallel trending Hunters Point Shear Zone. Both zones are obviously structurally related to the San Andreas Fault Zone. They are discussed as follows:

City College Shear Zone

This zone varies from 0.5 to 1 mile in width. It separates the Franciscan Complex in the northeast from the Great Valley Sequence in the southwest. Given that the shear zone appears to have structurally displaced the bedrock as opposed to the overlying unconsolidated materials, it is believed that this shear zone has little, if any, effect on groundwater flow in the area.

Hunters Point Shear Zone

This zone is from 5000 to 8000 feet in width, extending from Fort Point, through Potrero Hill and to the Hunters Point area. Like the previously mentioned zone, it appears that bedrock is the most affected component of the shearing.

General

The main water bearing units are the Colma Formation and the overlying undifferentiated alluvium. Elsewhere, in bedrock, the fill, or in the Bay Mud, the material has a very low conductivity and is probably highly compressible, thereby further obviating use of groundwater in these materials.

Groundwater flows from the bedrock ridges, towards the basin center and then towards the Bay, no doubt following the "trace" of old Islais Creek which formerly occupied the basin bottom. From a water balance perspective, approximately 2000 acft/yr of groundwater flows from the basin to San Francisco Bay. Specific hydrologic parameters for this basin is non-existent or sparse. However, from an anecdotal perspective, based on past historical uses of groundwater in the area some sense of groundwater use potential can be established.

Historical Uses

One active well has been reported for this basin (415 Delano) but no use or pump capacity information has been provided. In addition, it has been reported that in 1913 there were 208 wells and 4 springs in the area. In actual use there were 182 providing 1,874,050 gallons per day. Of these, thirteen had a yield in excess of 50,000 gallons per day. These wells were in the west and eastern areas of the basin, generally within 2000 feet of the trace of historical Islais creek.

Water Quality Issues

With the exception of areas east of Highway 101, total dissolved solids in ground water is less than 3000 ppm. Apparently, from historical information, some wells in the east experienced an increase in chloride content because of saltwater intrusion problems. Basically, however, groundwater quality tends to be questionable east of Highway 101 which is located within the artificial fill of an industrial area and is nearer the Bay margin. Further, in this area contaminants such as metals, solvents, TPH, and nitrates (from leaking sewage lines?) have been reported.

The area best suited for placement of wells in the basin would probably be near the historic creek bed where the unconsolidated material within the basin would be at its thickest. Further to the east, groundwater development would probably be limited by the existence of more fine grained materials, the presence of contaminated sites within an industrial area, and the proximity of the Bay's saline waters which would make saltwater intrusion a major environmental concern.

The Board presently has approximately 54 known leaking underground fuel tank cases in the area of which 11 have been closed. The bulk of these cases are known to have impacted groundwater with TPH as gasoline. As to other types of Board cases such as those under the SLIC program, these have as yet to be quantified. Of interest, the Southeast San Francisco POTW is located in the eastern part of the basin where it discharges its effluent into Islais

Creek. The effects of this practice, the plant's location, or the effects of its operations on groundwater quality should be checked with staff of the Surface Water Division.

Lobos Groundwater Basin

Hydrogeology

Lobos Basin encompasses approximately 2,400 acres in the northwestern corner of the San Francisco peninsula. The basin is separated from the Westside Basin to the south and the Marina Basin to the north by bedrock ridges. Lobos Basin has a low to moderate potential for development as a groundwater supply. Water bearing sediments in the Basin are dune sands and Colma Formation sediments. The unconsolidated sediments are mainly composed of Colma Formation sand overlain by dune sand. Colma Formation sediments are usually reddish brown fine grained sands with silts and clays intermixed. It appears from pump tests that the Colma Formation may differ slightly with the Colma Sands found to the south in the Westside Basin. One reason may be that the Colma Formation in Lobos Basin has a greater percentage of clays that in the Westside Basin. Dune sands vary in thickness from 0 to 140 feet, but are generally between 40 and 80 feet.

Hydraulic conductivity estimates for Colma Formation sediments range from .62 ft/day to 25 ft/day. Along the Lobos Creek Bed, it appears that high conductivity sediments exist. Groundwater flow seems to be towards Lobos Creek and then towards the ocean. Lobos Creek is thought to be entirely fed by groundwater seepage. Currently, the entire flow is diverted to the water treatment plant at the Presidio. Approximately 70% of the water is used for both municipal and irrigation purposes while the remainder is discharged to the ocean. The flow rate though Lobos Creek was estimated at 1.6 MGD. Several other wells are located throughout Lobos Basin for irrigation and as part of an emergency fire suppression system. These are all small capacity wells in comparison to the wells at the Presidio.

Water Quality

Water quality data in Lobos Basin suggests mixed water quality. Eight monitoring wells were analyzed for TDS, chloride, and nitrates. Total Dissolved Solids ranged 309 ppm to 4000 ppm. High levels of Nitrates were found in 3 of the 8 water samples taken. Chloride samples were below the secondary drinking water standard. Hardness was a problem in all of the samples.

There doesn't appear to be many toxic sites in Lobos Basin. The majority of the groundwater contamination appears to come from the Presidio. In 1989, one well in the Presidio had to be shut down because of the presence of solvents in the groundwater.

There doesn't appear to be any evidence that sea water intrusion has or is occurring. Perhaps bedrock along the eastern portion of Lobos Basin is acting as a barrier.

Summary

Groundwater sampled, in general, met title 22 Drinking Water Standards. Groundwater wells from the Presidio are being used for drinking water without treatment. Treated water from Lobos Creek is currently being used as drinking water also. Groundwater recharge and discharge appear to balance. There is a great potential for groundwater use from continued use of Lobos Creek.

Marina Groundwater Basin Characteristics

Areal Extent: The areal extent of the Marina Basin is approximately 2200 acres.

Boundaries: The Marina Basin is separated from the Lobos Basin by a northwest trending bedrock ridge that runs though the Presideo. It is separated from the downtown basin by a bedrock ridge that runs through Pacific Heights and Russian Hill. To the north the basin is open to the Bay.

Thickness: Varies from 0-200 feet.

Fill: A significant portion of the northern Marina Basin is made up of artificial fill over bay mud. To the south it is generally bay mud overlain by dune sand.

Subsidence potential: Due to the thickness of bay mud there is a potential for subsidence of the ground surface if groundwater pumping creates pressure on the bay mud.

Water Budget: The recharge is estimated at 1341 acft/yr.(USGS) Since there are no active wells, recharge likely equals discharge to the bay.

Historic Pumpage: In 1913, there were 24 wells. Thirteen of the 24 wells were in use and yielded 91,500 gpd. Only two wells exceeded 10,000 gpd; pumping 15,000-20,000 gpd.

Water Quality: No published results. A quick review of a few fuel leaks files was of no help because they monitor for fuel consistuents only.

Comparison of the Westside and Eastside Basins.

The seven San Francisco groundwater basins can be divided into two groups. The Westside Basins including West Side and Lobos Basins and the Eastside Basins including Marina, Downtown, Islais Valley, South, and Visitacion Valley Basins (See Figures 1 and 2). Table 1 is a brief summary of the major differences between the Westside and Eastside Basins.

Table 1. Comparison of the Westside and Eastside Groundwater Basins

Characteristic	Westside Basins (Westside and Lobos)	Eastside Basins (Marina, Downtown, Isalis Valley, South, Visitacion)
Geology	Dune Sand, Colma and Merced Sands	Colma sands, Bay mud, Artificial fill,
Grain size	generally coarser than eastside	generally finer than westside
Alluvial thickness	300-3000 ft.	<300 ft.
Water Levels	low	high
No. of toxic cases	few	many
Interconnection	yes	?
Water Use	current MUN use in Presideo & south of City Limits; AG use in SF	no known current[1] MUN use (except Albion Water Company)
Pumpage	12,000 ac-ft/yr MUN and AG in Westside	5600 ac-ft/yr pumped for dewatering in Downtown.

[1] In the early 1900's about 6900 acre-ft per year was withdrawn from eastside basins (caused significant drawdown and possible seawater intrusion).

Leakage from water and sewer pipes

Leakage from water and sewer pipes provides a significant amount of recharge to the San Francisco Groundwater basins. Using a conservative 4% leakage rate, it was estimated that leakage from water and sewer pipes accounts for 26% to 27% of total city wide recharge respectively. Note that the nationwide leakage rate for sewer pipes is reported to be approximately 10%. Approximately 32% of the water and sewer leakage in San Francisco occurs in the Downtown Basin due to the high population density in this area.

References

California Division of Mines and Geology, 1991, Geologic Excursions in Northern California: San Francisco to the Sierra Nevada, Special Publication 109.

CH2MHill, 1993, Groundwater Resources of San Francisco, Draft Technical Memorandum. Prepared for the San Francisco Water Department.

Phillips, S.P.,et.al., 1993, Geohydrology, Water Quality, and Estimation of Ground-Water Recharge in San Francisco, CA 1987-1992. USGS, Water-Resources Investigations Report 93-4019.

Schlocker, Julius, 1974 Geology of the San Francisco north quadrangle, CA: USGS Professional Paper 782.

San Francisco Department of Public Health - Fuel Leak List dated October 19, 1994

Appendix E. Proposal and Response: Site Specific Beneficial Use Exemptions

MEMORANDUM

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD • CENTRAL VALLEY REGION
3443 Routier Road, Suite A
Sacramento, California 95827-3098
Phone: (916) 255-3000
CALNET: 8-494-3000

TO: Walt Pettit, Executive Director
State Water Resources Control Board
and
Regional Water Board Executive Officers

FROM: William H. Crooks
Executive Officer

DATE: 18 July 1995

SIGNATURE: Bill Crooks

SUBJECT: ***PROPOSAL FOR SITE-SPECIFIC BENEFICIAL USE EXCEPTIONS***

In an effort to be proactive in the debate on streamlining and improving our site cleanup process, while maintaining intact our resource protection policies, I submit for your consideration a proposal for interpreting State Water Board's Resolution No. 88-63, the *Sources of Drinking Water Policy*. as an alternative to the recently distributed *Tiered Beneficial Uses* proposal. Under the Region 5 proposal (copy attached), exceptions to existing ground water beneficial use designations would be permitted as part of Regional Water Board adopted Cleanup and Abatement Orders and Waste Discharge Requirements for site cleanup. The proposal would permit consideration of site-specific information on the appropriateness of beneficial use designations in the development of cleanup standards for a site without the laborious requirement of a Basin Plan amendment. The process of determining cleanup levels under State Water Board Resolution No. 92-49 and Chapter 15 would remain unaltered.

The Region 5 proposal would eliminate consideration in cleanup decisions of water quality objectives designed to protect beneficial uses that are factually inappropriate for the water body in question. Cleanup standards for the site would still be driven by all remaining applicable water quality objectives and the achievability of further cleanup, as guided by feasibility and antidegradation principles. In conjunction with a Non-Attainment Zone policy that reflects the true inability to reach applicable water quality objectives in certain cleanup cases, this proposal would largely answer the current desire for reasonableness in our site cleanup programs.

If you think this proposal has merit, I recommend that the Office of the Chief Counsel draft a written interpretation of Resolution No. 88-63 which facilitates implementation. In addition, I propose that the Central Valley Board implement this interpretation on a portion of the Lawrence Livermore National Laboratory's Site 300 as a test case to gauge discharger and public reaction. The shallow aquifer beneath a portion of this site appears to meet the exception for limited yield.

The underground tank SB 1764 Advisory Committee to the State Water Board has requested white papers outlining changes to our underground tank cleanup program. I intend to submit this proposal to that group as well.

Attachment

cc: Regional Water Board Members
Redding, Fresno, and Victorville Branch Offices
SB 1764 Advisory Committee

PROPOSAL FOR SITE-SPECIFIC BENEFICIAL USE EXCEPTIONS FOR GROUND WATER CLEANUP

Jon B. Marshack, D. Env.
Senior Environmental Specialist
Central Valley Regional Water Quality Control Board

Issue—

Under State Water Board Resolution No. 92-49 and §2550.4 of Chapter 15, cleanup standards are required to protect designated beneficial uses by meeting, at a minimum, applicable water quality objectives. Broadly applicable beneficial use designations currently exist for certain ground waters which cannot support such use(s). Basin Planning resources are insufficient to allow most Regional Water Boards to gather the detailed information necessary to correct this problem through the Basin Plan amendment process. Adopting a Basin Plan amendment to correct the problem for a specific site is too time consuming and cumbersome to permit timely site assessment and cleanup decision making. As a result, cleanup standards are imposed on some sites that are guided by inappropriate beneficial use designations and their accompanying water quality objectives.

A current proposal to address this problem—Tiered Ground Water Beneficial Uses—would alter cleanup level setting policies already established in Resolution No. 92-49 and Chapter 15, and could potentially weaken the Water Boards' ability to protect the State's ground water resources for unrestricted future beneficial use. An alternative solution exists that is compatible with present resource protection mandates.

Proposed Solution—

A preferable solution to the problem would be to allow site-specific application of the exceptions provided by the Sources of Drinking Water Policy (State Water Board Resolution No. 88-63) through Regional Water Board adopted Cleanup and Abatement Orders and site cleanup Waste Discharge Requirements. Site-specific information on such parameters as ground water quality, quantity, and yield that is developed through the site assessment process would be used by the Board to determine the appropriateness of the exception(s), which would be documented through specific and detailed findings in the cleanup order. Cleanup standards for the site would be required, at a minimum, to achieve compliance with water quality objectives designed to protect all applicable beneficial uses which remain after the exceptions are applied, along with the usual feasibility and antidegradation principles. Such a determination would not negate the need for source controls (removal and/or isolation) to prevent a continuing discharge of waste at the site. If compliance with all remaining water quality objectives proves to be unachievable at the site, the Regional Water Board would have the option of establishing a zone of non-attainment.

A policy for establishment of ground water "non-attainment zones" is currently under development at the State Water Board. This proposal is separate from, but compatible with that policy development effort. Non-attainment zones would be used as a last resort, when compliance with applicable water quality objectives is unachievable for technologic or economic reasons.

Background—

To protect both current and unrestricted future use of the State's water resources, beneficial use designations have traditionally been assigned to water bodies based on the ability of the water body to support such uses now or in the future. In many parts of California, beneficial uses have been assigned to ground waters for which limited aquifer-specific data exist on water quality, quantity, yield, and other potentially limiting factors.

Due to the lack of clarity in many Basin Plan beneficial use designations for municipal or domestic supply (MUN) and the need to define the term "sources of drinking water" in Proposition 65, the State Water Board adopted Resolution No. 88-63, *Adoption of Policy Entitled "Sources of Drinking Water."* Due to the lack of detailed data on ground water resources, as discussed above, and the desire not to jeopardize protection for potential beneficial uses, this policy for water quality control assigned MUN to virtually all ground waters of the state. However, to account for cases where the designation of MUN is not appropriate, Resolution No. 88-63 also contains six exception criteria, four of which apply to ground waters:

"1. Surface and ground waters where:

a. The total dissolved solids (TDS) exceed 3,000 mg/l (5,000 µS/cm, electrical conductivity) and it is not reasonably expected by the Regional Water Board [for the ground water] to supply a public water system, or

b. There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices, or

c. The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day.

. . . .

"3. Ground water where:

The aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 CFR, Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR Section 261.3."

Resolution No. 88-63 is not clear on the mechanism for implementation; however, the State Water Board's Office of the Chief Counsel has maintained that *the exceptions* to MUN can only be implemented through Basin Plan amendments. The Water Code assigns the task of beneficial use designation to the State and Regional Water Boards, and the beneficial use designation process provided for in the Water Code is adoption and/or amendment of Water Quality Control Plans. Regional Water Boards, especially in the larger rural Regions, do not have sufficient Basin Planning resources to develop the information necessary to accurately determine the applicability of beneficial use designations and Resolution No. 88-63 exceptions to all ground waters. Amending the Basin Plan is a long and expensive process that does not lend itself to timely decision-making needed in site cleanup.

Discussion of the Site-Specific Proposal—

An alternate interpretation of Resolution No. 88-63 is that both the blanket MUN designations *and the exceptions* contained in the policy were implemented through the basin planning process when each Regional Water Board amended their Basin Plans to incorporate the policy. Therefore, the exceptions already apply to the waters specified by the exception criteria. Under this interpretation, demonstration that one or more of the exception criteria are satisfied for a particular water body or portion thereof would be sufficient to show that the exception(s) to the blanket MUN designations already apply. This alternate interpretation is key to the site-specific proposal. Amending Resolution No. 88-63 may also be necessary to clarify the appropriateness of this interpretation.

If a discharger can demonstrate, to the satisfaction of the Regional Water Board, that one of the Resolution No. 88-63 exceptions is applicable to a particular body of ground water beneath his/her site, the discharger should not be bound to cleanup standards that are based on water quality objectives for protection of MUN. A logical mechanism for timely acknowledgement of such a demonstration is through Regional Water Board cleanup orders. The orders should clearly define the aerial and vertical extent of application of the exemption(s), based on the body of information made available by the discharger and other interested parties. Such orders may also need to contain monitoring and containment requirements and contingency plans designed to protect MUN uses outside of the area for which the exception(s) are clearly demonstrated to be applicable.

Due to the gravity of the decisions and to provide the public with an opportunity to present opposing views in a public forum, these orders should be adopted by the Regional Water Board, rather than being issued by the Executive Officer. Drafts of such orders would be sufficiently noticed and widely disseminated (e.g. published in local newspapers in addition to using the normal mailing lists) to permit all interested parties to review and comment to the Board. Appeal of Regional Water Board acknowledgement of Resolution No. 88-63 exception applicability would be available through the normal appeal process for Regional Board orders. Once sufficient information is developed to demonstrate the applicability of Resolution No. 88-63 exceptions to larger geographic areas or entire aquifers, that applicability would be clarified by the Regional Water Board through specific beneficial use designations in Basin Plan amendments. Additionally, acknowledgement of the applicability of the beneficial use exceptions through Regional Water Board orders for specific sites would be included in the normal triennial Basin Plan updates.

Additional exception criteria may need to be developed to acknowledge situations not covered by the current Resolution No. 88-63 exceptions. Criteria may be needed for exceptions to uses other than MUN. The Central Valley Region recently adopted the following exception criteria for agricultural and industrial supply uses of ground waters (using language that is parallel to the Resolution No. 88-63 exceptions) in amendments to the Basin Plan for the Sacramento and San Joaquin River Basins:

> "In making any exceptions to the beneficial use designation of agricultural supply (AGR), the Regional Water Board will consider the following criteria:

- There is pollution, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for agricultural use using either Best Management Practices or best economically achievable treatment practices, or
- The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day, or
- The aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 CFR, Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR Section 261.3.

"In making any exceptions to the beneficial use designation of industrial supply (IND or PRO), the Regional Water Board will consider the following criteria:

- There is pollution, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for industrial use using either Best Management Practices or best economically achievable treatment practices, or
- The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day."

Additional exceptions to MUN may also be needed where the threat of salt water intrusion or other factors limit the usability of ground water. Any new criteria should be limited to cases where factors unrelated to a specific pollution incident prevent the water body from being able to support the intended beneficial use(s). The additional exceptions could be incorporated into Basin Plans or, to promote statewide consistency, into amendments to Resolution No. 88-63. As mentioned above, amending Resolution No. 88-63 may also be necessary to clarify the implementation of exceptions through site-specific cleanup orders.

If this interpretation of Resolution No. 88-63 is appropriate for site cleanup decisions made by the Regional Water Boards, it also may be appropriate for use in adopting waste discharge requirements for discharges which have the potential to affect ground water quality.

JM

State of California

Memorandum

To : William H. Crooks, Executive Director
Regional Water Quality Control Board
Region 5 (S)
3443 Routier Road, Suite A
Sacramento, CA 95827-2156

Date: SEP 22 1995

Walt Pettit
Executive Director

From : **STATE WATER RESOURCES CONTROL BOARD**
901 P Street Sacramento, CA 95814
Mail Code G-8

Subject: YOUR PROPOSAL FOR SITE SPECIFIC BENEFICIAL USE EXCEPTIONS

As we understand it, your proposal would interpret State Water Resources Control Board (SWRCB) Resolution 88-63 to allow exceptions to beneficial use designations for certain ground waters without going through the basin plan amendment process.

Your proposal does not appear to be consistent with the language of the resolution or with how the resolution has been interpreted. The "exceptions" as you call them are in reality new or revised beneficial use designations. That is, such designations are established (or revised) based upon the exception language in Resolution 88-63. It is the designations that must be made through the basin planning process. In fact, several amendments to basin plans to apply the exceptions have been adopted by Regional Water Quality Control Boards and approved by the SWRCB since Resolution 88-63 was adopted. Your suggestion that the exceptions have already been implemented when Resolution 88-63 was incorporated into the basin plan, is not consistent with this picture of applying the exception language to individual situations through the basin planning process. It also does not appear to be consistent with the definition of "water quality control plan"(Water Code Section 13050(j)). Under this definition, beneficial use designations are to be designated for waters within a specified area. In order to apply an exception to a given area, a specific designation is needed. Thus, while the "rules" of the Resolution qualify as use designations, the exceptions do not.

Your proposal underscores our concern that the broad application of Municipal Use designations for ground water basins is limiting a more reasoned approach to site cleanup. This may be particularly true for petroleum fuel releases which have affected shallow ground water in localized areas and where the resulting fuel leak plumes are not spreading but instead are naturally degrading. There are over 10,000 leaking underground storage tanks sites which have produced a plume of petroleum constituents in ground water.

We therefore are looking forward to the findings of the Lawrence Livermore study and to the recommendations of the SB 1764 Advisory Committee. We are also reviewing how proposed SWRCB policy to allow the establishment of Non-attainment Zones will affect cleanup of petroleum fuel release sites.

If you have questions concerning this subject, please call Harry Schueller at (916) 227-4428.

cc: William Attwater, OCC

Appendix F. Comments on the Tiered Approach

CALIFORNIA REGIONAL WATER
JUN 0 2 1995
QUALITY CONTROL BOARD

State of California

Memorandum

Date: May 30, 1995

To: Steven R. Ritchie, Executive Officer
Regional Water Quality Control Board
San Francisco Bay Region
2101 Webster St., Suite 500
Oakland, CA 94612

Harold

HAROLD J. SINGER, EXECUTIVE OFFICER

From: *California Regional Water Quality Control Board*
Lahontan Region
2092 Lake Tahoe Boulevard
South Lake Tahoe, California 96150
(916) 542-5400 Fax (916) 544-2271

Subject: **COMMENTS ON TIERED GROUND WATER BENEFICIAL USES CONCEPT FOR ESTABLISHING CLEANUP GOALS AT POLLUTED SITES**

I appreciate the opportunity to provide comments on the tiered ground water beneficial uses concept which has been developed by staff of your office. Staff of the Lahontan Region (Board staff) have reviewed the flowchart and table which was provided as an explanation of the concept. I have comments regarding two issues. First, several terms used in the flowchart need to be clearly defined. Second, it appears that the concept relies greatly on the natural processes of dilution, bioremediation, and attenuation to restore ground water quality over some period of time. For example, the Groundwater Quality Objectives table distinguishes between chemicals which are easily biodegradable versus chemicals which are persistent in the environment. No other factors which may affect the natural processes of remediation appear to be considered.

Definition of Terms

The flowchart uses terms such as geothermal source, subsidence, economics of water use, and certainty of existing supply. These terms are then used to determine if the water body is classified as a Category I, II, III, or IV beneficial use. A document should be prepared which clearly defines all of the terms used in the flowchart.

Natural Remediation Processes

Board staff have typically worked with dischargers in an attempt to restore degraded water to as close to background conditions as is feasible. Although I agree that consideration should be given to less restrictive cleanup levels at specific sites, the long-term goal should continue to be restoration of degraded water bodies.

State of California
MEMORANDUM

To: Linda Spencer
Assoc. Engineering Geologist
Region 2

Date: May 16, 1995

From: Phil Gruenberg, Executive Officer
California Regional Water Quality Control Board
Colorado River Basin Region -- 73-720 Fred Waring Drive, Suite 100
Palm Desert, California 92260

Subject: Tiered Evaluation of Ground Water Cleanup

I requested staff to review and comment on the subject concept. Attached are comments prepared by Robert Perdue and Abdi Haile.

In general, due to complex ground water hydrological situations and lack of satisfactory assessment thereof, we prefer the case-by-case evaluation we have been using in this Region. Although your proposal makes sense for Region 2 and perhaps other Regional Boards, we must recommend against adoption of a Statewide policy unless substantial modification is considered to address our somewhat unique situations - which represents a difficult effort at best.

Thank you for the opportunity to review and comment.

PAG/slh

cc: Walt Pettit, Executive Director
Dale Claypoole, Deputy Director
Barbara Evoy, Office of Statewide Consistency
Regional Board Executive Officers

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

INTERNAL MEMO

TO: Phil Gruenberg, Executive Officer

FROM: Robert Perdue, Sr. Eng. Geologist

DATE: May 16, 1995

SIGNATURE: Robert E Perdue

SUBJECT: Region 2 Policy Modification for Tiered Evaluation via Probable vs. Potential Beneficial Uses

California is predominantly a rural State. The vast majority of the population is concentrated in the greater Los Angeles, San Francisco and San Diego areas. However, the vast majority of the State's ground water resources lie outside these population centers. Therein lies the rationale for not adopting the tiered/probable beneficial use policy statewide.

In a densely populated area, socioeconomic drivers may control the daily activities of a Regional Board faced with an overwhelming number of cleanups. Prioritization is needed so that at the very least, the obvious, actively used drinking water sources can be stringently protected. Using the abundant socioeconomic data (Institutional Factors - Legal and Economic, local ordinances, Public Supply Economics and < > 30 years higher and lower susceptibility)) and abundant technical data (TDS, yield, capacity, recharge rate, depth, etc.) ground water basins can be evaluated through the tiered decision tree. Basically, if an aquifer is presently being used as drinking water or will likely be a drinking water supply for less than 50 years, then the expenditure of limited staff and budget of the Regional Board is warranted.

As a management policy tool in a densely populated urban area with contamination being more the rule than the exception (Silicon Valley, for example), the tiered approach may be fitting and feasible. However, in the overall scheme of protecting the bulk of California's ground water, this approach is usually not feasible and therefore not fitting.

In rural areas such as Eastern Riverside and Eastern San Bernardino Counties, contamination is the exception and the given is nearly pristine conditions with a dearth of socioeconomic and technical data for the lion's share of the ground water resources. The available data base may consist of a few wells at an abandoned farm sitting at the head of a 200 square mile valley or at best a small city in a large sparsely populated county.

In short, deciding yes or no at the majority of the decision boxes in the tiered evaluation decision tree is not possible for the vast majority of the aquifers in California. Therefore, the present policy of setting cleanup goals based on the potential beneficial uses is more appropriate Statewide. Individual Regional Boards in densely populated areas should be given the flexibility to establish and consider probable uses but imposing the probable beneficial use policy on the sparsely populated Regional Boards which are the guardians of the bulk of the ground water is unwarranted.

REP/slh

cc: Gary Morris

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

INTERNAL MEMO

TO: Phil Gruenberg, Executive Officer

FROM: Abdi Haile, Sr. Eng. Geologist

DATE: May 16, 1995

SIGNATURE: Abdi Haile

SUBJECT: Comments on Tiered Ground Water Beneficial Uses

Conceptually, the proposed approach is a good start. However, some modifications might be needed to get the desired result. For instance, it oversimplifies complex ground water basin conditions by assuming constant total dissolved solids throughout the aquifer. It also assumes distinctive ground water bodies. But, in reality, the majority of ground water basins are not fully characterized.

This approach requires that all ground water contamination be cleaned up to drinking water standards, unless it can be proven that there is no probable pollutant migration to higher class ground waters. The burden of proof is also on the discharger. For example, in Imperial County where the shallow ground water has a relatively high TDS, the discharger would have to either clean it up to drinking water standards, or prove that the aquifer is completely isolated and poses no threat of pollutant migration to the underlying/adjacent ground water basins. Such proof requires full characterization of the hydrologic properties and boundary conditions of the shallow aquifer. Proving it could be so costly that cleaning up the contamination may be a better option. But, if the intent of the proposal is to force dischargers to clean up the contamination, regardless of condition, it certainly does.

Overall, this plan addresses the ground water pollution problem fairly well. However, the probable pollutant migration issue needs further analysis.

AH/slh

MEMORANDUM

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD • CENTRAL VALLEY REGION
3443 Routier Road, Suite A
Sacramento, California 95827-3098
Phone: (916) 255-3000
CALNET: 8-494-3000

CALIFORNIA REGIONAL WATER
MAY 3 0 1995 LLS
QUALITY CONTROL BOARD

TO: Walt Pettit
Executive Director
State Water Resources Control Board

FROM: William H. Crooks
Executive Officer

DATE: 25 May 1995

SIGNATURE: Bill Crooks

SUBJECT: *TIERED BENEFICIAL USES FOR GROUND WATER CLEANUP*

You asked for our comments on the subject proposal, presented by the San Francisco Bay Region at the last ECC meeting. Generally, we agree that it makes sense to impose less onerous cleanup requirements where ground waters have a low potential for beneficial use. However, our lack of detailed site-specific knowledge of use patterns along with the high potential for changing use patterns in the Central Valley Region make the details of the subject proposal less workable here than in a smaller, mainly urban region like the San Francisco Bay area. In our situation, it makes more sense to establish beneficial uses based on the *potential* for use rather than the *probability* of use.

Where knowledge does exist to be able to establish, with certainty, that a body of ground water has a negligible potential for beneficial use, we should recognize this by removing unrealistic beneficial use designations. We suggest that State Board staff develop a mechanism whereby Regional Boards would be able to apply exceptions to the "Sources of Drinking Water" policy through site-specific Board orders to account for situations where existing broadly-applicable beneficial use designations do not make sense.

Using different cleanup standards based on the degree of *probability* for beneficial use will not ensure that the resource will become usable at some point in the future. If that *potential* for use exists, cleanup standards must, at a minimum, comply with water quality objectives. The Regional Boards have sufficient latitude in establishing time schedules for cleanup to be able to account for cases where ground waters have a lower *probability* of use.

cc: Regional Board Executive Officers
Barbara Evoy, Office of Statewide Consistency, State Water Resources Control Board
Linda Spencer, San Francisco Bay Regional Water Board, Oakland

State of California
MEMORANDUM

To: Linda Spencer, Associate Engineering Geologist
RWQCB - San Francisco Bay Region
2101 Webster St., Suite 500
Oakland, CA 94621

Date: May 23, 1995

From: Roger Briggs, Executive Officer
RWQCB - Central Coast Region
81 Higuera Street, Suite 200
San Luis Obispo, CA 93401-5427

Subject: **TIERED GROUND WATER BENEFICIAL USES (ECC ITEM 7)**

Like Region 2, our region has also been discussing the need to better combine site-specific considerations, probability of water use, cleanup level establishment, and our Basin Plan's water quality objectives. The Executive Officer's Ground Water Committee was zeroing in on this concept before we were sidetracked on trying to turn smooth sailing Regional Basin Plan amendments into smooth sailing changes to 92-49. Our initial attempts focused on a matrix for developing appropriate cleanup levels based on various hydrogeologic settings and types of contaminants (dissolved phase and separate free phase). Our second variation combined the hydrogeologic concerns with "probability of water use" (not limited to the MUN beneficial use), risk management, and best practical treatment determination. Although our efforts were more in the conceptual stages than the Tiered Evaluation approach, it is very encouraging that you've developed the idea further.

The main difference between our approaches lies in your title that identifies "Municipal/Domestic Beneficial Uses". If the Tiered Evaluation is meant to deal more practically with SWRCB Resolution No. 88-63 (Sources of Drinking Water), then the title seems sufficient; however, it seems that we should use this type of evaluation to address all beneficial uses (and in fact, other beneficial uses are considered in the flow chart where ground water classifications II, III, or IV are applicable). Perhaps changing the title by deleting "Municipal/Domestic" would alleviate the misconception. I suggested changing the title of 92-49 non-attainment zones to Zones of Acceptable Risk (ZAR), but Harry said I was too late. This time, I'm suggesting it right away!

Returning to the issue of Resolution No. 88-63 ... at a March 1995 training class for DoD Program staff, Phil Wyels of OCC specifically indicated that although criteria for excluding MUN designation are identified in Resolution No. 88-63, the resolution is <u>not</u> self-implementing (in other words, you'd still need a Basin Plan Amendment to de-designate a water body from the MUN category). Clearly, it is cumbersome to amend a Basin Plan to address the practical considerations outlined in the Tiered Approach; however, 92-49 amendments would provide a mechanism for ZAR designations without Basin Plan amendments. During the ECC discussion, I understood that we would formally propose the Tiered approach after 92-49 amendments are in place, as statewide guidance (policy?) to provide more consistent application of ZARs (if I use that acronym enough, it will become institutionalized). I would think <u>guidance</u> issued by the Office of Statewide Consistency would suffice as far as the vehicle for this idea. Public comment could be obtained by issuing a draft first.

Our specific comments and suggested changes on the flow chart and the Ground Water Quality Objectives table (Matrix) are as follows:

Flow Chart Comments

Tier III:	How is "Certainty of Existing Supply" (less than or greater than 50 years) to be determined?
Tier IV:	Add "Contaminants' chemical and physical properties" to the box.
	"Wild Card" ... you make my heart sing. What does it mean? Is there really any option other than GW I?
Ground Water Classification: (on flow chart)	"Yes" or "no" responses should be included alongside downward arrows leading from the "Sensitive Habitat ...?" box. For instance, "Yes" should be added above GW II; "Yes" should be added above "Potential Emergency Supply"; and "No" should be added above GW IV.
GW I:	"Meets water quality objective of Basin Plan" implies the water is already "clean" (if that were the case, this evaluation wouldn't be necessary). A suggested rewording is as follows: "Basin Plan water quality objectives must be attained."
GW II & III:	Add "continued monitoring and risk management plan needed for 'closure'".

Matrix Comments

Column 1:	Rather than "Ground Water Cleanup", clarify with "Ground Water Cleanup Goals".
	For "Easily Biodegradable" category, clarify with "Easily Biodegradable Contaminants".
	Change "Persistent Chemicals" to Persistent Contaminants".
GW I Category:	There are instances where specific water quality objectives warrant establishment of cleanup goals more stringent than MCLs. "MCL" should therefore be changed to indicate that the MCL is the maximum concentration selected as a cleanup goal (i.e., "MCL (max concentration)").
GW II Category:	As a caveat for both easily biodegradable and persistent chemicals, include the phrase "depending on site specifics".

As already stated, the suggestions are intended to help clarify some questionable or potentially problematic points. If you have any questions, please call either me at **(805) 549-3140** or **Diane Nork at (805) 542-4637** (Calnet prefix is 629).

cc: Regional Board Executive Officers

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dn/rwb/r2tier.smo & palC4/r2tier.smo

State of California

Memorandum

To: Regional Board Executive Officers
Walt Pettit, Executive Director, SWRCB

Date: July 21, 1995
TEL: (510) 286-1325 (MPC)
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Michael Carlin
Basin Planning Division

Steve Morse
Toxics Cleanup Division

From: REGIONAL WATER QUALITY CONTROL BOARD
San Francisco Bay Region
2101 Webster St., Suite 500
Oakland, CA 94612

Subject: May E.C.C. meeting, item #7: "Tiered ground water approach for beneficial uses and water quality objectives".

Thank you very much for your comments on our tiered approach, which was presented by Steve Ritchie during the May ECC meeting. We are planning to update the flowchart, based on the comments we received.

While you were reviewing the concept, our staff ran a pilot study with the San Francisco County L.O.P.. The pilot study was conducted to test its application to actual fuel cases. Based on this pilot study, we found significant changes must be made for the approach to be practicable. We will be revising and recirculating the tiered approach for further review.

Upon reflection of your responses to the tiered approach, we find that smaller coastal basins face unique dilemmas with ground water resource protection. To foster consistency and promote dialogue between coastal Regional Boards, we propose a state-wide symposium on ground water basins. To date, our Region and Region 3 are interested in sponsoring the event, which will be open to all Regions. We plan to hold the event in early 1996 at a convenient location. Please relay any initial thoughts you might have on this subject to Diane Mims at (510) 286-0915.

Thank you again for reviewing our draft tiered approach for ground water classification.

cc: Dale Claypoole, Chief Deputy Director
Barbara Evoy, Office of Statewide Consistency
Ken Harris, Division of Water Quality

Appendix G. Decision Science Agenda Item

STATE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

EXECUTIVE OFFICER SUMMARY REPORT
MEETING DATE : AUGUST 23, 1995

ITEM: 5.P.

SUBJECT: GROUNDWATER BASIN CLASSIFICATION IN THE REGION USING DECISION SCIENCE AND ECONOMIC EVALUATION TECHNIQUES

DISCUSSION: In 1994 the Groundwater committee embarked on a project to tackle problems identified with implementation of Resolution 89-39, "Sources of Drinking Water". Although Resolution 89-39 is the only RWQCB regulation that provides parameters in which to designate groundwater, the primary problem with this policy is that it designates groundwater as potential drinking water sources without providing regional guidance on how to consider probability of use or economics.

The Groundwater committee has initiated a project to refine the beneficial uses classification for groundwater. The goal of this project is to develop a reasonable, consistent and relatively simple method for designating beneficial uses of groundwater. To achieve this goal, the Groundwater committee is considering a Decision Science and Economic Evaluation methodology.

The Groundwater committee is seeking funding to continue the project because we are lacking technical expertise in the Decision Science and Economic Evaluation field. Furthermore, the Groundwater committee is dedicated and anxious to continue this project to completion. Comments or guidance from the Board would be most helpful.

RECOMMEN-DATION: This item is for information only.

File No. 1559.00

Appendices: A: Staff Report