Appendix 3.7: Underwater Inspection of the Chabot Reservoir Outlet Tower, DRS Marine, Inc., June 2011

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WRITTEN REPORT FOR

EAST BAY MUNICIPAL UTILITY DISTRICT

UNDERWATER INSPECTION of the CHABOT RESERVOIR OUTLET TOWER

June 7, 2011

INTRODUCTION

JOB LOCATION:

East Bay Municipal Utility District
Chabot Reservoir
Castro Valley, CA
Water Elevation at time of inspection: 224

JOB DESCRIPTION:

DRS MARINE, INC. is to provide a qualified crew to conduct an underwater inspection to determine the condition of the Chabot reservoir outlet tower. Inspection is to be conducted using a Remotely Operated Vehicle (ROV). The inspection is to be videotaped and provided along with this written report.

FINDINGS:

There are 3 total sluice gates in the outlet tower: 36" sluice gate, 30" sluice gate and a 20" sluice gate. All of the three sluice gates are OPEN. There are 6 screens on the Chabot outlet tower and all of these screens are intact. There is a trash rack intake structure located approx. 70 feet offshore from the outlet tower, this structure is stainless steel and in good condition.

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1.0 30" STEEL PIPE INSP (elev. 197)

The ROV started the inspection on the 30" steel pipe (Elev. 197) to look for any major damage or anomalies. The 30" steel pipe is original riveted steel. From the access shaft the 30" steel pipe runs approx. 30 feet into the outlet tower. There are rust and corrosion pockets throughout the pipe line. Overall the 30" steel pipe is intact with no major deformities. A 30" sluice gate is attached the end of the 30" steel pipe inside the outlet tower. From the face of the 30" sluice gate to the opening of the 38 ¾" riveted steel pipe there is no "30 inch extra strong pipe" as referred to in drawing 9480-G-1 {Chabot Reservoir Outlet Tower Screen Replacement (Tunnel #2 Inlet Structure)}. The ROV continued offshore towards the lower inlet screen through the 38 ¾" riveted steel pipe. This pipe also has rust and corrosion pockets throughout. Approx. 55' from the access shaft a riveted joint appears to be separated. This separation travels around the perimeter of the pipe along the joint. Approx. 70' from the access shaft a riveted joint appears to be separated. This separation is mainly at the top crown of the pipe. Approx. 80' from the access shaft a riveted joint appears to be separated. At the end of the 38 ¾" riveted steel pipe is a stainless steel inlet screen structure. This is located approx. 100' from the access shaft.

(DVD Location Chapter #1)

SEPARATION IN 38 ¾" RIVETED STEEL PIPE

2.0 20" SLUICEWAY (elev. 214)

The 20" Sluiceway is located inside the access shaft approx. 10 feet below the waste tunnel. This tunnel appears to be a brick masonry tunnel. This tunnel is approx. 25' long. No major damage or deformities were found inside this tunnel. At the end of the 20" sluiceway a 20" sluice gate is attached inside the outlet tower.

(DVD Location Chapter #2)

BRICK MASONRY SLUICEWAY

3.0 36" SLUICE GATE (elev. 197)- OPEN

The 36" sluice gate is located inside the access shaft at elevation 197. This sluice gate is 100% open. The guides have rust and corrosion. Parts of the left guide appear to be broken and/or missing. The stem guides have rust pockets but appear to be intact. It is unknown if this sluice gate valve is operational.

(DVD Location Chapter #3)

36" OPERATOR / 36" STEM GUIDE

4.0 30" SLUICE GATE (elev. 197)- OPEN

The 30" sluice gate is located inside the outlet tower at elevation 197. This sluice gate is 100% open. The guides for this gate are rusted and corroded. Parts of the gate frame and guides appear to be broken or missing. There are no stem guides underwater. It is unknown if this gate is operational.

(DVD Location Chapter #4)


30" OPERATOR / STEM CONNECTION ON 30" GATE

5.0 20" SLUICE GATE (elev. 214)– OPEN

The 20" sluice gate is located inside the outlet tower at elevation 214. This sluice gate is 100% open. The guides for this gate are rusted and corroded. There are no stem guides underwater. The stem is intact with no bends. It is unknown if this gate is operational.

(DVD Location Chapter #5)


20" OPERATOR / STEM CONNECTION ON 20" GATE

6.0 INTAKE TRASH RACK STRUCTURE

There is a trash rack structure located approx. 70' offshore from the Chabot outlet tower. The screen is made of a stainless steel frame and wire mesh. The screen is attached to the 38 ¾" riveted steel pipe with a squeeze clamp connection. This screen has minimal amount of debris on it and appears to be in good condition. The 38 ¾" riveted steel pipe is covered in mud and debris.

(DVD Location Chapter #6)

TRASH RACK SCREEN / SQUEEZE CLAMP CONNECTION

7.0 TOWER SCREENS (6 ea.)

The Chabot outlet tower has 6 vertical screens attached to the tower. These screens appear to be intact and in good condition. The bottom screen has mud, sticks and debris in front of it, covering approx. 50%. There are two wires connected with shackles to the lower screen.

(DVD Location Chapter #7)

MUD, STICKS AND DEBRIS AGAINST TOWER SCREENS

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Appendix 3.8: Field Inspection Memorandum, URS, Inc., Nov. 2011

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URS

Memorandum

Date: November 7th, 2011

To: Sean Todaro
East Bay Municipal Utility District

From: Jerry Wu and Sheri Janowski

Subject: ***Summary of August 2011 Field Investigation Program***
Chabot Dam Remediation Concept Project

Introduction

This memorandum summarizes the field investigation program performed for the Chabot Dam Remediation Concept project. The main objectives of the investigations were to: 1) refine the boundaries of the sluiced fill, wagon fill, and foundation materials, 2) obtain samples for laboratory testing, and 3) install monitoring wells to supplement the existing instruments. This study was authorized by EBMUD through an email dated April 28, 2011.

Field Investigation Program

The field investigations were performed between August 17 and September 1, 2011. A total of five (5) exploratory borings, designated WI-68 through WI-72, were drilled on the downstream face and at the downstream toe of the dam at the locations shown in Figure 1. EBMUD selected and staked the boring locations prior to the drilling and surveyed the as-drilled boring locations at the completion of the field explorations. The boring coordinates and ground surface elevations are presented in Table 1.

Cascade Drilling Company of Newark, California drilled the exploratory borings using a truck-mounted 50K Sonic drill rig, which uses high frequency vibration to advance the core barrel/sampler. The borings were advanced with an approximately 6 inch-diameter sonic bit and 8 inch-diameter casing, to total depths ranging from 64.5 to 84 feet below ground surface (bgs). URS geologist Ms. Sheri Janowski, PG, visually classified the soils and rock encountered during drilling, and logged the borings. The boring logs are provided in Appendix A.

Samples were retrieved on a continuous basis. The sonic core barrel was generally advanced at 5-foot lengths to the bottom of the boreholes. The outer casing was advanced in 10-foot lengths while drilling. All samples were collected in 6-inch diameter, 4-foot long plastic bags, which were then split open for visual classification. Bagged samples were then placed in wooden core boxes for storage.

Monitoring wells were installed in all of the borings, as listed in Table 1. The wells were constructed with 4-inch diameter solid PVC and 4-inch diameter stainless steel 0.05" slotted screen. The screen was encased in a sand filter pack (#3 or Aquarium). All wells were finished approximately 1-feet above ground with locking steel well boxes. Water level measurements in these wells will be performed by EBMUD.

Selected samples were collected by EBMUD for laboratory testing. EBMUD also carried out the laboratory testing including sieve and Atterberg limits tests. The test results for each sample were provided by EBMUD and are noted in the boring logs at the appropriate depths.

Summary of Material Encountered in the Exploratory Borings

A number of distinct soil units were encountered during this investigation, including random fill, modern fill, 1890's fill, sluiced fill, wagon fill, alluvium, and bedrock. These soil units are consistent with the URS 2005 report on the dynamic stability of the dam, and are described below. The depth intervals at which these units were encountered are listed in Table 1.

Random Fill: Indeterminate (random) fill was encountered at the surface of Boring WI-68. This soil overlies older sluiced fill, and consists of clayey gravel with sand, sandy lean clay with gravel, and sandy lean clay.

Modern Fill: This fill was encountered at the surface in borings WI-69 through WI-72. This fill is characterized by a relatively high level of compaction, and generally consists of silty or clayey sand with gravel, to silty or clayey gravel with sand.

1890's Fill: This fill was encountered beneath the modern fill in borings WI-69 through WI-72, and beneath the random fill in boring WI-68. This fill has similar soil description to the modern fill, but is generally less compacted.

Wagon Fill: The wagon-placed embankment fill was encountered in borings WI-69 through WI-72. This fill has similar soil description to the 1890's fill.

Sluiced Fill: The sluiced fill is dam embankment fill that was placed using hydraulic methods. This fill was encountered in borings WI-68 through WI-72. This fill is uncompacted, highly variable in color, and thinly laminated. The encountered sluiced fill consists of silty/clayey sand, fat clay, lean clay, poorly graded sand with silt, and silty gravel.

Alluvium: Naturally-occurring alluvium was encountered in all five borings. Clayey/silty gravel with sand to clayey/silty sand with gravel was encountered in borings WI-68, WI-69, WI-70, and WI-72. Borings WI-70, WI-71, and WI-72 also encountered sandy lean clay with a lower gravel percentage. Borings WI-71 and WI-72 encountered hard clayey gravel or sandy lean clay with gravel at the top of the alluvial soil layer.

Bedrock: Highly weathered, very weak shale underlies the alluvium at the downstream toe of the dam, as encountered in WI-68. Highly weathered to residual soil, very to extremely weak serpentinite was encountered in borings WI-69 through WI-72. All borings were extended approximately 5-feet into bedrock before terminating the borehole.

Discussions of Findings

HCl Reaction: Soil and rock samples retrieved from the borings were tested in the field for HCl reaction. Generally, soils from similar sources have similar reaction to the HCl thus this type of tests may be used to identify the source of material encountered. The random fill, the modern fill and the bedrock encountered in the exploratory borings have strong HCl reactions. The encountered 1890's fill has a lighter or nonexistent HCl reaction, while the sluiced fill, wagon fill and the alluvium soil have nonexistent HCl reaction. These test results suggest the sources of the random fill and the modern fill were different from the sources for the older fills (1890's fill, sluiced and wagon fill) and the in place alluvium.

Top of Bedrock: The elevations of the bedrock encountered in the new exploratory borings are incorporated into the GIS database developed originally for the dynamic study of the dam (URS, 2005) and are used to develop the contours of the bedrock surface elevation as shown in Figure 2.

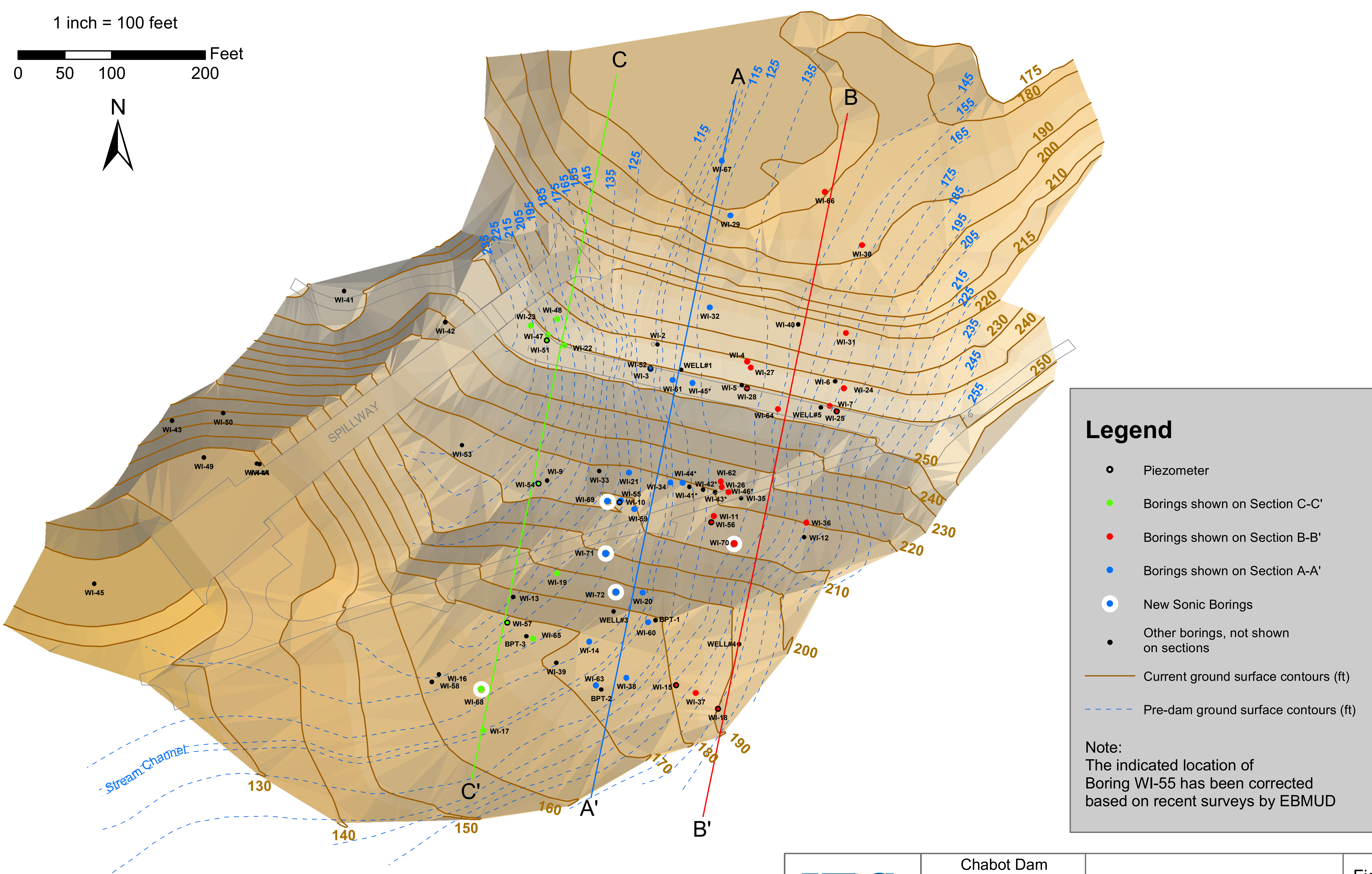
Sluiced Fill in Borings WI-69 and WI-70: Borings WI-69 and WI-70 encountered relatively thin (less than 2-foot thick) clay deposits between the 1890's fill and wagon fill layers. These clay deposits resemble the sluiced fill encountered in the other three borings.

Native Alluvium vs. Failed Hydraulic Fill: Although there is little evidence available, some reports suggest that an early hydraulic fill dam at the site failed in 1868. This would have been about 6 years before the start of construction on Chabot Dam in 1874.The investigation results do not support the theory that some of the alluvial soils encountered are actually remnants of a failed hydraulic fill dam. The basis for this conclusion includes the following points:

- The soil is fine-grained and massive. The soil deposit has none of the characteristics of typical hydraulic (sluiced) fill (lamination, changes in color, changes in plasticity, etc.) encountered in the investigations.
- Some of the fine-grained soil in question is found between soil layers that have similar grain size classification as alluvium in other borings (Borings WI-70 and WI-72).
- The hard "crust" that was encountered on the top of the soil deposit in question in borings WI-71 and WI-72 was most likely caused by pedogenesis. This is a soil forming process caused by prolonged and repeated desiccation over many years. If the soil deposit in question was an alluvial terrace deposit, this top layer could have been exposed to sunlight and evaporation for a long period of time which would cause the hardening at the surface. It is unlikely the 6 year period between the supposed early dam failure and the construction of Chabot Dam would be long enough to produce the hard crust.
- There is no evidence to suggest that the hard crust layer was formed by anthropogenic compaction, such as from a haul road. It would be a coincidence that haul road fills were encountered immediately above the postulated failed dam debris in borings WI-71 and WI-72, but not in the other borings drilled in the investigations. Thus, it is our interpretation that the hard clay soil "crust" is an alluvial terrace deposit with pedogenic cementation, which is a more probable scenario.

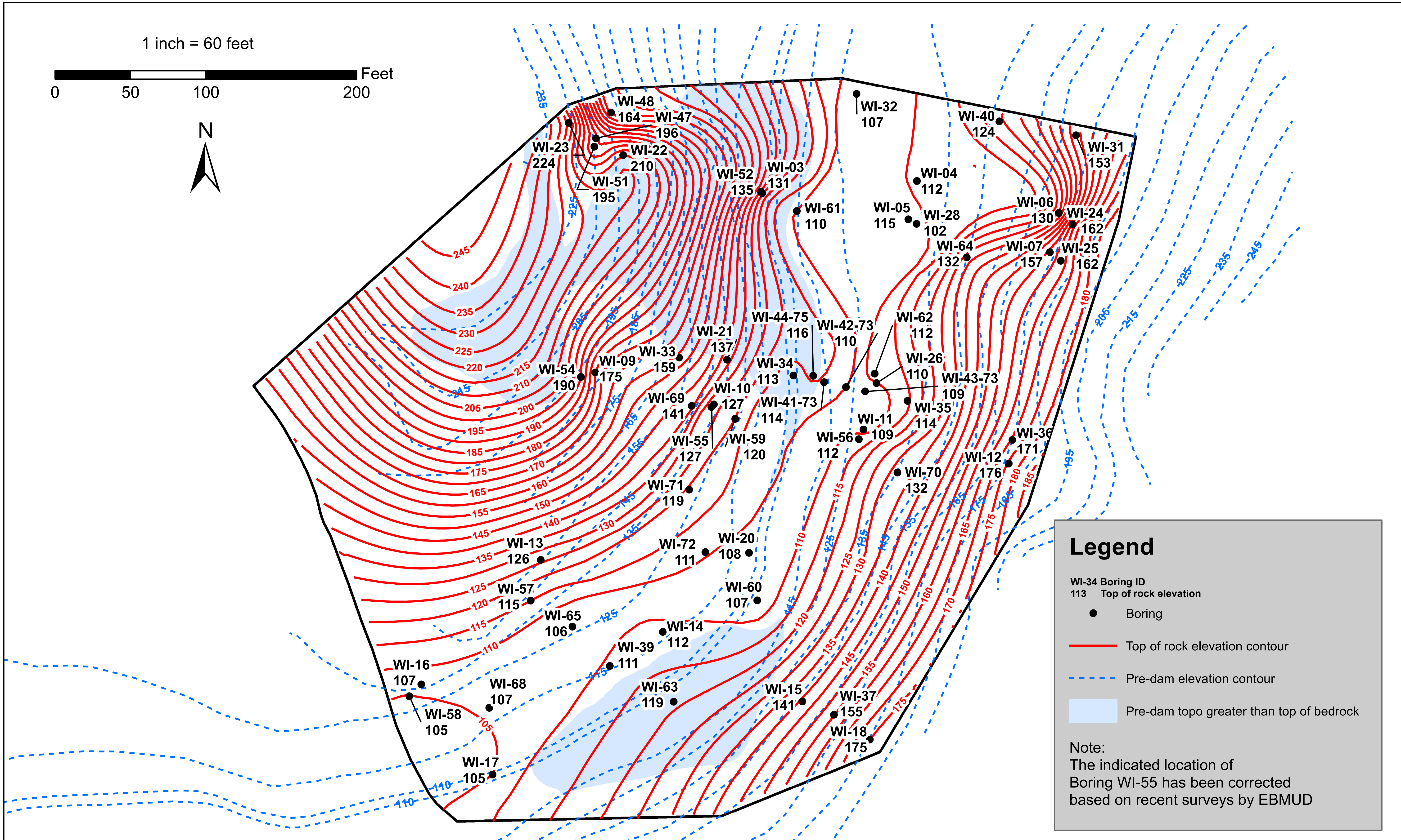
Table 1. Summary of Borings

Boring No.	Location	Coordinates	Ground Surface Elevation (ft.) (NGVD29)	Depth (ft.)	Materials Encountered	Observation Well
WI-68	Sta. 2+35.06 Offset 369.73	North 2091852.914 East 6092345.925	168.21	64.5	0-27 ft. Random Fill 27-39 ft. 1890's Fill 39-56.5 ft. Sluiced Fill 56.5-58.8 ft. Alluvium 58.8-64.5 ft. Shale Bedrock	Screen interval: 40-55 ft. Sand Filter Pack Type: #3
WI-69	Sta. 3+22.78 Offset 143.39	North 2092054.598 East 6092481.005	211.87	81.0	0-9 ft. Modern Fill 9-30.5 ft. 1890's Fill 30.5-32 ft. Sluiced Fill 32-60.5 ft. Wagon Fill 60.5-69 ft. Alluvium 69-81 ft. Serpentinite Bedrock	Screen interval: 37-57 ft. Sand Filter Pack Type: Aquarium
WI-70	Sta. 4+66.47 Offset 156.88	North 2092010.031 East 6092618.269	211.67	84.0	0-9 ft. Modern Fill 9-34 ft. 1890's Fill 34-35.7 ft. Sluiced Fill 35.7-69 ft. Wagon Fill 69-79 ft. Alluvium 79-84 ft. Serpentinite Bedrock	Screen interval: 50-65 ft. Sand Filter Pack Type: #3
WI-71	Sta. 3+33.38 Offset 198.43	North 2091998.581 East 6092479.319	199.54	84.0	0-15 ft. Modern Fill 15-29 ft. 1890's Fill 29-42 ft. Sluiced Fill 42-73 ft. Wagon Fill 73-80.5 ft. Alluvium 80.5-84 ft. Serpentinite Bedrock	Screen interval: 50-70 ft. Sand Filter Pack Type: #3
WI-72	Sta. 3+53.04 Offset 236.69	North 2091956.941 East 6092490.138	183.57	78.0	0-18 ft. Modern Fill / 1890's Fill 18-25.3 ft. Sluiced Fill 25.3-57.5 ft. Wagon Fill 57.5-72.2 ft. Alluvium 72.2-78 ft. Serpentinite Bedrock	Screen interval: 38-53 ft. Sand Filter Pack Type: #3



URS Corporation L:\Projects\Chabot_Dam_26814536\MXD\Current Working Documents\081904\Cross-section data with xsec members plus remainder.mxd Date: 9/13/2004 5:19:30 PM Name: dhwright0

URS	Chabot Dam Conceptual Remedial 26818113	Plan View of Dam	Figure 1



URS

Chabot Dam
Conceptual Remedial
26818113

Contours of estimated bedrock surface

Figure 2

APPENDIX A

BORING LOGS

Project: Chabot Dam Remediation Consulting Services
Project Location: Lake Chabot Dam, San Leandro, California
Project Number: 26818113

Log of Boring WI-68

Date(s) Drilled	**8/17/2011-8/18/2011**	Logged By	**S. Janowski**	Reviewer	**D. Simpson**
Drilling Method	**Sonic Drilling**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**64.5 feet**
Drill Rig Type	**50K Sonic Truck**	Drill Bit Size/Type	**5 7/8-in ID with 7.5-in ID casing**	Top of Casing Elevation	**168.18 NGVD 29**
Sampling Method	**Sonic Core**	Boring Location	**Sta 2+35.06, DS Offset 369.73**	Ground Surface Elevation	**165.86 NGVD 29**
Water Level and Date Measured	**GWT at 38.2 ft bgs at time of drilling**	Borehole Completion	**Open Standpipe Piezometer, screened interval 40 to 55 feet**		

Elevation, feet	Depth, feet	Samples: Number	Samples: % Recovery	Samples: Liquid Limit / Plasticity Index	Material Description	Well Schematic and Construction Details	Remarks and Other Tests
	0				CLAYEY GRAVEL with SAND (GC) **[RANDOM FILL]** very dark grayish brown (10yr3/2), moist, angular to subrounded gravel, fine to medium-grained sand, low plasticity fines, slow dilatency, high dry strength, laminations up to 0.2' thick of colors seen in intact specimens [Bluish gray (5g5/1) and dark grayish brown (10yr4/2)], strong HCl reaction	Stick-up well box; 4-in ID Schedule 80 PVC Solid pipe in cement grout	Begin drilling at 13:21
165							
		1	44				gravel includes concrete clasts
	5						
160							
	10						
155							
		2	40				
	15				SANDY LEAN CLAY with GRAVEL (CL) dark grayish brown (10yr3/2), dry to moist, fine-grained sand, low plasticity fines,slow dilatency, high dry strength, no color laminations, strong HCl reaction		
150							
	20						
145							
					Pulverized concrete layer		
		3	75		CLAYEY GRAVEL with SAND (GC) very dark grayish brown (10yr3/2), moist, subangular to subrounded gravel to 2.5-in, medium-grained sand, low plasticity fines, organic material seen in sample, strong HCl reaction		
	25						
140							
		4	100		CLAYEY GRAVEL with SAND (GC) **[1890's FILL]** yellowish-brown (10yr5/6), moist, subrounded to subangular gravel to 3/4-in, fine to coarse-grained sand, low plasticity fines, slight to no HCl reaction		
	30						End of day 8/17/2011. Resume

Project: Chabot Dam Remediation Consulting Services
Project Location: Lake Chabot Dam, San Leandro, California
Project Number: 26818113

Log of Boring WI-68

Elevation, feet	Depth, feet	Samples: Number	Samples: % Recovery	Liquid Limit / Plasticity Index	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	REMARKS AND OTHER TESTS
135	30				SANDY LEAN CLAY (CL) dark yellowish-brown (10yr4/4), dry, fine subangular gravel to 1/4-in, fine-grained sand, medium plasticity fines, slow dilatency, high dry strength, no HCl reaction		8/18/2011, water level=dry.
130	35	5	50		SANDY LEAN CLAY with GRAVEL (CL) dark yellowish-brown (10yr4/4), moist, fine to coarse subangular gravel to 1-in, fine to coarse-grained sand, medium plasticity fines, slow dilatency, high dry strength, some thin laminations in clay	5-ft thick bentonite seal #3 sand filter	
125	40	6	100		CLAYEY SAND (SC) **[SLUICED FILL]** dark gray (4/1), wet, fine-grained gravel and sand, low plasticity fines, slow dilatency, high dry strength, no HCl reaction	4-in ID continuous-wrap stainless steel 0.05 screen in #3 sand annulus	sample #5 fell out of sampler, advanced again to 39-ft to collect sample. Sample more disturbed.
					CLAYEY SAND with GRAVEL (SC) dark grayish-brown, wet, subangular gravel to 1-in, fine to coarse-grained sand, medium plasticity fines		
120	45	7	100		FAT CLAY (CH) very dark greenish-gray (10y3/1), moist, thinly laminated, medium stiff to stiff, no dilatency, very high dry strength, medium to high plasticity		pp=0.75 to 1.0 tsf
					CLAYEY SAND with GRAVEL (SC) brown (10yr4/3), wet, fine gravel, fine to coarse-grained sand, low plasticity fines		
					FAT CLAY (CH) as at 43.5-ft		
					SILTY SAND (SM) olive brown (2.5y4/3), wet, fine-grained sand, low plasticity fines, rapid dilatency, medium dry strength		
115	50				SILTY SAND (SM) as above, except greenish-black (10y2.5/1) with black clayey interbeds 0.03-ft to 0.6-ft thick		
					POORLY GRADED SAND with SILT and GRAVEL (SP-SM) greenish-black (10GY2.5/1), wet, gravel and cobbles up to 4-in, fine to coarse-grained sand, no plasticity fines		
110	55	8	90		SILTY GRAVEL with SAND (GM) greenish-black (10y2.5/1), wet, subangular gravel to 3-in, fine to coarse-grained sand, no plasticity fines	Bentonite chips to bottom of hole	
				29/12 27/11	CLAYEY SAND with GRAVEL (SC) to CLAYEY GRAVEL with SAND (GC) **[ALLUVIUM]** brown (10yr4/3), moist, subrounded gravel to 3-in, fine-grained sand, low plasticity fines, no HCl reaction		SA: %F=22, %G=38 SA: %F=20, %G=47
105	60	9	100		SHALE **[BEDROCK]** medium dark gray (N4), highly weathered, very weak, low hardness, calcareous with strong HCl reaction becomes grayish black (N2)		
	65				End of boring (EOB) 64.5 feet		

Date(s) Drilled	8/18/2011-8/19/2011	Logged By	S. Janowski	Reviewer	D. Simpson
Drilling Method	Sonic Drilling	Drilling Contractor	Cascade Drilling	Total Depth of Borehole	81.0 feet
Drill Rig Type	50K Sonic Truck	Drill Bit Size/Type	5 7/8-in ID with 7.5-in ID casing	Top of Casing Elevation	211.84 NGVD 29
Sampling Method	Sonic Core	Boring Location	Sta 3+22.78, DS Offset 143.39	Ground Surface Elevation	210.26 NGVD 29
Water Level and Date Measured	GWT at 46 ft bgs at time of drilling	Borehole Completion	Open Standpipe Piezometer, screened interval 37 to 57 feet		

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: % Recovery	SAMPLES: Liquid Limit / Plasticity Index	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	REMARKS AND OTHER TESTS
210	0		1	100			SILTY GRAVEL with SAND (GM) **[MODERN FILL]** dark yellowish brown (10yr4/4), dry, angular rhyolite gravel to 3-in, fine to medium-grained sand, no plasticity fines, strong HCl reaction	Stick-up well box; 4-in ID Schedule 80 PVC Solid pipe in cement grout	Begin drilling at 13:00
							SILTY GRAVEL with SAND (GM) layered compacted lifts of weathered SERPENTINITE and SILTSTONE, becomes soil-like, strong HCl reaction		
			2	100			SILTY SAND with GRAVEL (SM) yellowish-brown (10yr5/8), gravel, medium-grained sand, no to low plasticity fines, slight HCl reaction		Sample wet due to drillers adding water
205	5						CLAYEY GRAVEL with SAND (GC) olive brown (2.5y4/3), dry to moist, hard, subangular gravel to 1/2-in, fine to coarse-grained sand, low pasticity fines, strong HCl reaction		
			3	25					
200	10						CLAYEY GRAVEL with SAND (GC) **[1890's FILL]** very dark grayish-brown (2.5y3/2), moist, angular to subangular gravel, fine to coarse-grained sand, low to medium plasticity fines, slight HCl reaction		
			4	100			becomes dark yellowish-brown (10yr4/6), hard, angular gravel clasts up to 2-in		
195	15		5	33					
			6	100			becomes dark yellowish-brown (10yr3/4), slow dilatency, high dry strength, fine to coarse angular gravel clasts to 2-in		
190	20								
			7	12					
185	25								
							becomes brown (10yr4/3), subangular to subrounded gravel to 1.75-in, fine to coarse-grained sand, low to medium plasticity fines		
	30								

Elevation, feet	Depth, feet	Samples: Type	Samples: Number	Samples: % Recovery	Samples: Liquid Limit / Plasticity Index	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	REMARKS AND OTHER TESTS
180	30		8	100	59/34		CLAYEY GRAVEL with SAND (GC) (continued) FAT CLAY (CH) **[SLUICED FILL]** yellowish-brown (10yr5/6) and dark gray (10yr4/1), moist, trace fine sand, high plasticity fines, thinly laminated but disturbed, no dilatency, very high dry strength, no HCl reaction CLAYEY GRAVEL with SAND (GC) **[WAGON FILL]** dark yellowish-brown (10yr4/6), dry, angular to subangular fine to coarse gravel to 1.5-in, fine to coarse-grained sand, low plasticity fines, no HCl reaction	2-ft thick bentonite seal	SA: %F=99, %G=0
175	35		9	100			SILTY SAND with GRAVEL (SM) subanfular gravel, fine to medium-grained sand, low plasticity fines	Aquarium sand filter 4-in ID continuous-wrap stainless steel 0.05 screen in aquarium sand annulus	field volumetric wash completed
170	40		10	100	31/14		CLAYEY SAND to CLAYEY SAND with GRAVEL (SC) dark yellowish-brown (10yr4/4 & 10yr4/6), moist, subangular fine to coarse gravel to 1.5-in, fine to coarse-grained sand, low plasticity fines		SA: %F=34, %G=15
165	45		11	100			trace cobbles		water tagged at 47.5-ft in rods, could be water added by drillers drillers ran out of water. End of day 8/18/2011 at 16:30. Water level 8/19/2011 before drilling at 46-ft
160	50		12	80	28/10		GRAVELLY LEAN CLAY with SAND (CL) dark yellowish-brown (10yr4/4), mosit, very stiff, trace cobbles to 4-in, subangular gravel to 1-in, fine-grained sand, low plasticity fines, high dry strength, no dilatency CLAYEY SAND (SC) yellowish-brown (10yr5/8), moist, fine subangular gravel to 3/4-in, fine to coarse-grained sand, low plasticity fines, rapid dilatency, medium dry strength becomes CLAYEY SAND with GRAVEL (SC), dark brown (10yr3/3), subangular gravel to 3/4-in, no plasticity fines, rapid dilatency, medium dry strength		SA: %F=36, %G=12
155	55		13	80			becomes dark yellowish-brown (10yr4/6), angular gravel to 1.5-in, no plasticity fines	Bentonite chips to bottom of hole	
150	60		14	100	47/24 47/25 37/16		SANDY LEAN CLAY with GRAVEL (CL) very dark brown (10yr2/2), mosit, stiff, fine angular gravel to 1/4-in, fine to coarse-grained sand, low to medium plasticity fines CLAYEY SAND to CLAYEY SAND with GRAVEL (SC) **[ALLUVIUM]** very dark grayish-brown (10yr3/2), moist, subangular to subrounded shale gravel to 1-in, fine to coarse-grained sand, low to medium plasticity fines, no HCl reaction		SA: %F=40, %G=13 SA: %F=43, %G=10 SA: %F=29, %G=22
	65								

Project: Chabot Dam Remediation Consulting Services
Project Location: Lake Chabot Dam, San Leandro, California
Project Number: 26818113

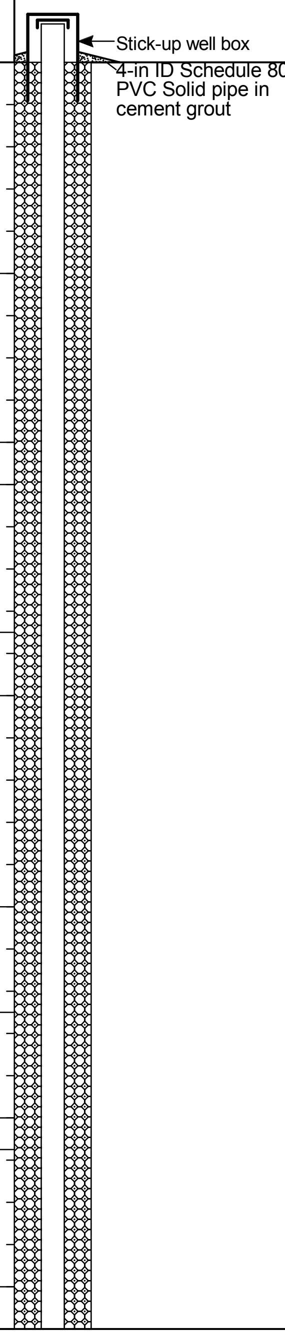
Log of Boring WI-69

Elevation, feet	Depth, feet	Samples: Type	Samples: Number	Samples: % Recovery	Liquid Limit / Plasticity Index	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	REMARKS AND OTHER TESTS
145	65		15	70	40/19 39/17 38/15		CLAYEY SAND to CLAYEY SAND with GRAVEL (SC) (continued) becomes very dark gray (10yr3/1), moist to wet, slow to no dilatency, high dry strength		SA: %F=31, %G=25 SA: %F=27, %G=25 SA: %F=40, %G=13
140	70		16	100			SERPENTINITE **[BEDROCK]** completely weathered, moderate yellowish-brown (10yr5/4), extremely weak, friable, iron and manganese-oxide staining on fracture surfaces, strong HCl reaction becomes highly weathered, very weak, low hardness		Run #16 fell out of sampler. Retrieved sample in Run #17
135	75		17	40					Casing to 75-ft. When removing casing, broke at 35-ft. 40-ft of casing stuck in hole. Drillers will retrieve next day
130	80		18	100			becomes dusky brown (5yr2/2), completely weathered, extremely weak, friable		
							End of boring (EOB) 81.0 feet		
125	85								
120	90								
115	95								
	100								

Date(s) Drilled	**8/30/2011**	Logged By	**S. Janowski**	Reviewer	**D. Simpson**
Drilling Method	**Sonic Drilling**	Drilling Contractor	**Cascade Drilling**	Total Depth of Borehole	**84.0 feet**
Drill Rig Type	**50K Sonic Truck**	Drill Bit Size/Type	**5 7/8-in ID with 7.5-in ID casing**	Top of Casing Elevation	**211.64 NGVD 29**
Sampling Method	**Sonic Core**	Boring Location	**Sta 4+66.47, DS Offset 156.88**	Ground Surface Elevation	**211.04 NGVD 29**
Water Level and Date Measured	**GWT at 36 ft bgs at time of drilling**	Borehole Completion	**Open Standpipe Piezometer, screened interval 50 to 65 feet**		

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: % Recovery	SAMPLES: Liquid Limit / Plasticity Index	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
210	0		1	100			CLAYEY SAND with GRAVEL (SC) **[MODERN FILL]** dark yellowish-brown (10yr4/4) and greenish-gray (10gy5/1), moist,fine angular gravel to 1/2-in, fine to medium-grained sand, low plasticity fines, consisted of compacted lifts of weathered SILTSTONE and SERPENTINITE, strong HCL reaction	08:00 Begin Drilling
205	5		2	100			becomes dark greenish-gray (10gy4/1), no HCl reaction	
200	10		3	100			CLAYEY SAND with GRAVEL (SC) **[1890's FILL]** dark yellowish-brown (10yr4/4), moist, fine subangular to subrounded gravel to 1/4-in, fine to medium-grained sand, low plasticity fines, no HCl reaction	
195	15		4	100			SANDY LEAN CLAY with GRAVEL (CL) dark yellowish-brown (10yr4/4), moist, fine subangular to subrounded gravel to 1/2-in, fine-grained sand, low plasticity fines, compacted	
190	20		5	100			becomes less compacted, gravel is subrounded. One calcareous gravel clast to 1.5-in	
							SILTY GRAVEL with SAND (GM) dark yellowish-brown (10yr4/4), moist, subangular gravel to 3/4-in, fine to coarse-grained sand, no to low plasticity fines	
185	25		6	100			SILTY SAND with GRAVEL (SM) dark yellowish-brown (10yr4/4), moist, fine subangular gravel to 1/4-in, fine to medium-grained sand, low to no plasticity fines	
							CLAYEY SAND with GRAVEL (SC)	
	30							

WELL SCHEMATIC AND CONSTRUCTION DETAILS



Project: Chabot Dam Remediation Consulting Services	Log of Boring WI-70
Project Location: Lake Chabot Dam, San Leandro, California	Sheet 2 of 3
Project Number: 26818113	

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: % Recovery	SAMPLES: Liquid Limit / Plasticity Index	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	REMARKS AND OTHER TESTS
180	30		7	100			CLAYEY SAND with GRAVEL (SC) dark yellowish-brown (10yr3/4), moist, fine subrounded gravel to 1/4-in, medium-grained sand, medium plasticity fines (continued)		
					47/26		SILTY SAND (SM) moist, dark yellowish-brown (10yr4/6), subangular gravel to 1-in, fine to medium-grained sand, low to no plasticity fines		SA: %F=89, %G=1
175	35		8	100			LEAN CLAY (CL) **[SLUICED FILL]** very dark greenish-gray (10y3/1), moist, very soft, fine-grained sand, medium plasticity fines, no dilatency, high dry strength, thinly laminated, no HCl reaction		pp=0.25 tsf
							SILTY GRAVEL with SAND (GM) **[WAGON FILL]** dark yellowish-brown (10yr4/4), moist, subangular gravel to 1.5-in, fine to coarse-grained sand, no to low plasticity fines, no HCl reaction		
170	40		9	100				5-ft thick bentonite seal	
165	45		10	100			SILTY SAND with GRAVEL (SM) dark yellowish-brown (10yr4/4), moist, subangular gravel to 2-in, fine to coarse-grained sand, no to low plasticity fines		
							CLAYEY SAND with GRAVEL (SC) brown (10yr4/3), moist, fine subrounded gravel to 1/4-in, fine to coarse-grained sand, low plasticity fines	#3 sand filter	
160	50		11	100			SILTY GRAVEL with SAND (GM) brown (10yr4/3), moist, subangular gravel to 2-in, fine to medium-grained sand, no plasticity fines	4-in ID continuous-wrap stainless steel 0.05 screen in #3 sand annulus	
							SILTY, CLAYEY SAND with GRAVEL (SC-SM) very dark grayish-brown (10yr3/2), moist, subangular to subrounded gravel to 3/4-in, fine to coarse-grained sand, low plasticity fines		
155	55		12	80			becomes brown (10yr4/3		
150	60						olive gray (5y5/2), parent material serpentinite, SERPENTINITE clasts, strong HCl reaction		
			13	100	40/19		CLAYEY GRAVEL with SAND (GC) very dark grayish-brown (10yr3/2), angular to subangular gravel to 1.75-in, fine-grained sand, low plasticity fines, no HCl reaction		SA: %F=26, %G=23
	65						CLAYEY SAND with GRAVEL (SC) dark brown (10yr3/3), moist, fine angular to subangular gravel to 1-in, fine to coarse-grained sand, medium plasticity fines		

Report: GEO_12W_OAK_POINTER; File: CHABOTDAMSONIC.GPJ; 11/7/2011 WI-70

Elevation, feet	Depth, feet	Samples: Type	Samples: Number	Samples: % Recovery	Samples: Liquid Limit / Plasticity Index	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	REMARKS AND OTHER TESTS
145	65		14	100			CLAYEY SAND with GRAVEL (SC) dark brown (10yr3/3), moist, fine angular to subangular gravel to 1-in, fine to coarse-grained sand, medium plasticity fines (continued)	Bentonite chips to bottom of hole	pp=1.5 tsf
							SANDY LEAN CLAY with GRAVEL (CL) greenish-black (10y2.5/1), moist, hard, compacted, fine angular gravel to 1/4-in, fine-grained sand, medium plasticity fines, SERPENTINITE parent source, strong HCl reaction		pp=>4.5 tsf
140	70		15	100	31/14 38/20 51/22 35/17 26/10		SANDY LEAN CLAY (CL) to CLAYEY SAND (SC) **[ALLUVIUM]** black (2.5/N)and greenish-black (10y2.5/1), moist, fine angular gravel, fine-grained sand, medium plasticity fines, medium dry strength, two 3-in calcareous clasts seen, no HCl reaction on matrix soil SANDY ELASTIC SILT (MH) interbed, dark greenish-gray (10y4/1)		SA: %F=62, %G=2 SA: %F=44, %G=14 SA: %F=55, %G=4 SA: %F=48, %G=9 SA: %F=49, %G=4
135	75		16	100	32/16 39/19 38/19 43/21		CLAYEY SAND with GRAVEL to CLAYEY SAND (SC) brown (10yr4/3), moist, angular gravel to 1/2-in, fine to coarse-grained sand, no to low plasticity fines		pp=1.5 tsf SA: %F=62, %G=3 SA: %F=36, %G=18 SA: %F=36, %G=17 SA: %F=34, %G=14
130	80		17	100			SERPENTINITE **[BEDROCK]** medium bluish gray (5b5/1), completely weathered, extremely weak, friable, calcite veins/banding, strong HCl reaction		
125	85						End of boring (EOB) 84.0 feet		
120	90								
115	95								
	100								

Project: Chabot Dam Remediation Consulting Services
Project Location: Lake Chabot Dam, San Leandro, California
Project Number: 26818113

Log of Boring WI-71

Date(s) Drilled	8/24/2011-8/29/2011	Logged By	S. Janowski	Reviewer	D. Simpson
Drilling Method	Sonic Drilling	Drilling Contractor	Cascade Drilling	Total Depth of Borehole	84.0 feet
Drill Rig Type	50K Sonic Truck	Drill Bit Size/Type	5 7/8-in ID with 7.5-in ID casing	Top of Casing Elevation	199.51 NGVD 29
Sampling Method	Sonic Core	Boring Location	Sta 3+33.38, DS Offset 198.43	Ground Surface Elevation	199.10 NGVD 29
Water Level and Date Measured	GWT at 51.7 ft bgs at time of drilling	Borehole Completion	Open Standpipe Piezometer, screened interval 50 to 70 feet		

Elevation, feet	Depth, feet	SAMPLES Type	Number	% Recovery	Liquid Limit / Plasticity Index	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	REMARKS AND OTHER TESTS
	0		1	100			SANDY SILTY CLAY with GRAVEL (CL-ML) **[MODERN FILL]** bluish-gray (10b5/1) & brown (10yr4/3), moist, subrounded to angular gravel to 1-in, fine-grained sand, low plasticity fines, no dilatency, medium dry strength, compacted lifts of weathered shale, serpentinite, and siltstone, strong HCl reaction	Stick-up well box; 4-in ID Schedule 80 PVC Solid pipe in cement grout	
195	5		2	100			7 to 8-ft, possible concrete boulder/clast, gravel is composed of PUMICE/SCORIA		
190	10		3	100					
185	15		4	100			SANDY LEAN CLAY with GRAVEL (CL) **[1890's FILL]** dark yellowish-brown (10yr4/6), moist, subrounded gravel to 1.5-ft, fine to coarse-grained sand, low plasticity fines, slow dilatency, medium dry strength, moderately compacted, no to slight HCl reaction		
180	20		5	100			19 to 20.9-ft angular RHYOLITE cobbles to 4.5-in		Casing to 19-ft
175							becomes brown (10yr4/3), dry to moist, subangular to angular gravel to 1-in, fine-grained sand, low plasticity fines, highly compacted		
	25		6	100			SILTY GRAVEL with SAND (GM) yellowish-brown (10yr5/4 & 10yr5/6), dry to moist, subangular to subrounded gravel to 2-in, fine to medium-grained sand, low plasticity fines, highly compacted		
170							FAT CLAY (CH) **[SLUICED FILL]**		
	30								

Project: Chabot Dam Remediation Consulting Services
Project Location: Lake Chabot Dam, San Leandro, California
Project Number: 26818113

Log of Boring WI-71

Elevation, feet	Depth, feet	Sample Number	% Recovery	Liquid Limit / Plasticity Index	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	REMARKS AND OTHER TESTS
	30				FAT CLAY (CH) very dark grayish-brown (10yr3/2), moist, medium stiff, thinly laminated, no HCl reaction (continued)		
		7	100		LEAN CLAY with SAND (CL) very dark greenish-gray (10y3/1), moist, fine subrounded gravel to 1/4-in, fine-grained sand, low to medium plasticity fines, slow dilatency, high dry strength, thinly laminated		
165					CLAYEY SAND (SC) dark yellowish-brown (10y3/4), moist, fine to medium-grained sand, low plasticity fines, rapid dilatency, medium dry strength		pp=0.5 tsf
	35						
		8	100	49/28	SILTY CLAY with SAND (CL-ML) very dark greenish-gray (10y3/1), moist, medium stiff, fine-grained sand, low plasticity fines, slow dilatency, high dry strength, thinly laminated, sand interbeds		pp=2.0 tsf SA: %F=63, %G=12
				35/15	GRAVELLY LEAN CLAY with SAND (CL) very dark gray (3/N), moist, fine to coarse subrounded gravel to 1.5-in, fine to coarse-grained sand (coarse interbeds), medium plasticity fines		pp=0.5 tsf SA: %F=37, %G=7
160							
	40				interbeds of FAT CLAY and SANDY LEAN CLAY (CH-CL) reddish-brown (5yr4/4), very dark grayish-brown (10yr3/2), and very dark greenish-gray (10y3/1), moist, fine- to medium-grained sand, medium stiff to very stiff, medium to high plasticity fines		
		9	80		CLAYEY SAND (SC) dark yellowish-brown (10yr4/4), moist, fine- to medium-grained sand, low plasticity fines		
155					SILTY SAND with GRAVEL (SM) brown (10yr4/3), moist to wet, fine subrounded gravel to 1/4-in, fine to coarse-grained sand, no to low plasticity fines, low compaction		
	45						
					CLAYEY SAND with GRAVEL (SC) brown (10yr4/3), moist to wet, fine subrounded gravel to 1/4-in, fine to coarse-grained sand, low to medium plasticity fines, low compaction	2-ft thick bentonite seal	
150					LEAN CLAY with SAND (CL) very dark greenish-gray (10y3/1), moist, medium stiff, fine subrounded gravel to 1/4-in, fine-grained sand, low to medium plasticity fines, slow dilatency, high dry strength, thinly laminated	#3 sand filter	
	50					4-in ID continuous-wrap stainless steel 0.05 screen in #3 sand annulus	
		10	100		CLAYEY GRAVEL with SAND (GC) to CLAYEY SAND with GRAVEL (SC) **[WAGON FILL]** strong brown (7.5yr5/6), moist, fine subrounded to subangular gravel to 1/2-in, fine-grained sand, low plasticity fines, compacted, no HCl reaction @48-ft, becomes fine to medium-grained sand		
145					becomes fine to coarse subangular to angular gravel to 1-in		
	55						
		11	100	29/11			Lost 2-ft of sample in Run 11, recovered in Run 12 SA: %F=28, %G=30
					becomes dark yellowish-brown (10yr4/4), less compacted		
140		12	100				
	60						
					POORLY GRADED GRAVEL and COBBLES (GP) wet, clasts up to 4-in		
		13	100		SILTY GRAVEL with SAND (GM) brown (10yr4/3), moist to wet, apparently loose, subangular to angular gravel to 2-in, fine to coarse-grained sand, no to low plasticity fines		
135							
	65						

Project: Chabot Dam Remediation Consulting Services

Project Location: Lake Chabot Dam, San Leandro, California

Project Number: 26818113

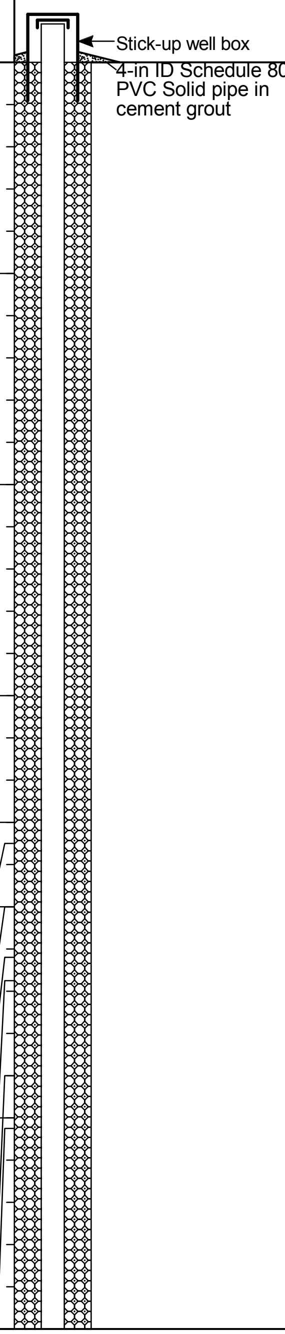
Log of Boring WI-71

Elevation, feet	Depth, feet	Sample Number	% Recovery	Liquid Limit / Plasticity Index	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	REMARKS AND OTHER TESTS
	65	14	100	28/9	CLAYEY SAND with GRAVEL (SC) brown (10yr4/3), wet, subangular gravel to 2-in, fine to coarse-grained sand, low plasticity fines, silt and clay interbeds		SA: %F=14, %G=42
130	70	15	100		CLAYEY GRAVEL with SAND (GC) dark yellowish-brown (10yr4/4), moist, subangular gravel, fine to medium-grained sand, medium plasticity fines	Bentonite chips to bottom of hole	
125				29/12	SANDY LEAN CLAY with GRAVEL (CL) **[ALLUVIUM]** dark greenish-gray (10y4/1) and dark yellowish-brown (10yr4/4), moist, hard, trace wood chips, subrounded gravel to 1/4-in, fine-grained sand, low to medium plasticity fines, no HCl reaction		pp=>4.5 tsf SA: %F=69, %G=0
	75	16	100	29/12 25/8 27/9	SANDY LEAN CLAY (CL) dark yellowish brown (10yr4/4) and dark greenish-gray (5gy4/1), moist, very stiff to hard, fine-grained sand, low plasticity fines		pp=2.0 tsf SA: %F=70, %G=0 SA: %F=52, %G=1 SA: %F=63, %G=0
120				28/11 26/9 28/12	CLAYEY SAND with GRAVEL to CLAYEY SAND (SC) dark grayish-brown (10yr3/2), moist, subangular to subrounded gravel to 1-in, fine-grained sand, low plasticity fines		SA: %F=49, %G=16 SA: %F=43, %G=10
	80	17	100		SANDY LEAN CLAY (CL) dark grayish-brown (10yr3/2), moist, fine-grained subrounded gravel to 3/8-in, fine-grained sand, low plasticity fines		Very rough drilling SA: %F=50, %G=4
		18	100		SERPENTINITE **[BEDROCK]** dark greenish-gray (5g4/1), highly weathered, very weak, friable, banded with calcite, strong HCl reaction		
115					End of boring (EOB) 84.0 feet		
110	85						
105	90						
100	95						
	100						

Project: Chabot Dam Remediation Consulting Services
Project Location: Lake Chabot Dam, San Leandro, California
Project Number: 26818113

Log of Boring WI-72

Date(s) Drilled	8/31/2011-9/1/2011	Logged By	S. Janowski	Reviewer	D. Simpson
Drilling Method	Sonic Drilling	Drilling Contractor	Cascade Drilling	Total Depth of Borehole	78.0 feet
Drill Rig Type	50K Sonic Truck	Drill Bit Size/Type	5 7/8-in ID with 7.5-in ID casing	Top of Casing Elevation	183.51 NGVD 29
Sampling Method	Sonic Core	Boring Location	Sta 3+53.04, DS Offset 236.69	Ground Surface Elevation	183.17 NGVD 29
Water Level and Date Measured	GWT at 35.8 ft bgs at time of drilling	Borehole Completion	Open Standpipe Piezometer, screened interval 38 to 53 feet		



Elevation, feet	Depth, feet	Sample Type	Sample Number	% Recovery	Liquid Limit / Plasticity Index	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0		1	100		SILTY SAND with GRAVEL (SM) **[MODERN FILL]** olive gray (5y4/2), moist, subangular gravel, fine to coarse-grained sand, no to low plasticity fines, composed of compacted lifts of weathered SERPENTINITE, SHALE, and SILTSTONE, strong HCl reaction	
180	5		2	100			
175	10		3	100		Compacted RHYOLITE, dark yellowish-brown (10yr4/6), no HCl reaction	
170	15		4	100		becomes dark yellowish-brown (10yr4/4), less SERPENTINITE [POSSIBLE 1890's FILL]	
165			5	100	59/33	SANDY LEAN CLAY (CL) **[SLUICED FILL]** dark yellowish-brown (10yr4/4), moist, fine-grained sand, low plasticity fines, no HCl reaction	pp=0.75 tsf SA: %F=94, %G=0
	20					FAT CLAY (CH) dark yellowish-brown (10yr5/8), olive brown (2.5y4/4) and very dark gray (5y3/1), moist, fine sand (coarsening with depth), high plasticity fines	pp=1.0 tsf
						FAT CLAY (CH) and LEAN CLAY (CL) reddish brown (5yr4/4), moist, trace sand, medium to high plasticity fines (interbedded)	
160					56/30	SILTY CLAY with SAND (CL-ML) dark yellowish-brown (10yr4/4), moist, fine-grained sand, low plasticity fines @22.15-ft becomes dark greenish-gray (10y4/1) & greenish-black (10y2.5/1) 23 to 24-ft becomes brown (10yr4/3)	SA: %F=95, %G=1
	25		6	100		SANDY SILTY CLAY (CL-ML) dark yellowish-brown (10yr4/4), moist, fine-grained sand, low plasticity fines @22.15-ft becomes dark greenish-gray (10y4/1) & greenish-black (10y2.5/1) @23-ft becomes brown (10yr4/3)	
155						FAT CLAY (CH)	
	30						

Report: GEO_12W_OAK_POINTER; File: CHABOTDAMSONIC.GPJ; 11/7/2011 WI-72

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: % Recovery	Liquid Limit / Plasticity Index	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	REMARKS AND OTHER TESTS
	30		7	100		FAT CLAY (CH) dark yellowish-brown (10yr4/4), moist, fine-grained sand, high plasticity fines (continued)	5-ft thick bentonite seal	
					34/14	CLAYEY SAND with GRAVEL (SC) **[WAGON FILL]** dark brown (7.5yr3/4), moist, angular gravel to 2-in, fine to coarse-grained sand, low plasticity fines, compacted, no HCl reaction		SA: %F=21, %G=31
150						POORLY GRADED GRAVEL with SAND (GP) dark yellowish-brown (10yr3/4), wet, angular gravel to 2.5-in, fine to coarse-grained sand, poor recovery, matrix washed out?		
	35		8	75		SILTY GRAVEL with SAND (GM) moist, dark yellowish-brown (10yr3/4), angular gravel, fine to coarse-grained sand, no to low plasticity fines	#3 sand filter	
145						CLAYEY SAND with GRAVEL (SC) olive gray (5y4/2), moist, angular to subangular gravel to 1-in, fine to coarse-grained sand, low plasticity fines, material less compacted	4-in ID continuous-wrap stainless steel 0.05 screen in #3 sand annulus	
	40		9	100	39/17			SA: %F=34, %G=19
140								
	45		10	60		SILTY GRAVEL with SAND (GM) brown (10yr4/3), moist, angular gravel to 2-in, fine to medium-grained sand, no plasticity fines		
135						SILTY SAND with GRAVEL (SM) brown (10yr4/3), moist, subangular to subrounded gravel to 2-in, fine to medium-grained sand, low plasticity fines		
	50		11	100		5-in diameter cobble, subrounded		
130								
	55		12	75			Bentonite chips to bottom of hole	
125					30/13	CLAYEY GRAVEL with SAND (GC) **[ALLUVIUM]** dark yellowish-brown (10yr4/4), moist, hard, angular gravel to 1-in, fine to coarse-grained sand, low plasticity fines, no HCl reaction		pp=>4.5 tsf SA: %F=19, %G=44
					32/15	CLAYEY SAND with GRAVEL (SC) very dark grayish-brown (10yr3/2), moist, angular fine gravel to 1/2-in, fine to coarse-grained sand, low plasticity fines		SA: %F=39, %G=19
	60		13	100	32/14			SA: %F=54, %G=5
					33/15 32/15	SANDY LEAN CLAY to CLAYEY SAND (CL/SC) very dark grayish-brown (10yr3/2), moist, very stiff to hard, subrounded shale and sandstone gravel to 3/4-in, fine to medium-grained sand, low plasticity fines		pp=2.0 tsf SA: %F=48, %G=7 pp=4.0 tsf SA: %F=52, %G=9
120					32/14	CLAYEY SAND with GRAVEL (SC) very dark grayish-brown (10yr3/2), wet, subangular gravel to 3/4-in, fine to coarse-grained sand, low plasticity fines		SA: %F=43, %G=17
	65				30/13			SA: %F=37, %G=20

Elevation, feet	Depth, feet	Type	Number	% Recovery	Liquid Limit / Plasticity Index	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	REMARKS AND OTHER TESTS
	65		14	40	28/11 30/14 30/14		CLAYEY SAND with GRAVEL (SC) very dark grayish-brown (10yr3/2), wet, subangular gravel to 3/4-in, fine to coarse-grained sand, low plasticity fines (continued)		SA: %F=25, %G=20 SA: %F=31, %G=23
115							POORLY GRADED SAND (SP) greenish-black (5gy2.5/1), wet, medium-grained sand		SA: %F=35, %G=23
					NP/NP		SANDY SILT (ML) black (2.5/n), moist, fine-grained sand, low plasticity fines		SA: %F=20, %G=9
	70		15	100	NP/NP NP/NP NP/NP		SILTY SAND to SILTY SAND with GRAVEL (SM) greenish-black (10y2.5/1), wet, fine gravel to 3/4-in, fine to coarse-grained sand, no plasticity fines @ 71-ft becomes very dark gray (3/n) @ 72-ft becomes very dark greenish-gray (10y3/1)		SA: %F=20, %G=12 SA: %F=15, %G=21 SA: %F=14, %G=22
110							SERPENTINITE **[BEDROCK]** grayish-green (5g5/2), residual soil, extremely weak, friable, calcareous, strong HCl reaction		Water level 35.8-ft 9/1/2011 @ 08:00
	75		16	100					
105							End of boring (EOB) 78.0 feet		
	80								
100									
	85								
95									
	90								
90									
	95								
85									
	100								

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Appendix 3.9: Historic Environmental Documentation (Draft and Final EIR) for Lake Chabot Modifications Undertaken in the Late 1970s

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DRAFT

ENVIRONMENTAL IMPACT REPORT FOR CHABOT DAM AND SPILLWAY MODIFICATION PROJECT

EAST BAY MUNICIPAL UTILITY DISTRICT
P. O. BOX 24055 · OAKLAND, CA 94623 · (415) 835-3000

DRAFT

ENVIRONMENTAL IMPACT REPORT

FOR

CHABOT DAM AND SPILLWAY

MODIFICATION PROJECT

EAST BAY MUNICIPAL UTILITY DISTRICT

P. O. Box 24055

Oakland, CA 94623

Prepared by the Staff

of the East Bay Municipal Utility District

REVIEWED AND APPROVED BY THE DISTRICT'S
ENVIRONMENTAL COMMITTEE
on January 11, 1978

K. D. McCloskey

K. D. McCLOSKEY
Chairman
Environmental Committee

Comments received in letter format prior to noon on
March 8, 1978, will be incorporated in the Final EIR

DRAFT EIR - CHABOT DAM AND SPILLWAY

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SUMMARY

The purpose of the proposed Chabot Dam and Spillway Modification Project is to increase the hydraulic capacity to safely pass the flood resulting from the probable maximum precipitation (PMP) storm and to increase the structural integrity of the dam and spillway to withstand the maximum credible earthquake, thereby providing a higher degree of safety and welfare for the public located below the dam.[1] The proposed project would involve construction of a chute spillway capable of carrying a flow of 9,500 cubic feet per second from Chabot Reservoir to San Leandro Creek 116 feet below without endangering the earth-fill dam. In addition, the proposed project would raise the dam crest by about 5 feet. This increase in dam freeboard would mitigate the risk of the dam being overtopped in the event of slumping of the crest or extensive surface sloughing of the upstream face during a maximum credible earthquake. The events which could potentially cause such damage to the dam would be large earthquakes exceeding the maximum credible earthquake on either the Hayward Fault ($7\frac{1}{2}$ magnitude), 0.5 miles to the west, or on the San Andreas Fault (8+ magnitude), 19 miles to the west.

The proposed project would permit continued use of Chabot Reservoir as a standby terminal reservoir. The reservoir represents approximately 7% of the District's terminal reservoir storage capacity. Chabot Reservoir, a scenic adjunct to Anthony Chabot Regional Park, would continue to offer recreational opportunities (boating and fishing) to residents of the Bay Area as part of Alameda County's Open Space Inventory.

The proposed project, estimated to cost $2.9 million, would construct a new spillway, requiring removal of approximately 100,000 cubic yards of rock and soil from the right abutment, and placement of most of this excavated material on the crest and downstream face of the dam, thereby raising the available free-board by 5 feet. The new concrete chute spillway would vary from 25 to 46 feet in width and would be 520 feet in overall length, with vertical walls from 8 to 31 feet in height. The proposed spillway would cut through the right abutment to the right of the existing spillway at about a 45° angle to the dam axis. The spillway would consist of an 8 foot high ogee control weir at the upstream end, a steeply sloped chute section, and a dissipation structure at the downstream end capable of safely passing the estimated PMP storm flow of 9500 cfs.

The proposed project would have some significant adverse environmental impacts. Overriding public safety considerations necessitate implementation of the project. Short-term adverse impacts during construction would include temporary reduction of the lake level by approximately 15 feet to allow feasible construction of the upper end of the spillway, disruption of fisheries and wildlife habitat by construction activities, and inconvenience to the public due to increased truck traffic in the vicinity of the site.

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1 The maximum credible earthquake is the maximum earthquake that, in the judgment of seismic consultants, appears capable of occurring under the conditions of the presently known geologic framework. It is a rational and believable event even though its frequency of recurrence may be very low; it is a sensible event based on our present state of knowledge. In determining the maximum credible earthquake, there is little regard to its probability of occurrence, except that its likelihood of occurring is great enough to be of concern.

The long-term adverse environmental impact of the proposed project would be the partial obliteration of an ASCE and AWWA historical landmark, the loss of some wildlife habitat in the area around the dam and right abutment, the loss of the marsh located at the foot of the existing dam and some visual impact due to the new spillway.

Several alternatives to the project were analyzed. Each of these consisted of modification of the dam or some alternate treatment of the spillway alignment. The proposed project was selected because of the preferred design of a straight chute spillway set on bedrock away from the dam embankment. The new spillway and additional freeboard ensures safe passage of the PMP flow of 9500 cfs over the spillway as well as increased safety against overtopping by the reservoir water in the event of a maximum credible earthquake.

PROJECT DESCRIPTION

The proposed project would require clearing and excavation in the area of the right abutment for the spillway, demolition or burial of the existing Spillway #1, construction of the proposed concrete spillway, placement and compaction of the embankment material on the crest and downstream face of the dam, and improvement of the narrow access road adjacent to the lake.

Chabot Reservoir Complex

The Chabot Reservoir is located on San Leandro Creek, which passes through the Oakland Hills, just east of the City of San Leandro in Alameda County, California. The complex consists of the dam and the impoundment reservoir, the Chabot Center (a standby water treatment plant in operation during the current drought), and a chute spillway. Exhibits 3 and 4 show the general area of the proposed project. Exhibit 5 shows the existing spillway locations.

The history of Chabot Reservoir, formerly San Leandro Reservoir, extends back over 100 years. Population growth in the East Bay area in the late 1800's required more water than wells were able to supply. Chabot Reservoir was the second major impoundment of local runoff, created after Lake Temescal to the north. The potential of the relatively narrow, deep San Leandro Creek canyon close to a suitable quarry was recognized early as an optimum location for an impoundment of local runoff.

The dam is not widely visible to the public, although portions of the structure can be seen by passing motorists from two short segments of Lake Chabot Road which passes to the south of the reservoir. The "Temple" structure of pseudo Greco-Roman architecture can be seen north of the dam, serving as the entrance to Tunnel No. 2. The existing dam and spillways can be seen by boat from Chabot Reservoir although buoys prevent boaters from approaching closer than 1500 feet. Chabot Park, a small park leased by the City of San Leandro, is 700 feet downstream and west of the dam. Vehicle access to the dam and the Chabot Filter Plant (Chabot Center) can be gained from this park from the terminus of Estudillo Avenue in San Leandro across a small bridge. The dam site can be approached from the south from a narrow unpaved road which enters District property from Anthony Chabot Regional Park. The entire area is frequented by hikers, bicyclists and boaters. The area is marked by numerous unpaved roads and trails.

Existing Dam and Spillway

The existing earth dam has been modified many times in its history. Today, the dam rises 130 feet from the original creek bottom and is about 700 feet wide at its base. From its broad base, the dam gradually slopes upward to a 500 foot long, 30 foot wide crest at elevation 243 feet with a concrete parapet wall at elevation 245 feet. It is estimated that the dam contains 622,000 cubic yards of earthfill material.

The upstream slope of the dam is faced with grouted riprap from elevation 200 feet to 240 feet. The downstream slope of the dam is terraced with occasional berms to accommodate small concrete lined drainage ditches which carry off surface water during rains thereby limiting erosion of the face. Erosion is further controlled by the grass and scattered brush which grows on the downstream face. The area below the dam is a dense tangle of brush. This verdant growth, characterized as "moist chaparral", is fed by seepage.

The right abutment is a very steep hillside supporting native and introduced species. (Right and left are defined as one views the project looking downstream.) In the proposed project area, there are introduced species such as pine (6 specimens), red gum eucalyptus (7 specimens), a solitary cherry tree and a large clump of prickly-pear cactus which cascades down the right abutment. Also present at the proposed construction site are indigeneous species well adapted to their particular habitat. The most prominent native trees are a large clump of California bay laurel and scattered Coast Live Oak ranging up to 36" in diameter.

Original construction of the present dam was begun in 1874 and completed in 1876. The construction technique involved bringing soil and rock particles to the site in carts and wagons, spreading thin layers of the clay rich soil mixture, and compacting each successive lift with teams of horses and some team driven wagons. The fill deposited in this manner is referred to as "wagon fill". Although the material placed in the center core of the original dam was selected, the final section was an earth-filled dam of rather homogenous material. When originally constructed, the dam crest elevation was 218 feet, but in 1885, to increase reservoir capacity, the crest elevation was increased to 233 feet using the same construction technique. Intermittently between 1875 and 1891, a hydraulic fill buttress was placed on the downstream face to thicken and reinforce the dam. "Hydraulic fill" refers to the method of construction whereby soil and rock particles are transported to a site by sluicing (mixing with fast moving water). The water is permitted to drain away, leaving the soil and rock particles. Between 1891 and 1892, additional wagon fill was placed atop the dam to bring the dam up to its present crest elevation of 243 feet. During 1892 to 1895, in order to protect the upstream face of the dam from erosion, sandstone riprap was laid. The dam was not damaged during the 1906 San Francisco Earthquake which caused severe devastation in nearby San Francisco.

The riprap was grouted in place in 1912 when the existing parapet wall was added, bringing the dam crest to elevation 245 feet. Although other modifications of the dam facilities were carried out, no further work on the dam was required until 1964 when a buttress fill was added to the downstream face after a study of its stability was made by Shannon & Wilson, geotechnical consultants engaged by the District. For this analysis, the consultant used the "pseudostatic" method of analysis, which was the existing state-of-the-art method. As a result, approximately 5,000 cubic yards of fill was strategically placed to improve the stability of the dam. Some surface and sub-surface drains were also installed in conjunction with the fill operation.

The crest of Spillway No. 3 is located 1300 feet north of the dam on a narrow inlet of Chabot Reservoir. The capacity of Tunnel No. 3 is estimated to be 2,000 cubic feet per second. The spillway crest is at a nominal elevation of 227 feet. The 1,433 foot long spillway tunnel exits on the hill just north of Chabot Center into a concrete and masonry-lined channel leading to San Leandro Creek.

Spillway No. 1 is the most visible spillway located adjacent to the dam on the right abutment. This has been modified at various times in the 100-year history of the dam. Upstream of the access road concrete bridge (built in 1954) there is a 100 foot wide trash rack structure, built in 1933. The nominal spillway lip elevation is 233 feet, about 6 feet higher than Spillway No. 3 to the north.

Just beneath the bridge, the 50 foot wide Spillway No. 1 drops abruptly over masonry steps through a vertical distance of about 43 feet. The masonry steps serve as a combined energy dissipator and transition structure, and they narrow rapidly to a 16 foot deep channel. The concrete-lined channel drops at a 5% slope and curves slightly for a distance of 172 feet to enter a tunnel structure excavated into the right abutment.

The concrete lined tunnel structure slopes rather abruptly to a 10-foot diameter steel pipe some 45 feet below. It is this tunnel-pipe structure, in particular, which limits Spillway No. 1 safe flow capacity to an estimated 2,600 cfs. The 10-foot pipe, which has a slight slope and directs the spillway's discharge over a sloped concrete apron approximately 20 feet wide with 16-foot vertical walls, drops abruptly into a small round pool approximately 8 feet below.

Other than the masonry steps, this 8-foot drop-off is the only feature available to dissipate the kinetic energy of flood waters dropping the entire 123 feet to the pool and creek below. The stream bed was riprapped originally but the work is not evident today due to the lush vegetation which has overgrown the site over the past 40 years. At present, a slow trickle of water seeps continuously into the spillway from the right abutment up near the bridge overpass. This flow helps to maintain the pond and the associated marsh downstream.

The existing spillway system has operated in 23 of the last 50 years, safely dissipating flood waters from Chabot Reservoir to San Leandro Creek downstream. The maximum flow that has occurred was 1,626 cfs in 1958. This flow consisted of 722 cfs at Spillway No. 1, and 904 cfs at Spillway No. 3, which serves as the primary spillway. It is 6 feet lower than Spillway No. 1. As a result, Spillway No. 1 has carried flood waters only once in the last 50 years. The combined safe spillway maximum capacity of 3600 cfs is considered insufficient by current standards. The inadequacy of the spillway system has been recognized for some time and the proposed project would remedy these known deficiencies in operation. Both the No. 1 and No. 3 spillways are subject to obstruction by floating debris.

Reservoir and Water Supply Functions

The reservoir created by Anthony Chabot has served as a source of domestic water since the summer of 1875 when the first tap was turned on. Originally, the raw water was brought from the lake bottom (Tunnel No. 1) and was processed at a small screening plant at the portal of Tunnel No. 1. This screen did little more than remove the larger matter from the water. Problems with taste and odor soon occurred -- supposedly because the contractor had neglected to remove an orchard from the lake, thus tainting the water. The continuing public furor and the persistence of Dr. George C. Pardee forced the Contra Costa Water Company (then a private concern) to install a filtering system in 1888.

The "filtering reservoir", as it was called then, (presently used as a sedimentation basin) did little to remove the offensive tastes and odors, but the nine "Hyatt Filters" installed soon after did improve the water quality substantially. The Chabot Filter Plant complex (Chabot Center) was upgraded in 1910 and changed little up to 1931.

The filter plant was upgraded by the District in 1931 and the Center remained in service until the late 30's. Filtering operations ceased at that time, but resumed in the early 40's and continued until the middle 60's. Since then the reservoir has served as a standby terminal reservoir except for a brief period between July and September of 1973 and again during the present drought.

A number of factors contributed to the "standby" terminal reservoir status of Chabot Reservoir. With completion of the First Mokelumne Aqueduct in 1929 the need for Chabot water was reduced. This new source of water from Pardee Reservoir in the Sierra Nevada foothills offered a stable source of excellent quality water. The changeover from dependence on local runoff to the distant Sierra Nevada source and changes in water service requirements made operation of the Chabot Center uneconomical. The relatively high turbidity and organic content of Chabot also creates a greater potential for water quality problems. The reservoir level is such that after the water has been filtered, all water treated at this plant has to be pumped into the distribution system. The relatively high cost of Chabot water thus was a crucial factor in the decision to place Chabot Reservoir on a standby basis.

As a standby terminal reservoir, Chabot Reservoir serves the following purposes:

1. Should the need arise because of drought, fire, or earthquake emergency, provisions have been made to route chlorinated raw lake water directly into the District's major distribution system, bypassing the filter plant.

2. The Chabot Center has a maximum capacity of 7 million gallons per day which can be used to deliver filtered and chlorinated water from Chabot Reservoir to the southern portion of the District's service area. Thus, the Chabot Filter Plant has the potential of providing limited service to portions of Oakland, San Leandro, San Lorenzo, and Castro Valley.

3. The lake is utilized for recreational fishing and boating, and is a scenic adjunct to Anthony Chabot Regional Park.

Chabot Reservoir and its filter plant have been utilized during the current drought.

Purpose and Nature of the Project

The proposed dam and spillway modification project would be undertaken to improve the dam safety in the event of extreme flood conditions, or a severe earthquake. The modifications proposed consist basically of raising the crest of the dam to gain freeboard and building a new spillway capable of safely passing the PMP flow or PMP flood.

In 1974, an evaluation of the seismic stability of Chabot Dam using the recently developed "dynamic analysis" method was conducted by Woodward-Clyde Consultants (then operating under their former corporate name of "Woodward Lundgren and Associates"), an independent consulting firm for EBMUD. A summary of that report stated:

"Based on the results of this evaluation, it appears that during a magnitude 8+ earthquake originating along the San Andreas Fault or a magnitude $7\frac{1}{2}$ earthquake originating on the Hayward Fault there is a possibility of surface sloughing on the upstream face of the Chabot Dam and hence an ultimate slumping of the crest. This could result in some reduction of freeboard."

The report went on to say that 10 to 15 feet of additional freeboard would be desirable, but that the specific amount would have to be determined when additional analyses were made for the necessary modification to the dam. The report further mentioned the favorable response of the dam during the 1906 San Francisco Earthquake on the San Andreas Fault, which has been estimated to be 8.2 magnitude on the Modified Richter Scale. The dam was in full operation at that time and suffered no apparent damage.

Woodward-Clyde Consultants submitted a subsequent report in 1977 on their evaluation of the seismic stability of Chabot Dam with the modifications proposed by the District's Engineering Department. This evaluation was based on new studies conducted at the University of California at Berkeley which resulted in a refinement of the dynamic properties of the embankment materials. A re-evaluation of the behavior of the embankment during the postulated San Andreas event, using the refined dynamic properties, showed a much improved picture of the behavior of the embankment in terms of potential settlement and permanent deformations.

On the basis of an assessment of the revised computations of strain potential, it was concluded that the maximum settlements of the embankment at the mid-section due to an event of magnitude 8+ occurring along the San Andreas Fault are not expected to exceed about 3 to 5 ft. The consultants therefore recommended raising the elevation of the crest of the dam by 5 ft. to accommodate the possible loss of freeboard.

The Corps of Engineers' guidelines developed under the 1972 National Dam Safety Act classifies Chabot Dam as a large dam with "high hazard" potential (because there is the potential for a large loss of life and extensive economic loss). Because of its large size and high hazard potential, the guidelines recommend that the spillway should be capable of passing the probable maximum flood (PMF).

In a letter to the District, July 18, 1975, the Division of Safety of Dams stated that "The Division's present practice requires that the spillway for a dam and reservoir with the physical size and downstream population and property as at Chabot Dam should be designed to safely pass a probable maximum flood (PMF)." This letter stated further that "We believe the flows associated with a PMF are considerably in excess of what could be safely passed by portions of the existing Spillway No. 1, even for relatively brief periods of maximum flow".

A study conducted by the Water Resources Planning Division of EBMUD established the magnitude of such a flood. Factors considered were: basin urbanization, watershed soil conditions, a probable maximum precipitation storm over the entire watershed, and full Upper San Leandro and Chabot Reservoirs. The estimated probable maximum precipitation (PMP) storm for the Chabot Reservoir watershed area (approximately 42 square miles) would have a rainfall of approximately 14.5 inches in a 24-hour period. Based on the above, runoff from the PMP storm was routed into and regulated through Upper San Leandro Reservoir and spilled over the newly modified USL dam and spillway. This Upper San Leandro outflow was combined with the intermediate Chabot basin runoff to become the inflow to Chabot Reservoir. The results were a peak

Chabot inflow of 16,000 cubic feet per second (CFS) and a regulated peak outflow over the dam and spillway of 9,500 CFS.

As proposed, the spillway modifications would noticeably change the existing dam and right abutment (Figure 1). The structures on Spillway No. 1 that would have to be removed include the present broad spillway entrance, the trash racks, the stop log structure, and the bridge. The upper portion of Spillway No. 1 would be excavated down to suitable embankment material and would be backfilled with selected and suitably compacted material from the adjacent spillway excavation and other borrow sources, and would become a part of the dam embankment. The Spillway No. 1 tunnel structure would be plugged with concrete or removed and the pipe downstream of the tunnel would be removed. The concrete discharge apron would be leveled. The masonry steps and adjacent lined channel and the discharge apron downstream of the tunnel would be covered with compacted material from the required spillway excavation.

The vegetation, including trees, on a portion of the right abutment would be removed and offhauled. Construction of the proposed spillway would require excavation of 96,500 cubic yards of material. To minimize the amount of material that must be disposed of, cut and fill quantities would be balanced as much as possible by flattening fill slopes on the downstream side or by widening the dam crest. Surface soils containing organic material would be temporarily stockpiled for later use on selected graded surfaces to facilitate growth of grass. It is anticipated that most of the excavated soil and rock would be used for raising the downstream face of the dam to the new crest elevation. Any excavated material encountered which is unsuitable would probably be disposed of on site.

The on-site disposal area for excess or unsuitable excavated material would be at the toe of the dam, on a gently sloping area on the left side of the creek, and in the hollow where the 10-foot diameter pipe is now located. The dam fill to be added would cover the existing crest and the upper portion of the existing downstream face of the old dam. No placement of material on the upstream face of the dam is proposed. The fill would be placed to increase the height of the dam by five feet. The new dam crest would be 40 feet wide. Two thousand three hundred cubic yards of impervious core material in the crest addition will come from a borrow area on the left abutment near the crest. A new road and bridge would be installed over the new crest and new spillway to provide continued access across the dam. Berms on the downstream face would control erosion damage and allow easy access to the drainage ditches created to carry off surface water during heavy rains.

The general features of construction are illustrated in Exhibits 7 through 9.

The proposed spillway would be a large reinforced concrete structure capable of conducting safely waters of a probable maximum precipitation past Chabot Dam. Capable of carrying 9,500 cfs, the proposed spillway would be approximately 500 feet long, 25 to 72 feet wide, and 8 to 31 feet deep with a control weir at the upstream end and an energy dissipating structure at the downstream end. The configuration has been carefully checked by hydraulic model studies conducted at the Santa Clara laboratory of HRS (Hydro Research Science) under the direction of Dr. Alexander Rudesky.

The proposed spillway would be oriented approximately 45° from the base line of the dam, would be excavated into the right abutment, and would end just downstream of the existing 60-foot apron and small pool. The entire structure, with the possible exception of the upstream apron section would be founded on bedrock. A broad 100-foot wide flat apron would narrow to a 25-foot wide "ogee" weir 8 feet high with a crest elevation of 227 feet, thereby maintaining the present lake elevation.

The proposed stilling basin located approximately 116 feet lower in elevation than the spillway crest, would be approximately 90 feet long, 30 feet deep, and 72 feet wide. The proposed stilling basin essentially converts the shallow, high velocity flow from the steep chute to a deep low velocity flow. The special design incorporated in the basin permits this to be accomplished in a much shorter distance than a conventional "hydraulic jump" stilling basin. The hydraulic model studies indicate that erosive velocities from the proposed spillway design would be minimal, but erosion to the streambed would be further prevented by rock riprapping the creek channel for a short distance downstream of the stilling basin. The cutoff wall required at the end of the new spillway stilling basin would extend 30 feet on either side of the basin and extend down to a depth of 10 feet or to bedrock.

The existing creek downstream of the spillway stilling basin would be altered for a distance of approximately 300 feet. The existing vegetation, particularly downstream of the spillway, would be removed and disposed of and the existing unlined stilling pool would be filled. The creek bed would be graded in preparation for placement of large riprap rock. The bed downstream of the stilling basin would be improved and riprapped for approximately 100 feet to protect the streambed and creek valley walls from erosion. The creek channel would be improved (requiring the removal of some trees) for another 900 feet to allow the flood flows to pass unrestricted.

A primary consideration in the design of the proposed new spillway was the criterion that no significant increases in either downstream flood discharges or in reservoir elevation over those that would have occurred from the existing spillway system (if there had been adequate free board and structural soundness) would result from the new spillway. To accomplish this, the new spillway crest was designed to have a discharge rating curve closely matching that of the existing spillway system. This rating curve was subsequently verified by hydraulic model studies and the closeness of matching can be seen on Exhibit 7. The peak discharge and maximum water surface elevation for a range of infrequent storms with the present spillway system and the proposed spillway are also noted on the figure. These results are based on reservoir routing studies of the flood inflows for the various frequency events.

For a proposed project of this magnitude and complexity, considerable amounts of material, manpower, and equipment would be required. The spillway would require about 8,000 cubic yards of concrete and 1,250,000 pounds of steel reinforcing bars. The removal of approximately 96,000 cubic yards of rock from the steep right abutment for the spillway and the subsequent placement of this material on the dam embankment and the disposal sites would require heavy earth moving equipment. This equipment would require widening and some possible reconstruction of a narrow access road which starts from Lake Chabot Road upstream of the dam. Access from Estudillo Avenue in San Leandro would be limited to relatively light vehicles because of the limited capacity (5 ton) of the wooden trestle bridge leading to Chabot Park.

ENVIRONMENTAL SETTING

The environmental setting of the proposed project is complex. It will be discussed below under several separate classifications.

A. Hydrology

The proposed project is located entirely within the watershed of San Leandro Creek. Due to the existence of the present dam, a substantial portion of the runoff from the watershed above the dam is impounded in the reservoir. Normally, no controlled releases are made into the creek downstream. There is some very small flow into the stream from seepage around and through the dam.

The District holds water rights to the Upper San Leandro Creek watershed above Chabot Dam, and has no obligation to maintain flow in the creek below Chabot Dam. There are no known downstream users that depend on water from the creek in this area.

The site receives, on the average, about 27 inches of rainfall per year. Data collected by the District indicates that runoff from the watershed above the dam is important but is not of major significance in terms of the District's total water demands.

Groundwater in the San Leandro Creek Valley area is not a significant factor. The existing Chabot Reservoir intercepts the stream flow or groundwater from San Leandro Creek valleys below the existing USL Dam, and from Grass Valley to the northeast of Chabot Dam.

The total drainage area above Chabot Dam is 42.35 square miles. Of this amount, 30.36 square miles is above Upper San Leandro (USL) Dam. Urbanization in the Moraga and Orinda area accounts for approximately 13% or 4 square miles of the drainage into USL Reservoir.

There are six principal drainages into the basin above Chabot Reservoir which all flow intermittently. San Leandro Creek drains the unincorporated community of Canyon. Moraga Creek drains much of the town of Moraga and forms the Valle Vista arm of USL Reservoir. Redwood Creek drains Redwood Canyon. Buckhorn and Kaiser Creeks drain a large area northeast of USL Reservoir. Miller Creek drains the canyon south of Riley Ridge and enters San Leandro Creek immediately downstream of the new USL Dam. These streams, plus the upstream releases from USL Reservoir, account for more than 90% of the inflows to Chabot Reservoir. The remaining inflow comes from smaller intermittent streams to the northeast and south of the reservoir.

B. Water Quality

The District routinely carries out chemical analysis of water from its terminal reservoirs. Tests indicate that the water from Chabot Reservoir has a consistently higher mineral content than other terminal reservoirs. Chemical analysis taken in 1974 indicated that Chabot water alkalinity and hardness (reported as CaCO in mg/ℓ) was over 10 times that reported for Pardee water, the major source of the District. It is the higher turbidity and organic content of untreated Chabot Resrvoir water that requires its more elaborate treatment, thereby increasing its cost.

The water quality available to the District from the Mokelumne Aqueducts is excellent (low in turbidity and organic matter), thus is less expensive to treat. With a normally adequate supply of excellent quality water for its customers at lower cost, the District has elected to use the Chabot Reservoir only as a standby terminal reservoir.

C. Flood Control

Both Upper San Leandro and Chabot Reservoirs serve to store the watershed runoff carried by San Leandro Creek. The District does not operate these reservoirs for flood control purposes and has no commitment to do so. As a water supplier and water right holder, every effort is made to avoid spills through good planning.

D. Sediment Transport

An incidental benefit afforded by the Chabot Dam is the retention of silt that would otherwise be carried to the lower reaches of San Leandro Creek. The reservoir serves to reduce possible channel maintenance costs for removal of silt from the portions of San Leandro Creek below the dam.

According to survey information, silt has been deposited to an elevation of 175 feet in the vicinity of the dam. According to early surveys, the quantity of silt that has been deposited in the Chabot Reservoir is about 4 million cubic yards. This sedimentation has reduced the storage capacity by an equivalent volume of 800 million gallons, or 2,500 acre-feet. The rate of sedimentation of the lake was reduced as a result of construction of the USL Dam. When completed, the proposed project would alter sedimentation transport very little, except by reducing erosion of the stream bed downstream of the dam.

E. Soils and Geology

Field explorations and geological analyses indicated that the right abutment where the proposed spillway would be located, has a soil mantle which ranges in depth from 0 to 15 feet above firm bedrock. The soil mantle is generally derived from weathering of the bedrock beneath. At the bottom of the canyon, the soil is deeper alluvium deposited by San Leandro Creek throughout its history.

A report by the District's Consulting Geologist, Burton H. Marlaive, indicated that:

> A wide variety of rock types is found at the Chabot Dam site and identification is complicated by surface weathering and by alteration due to metamorphic processes. The oldest rocks are from the Franciscan Group which is here represented by meta-volcanics or greenstones and by intrusive gabbros and ultrabasic intrusives. The ultrabasic intrusives are partially altered to serpentine, talc, and magnesite, and near the surface may be weathered to a blue grey clay in places. Cretaceous and jurassic sediments found upstream of the site are predominately blue grey clay shales with some sandstone and conglomerate. Some massive clay shales of the same formation are also found downstream

of the left abutment. Quaternary rhyolitic dike rock has intruded along an old fault contact between the older Franciscan igneous rocks to the west and the younger Knoxville and Chico sedimentary rocks to the east. A volcanic flow of rhyolite caps much of the ridge a quarter-mile southeast of the dam.

Geologic structure in the area is controlled by the northwesterly trending Chabot and Hayward Faults and by cross-faulting between them. A half-mile downstream of the dam, the San Leandro Creek is offset over 1000 feet by the Hayward Fault, the west side of the fault moving northerly. The east Chabot Fault cuts the peninsula across Chabot Reservoir from the dam, while the west Chabot Fault is offset by cross-faulting that passes along the axis of the dam. Most indications of the old cross-faults have been destroyed by the intrusion of the rhyolitic dike rock along their traces. No fault movement in the rhyolitic rocks can be detected other than minor slip planes along the southern contact so it may be assumed that the faults are inactive.

F. Seismicity

A seismic fault map is shown for the area of the proposed project on Exhibit 6. The most significant active faults affecting the general area are the active Hayward Fault one-half mile to the west; the active San Andreas Fault 19 miles to the west; and the active Franklin-Calaveras Fault nine miles to the east. Inactive faults in the vicinity of the project include the Miller Creek Fault three miles to the east and the East and West Chabot Faults, both located within 2000 feet of the proposed project. Woodward-Clyde Consultants made a thorough evaluation of faults and earthquake potential affecting this area and indicated that the Hayward and San Andreas Faults pose the greatest potential threat to Chabot Dam. These consultants, in cooperation with Professor H. B. Seed, Program Consultant to EBMUD for the seismic re-evaluation of dams, chose "design earthquakes", which are generally accepted as the maximum credible earthquakes capable of occurring along the Hayward and San Andreas Faults. The "design earthquakes" were established as M = 7-1/2 on the Richter Scale for the Hayward Fault, and M = 8+ for the San Andreas Fault. These are the levels of magnitude which the modified embankment would be designed to withstand. Woodward-Clyde Consultants estimated the recurrance of such earthquakes at 500-1000 years for both the San Andreas and Hayward events. They also noted that these recurrence estimates were based on a statistical analysis of earthquake events that have occurred in the past, and that both design earthquakes are "sensible" events based on present state of knowledge.

G. Vegetation Patterns

The area around Chabot Reservoir is generally classified as chaparral and mixed woodlands. The original streambed immediately downstream of the project site has been characterized as "moist chaparral."

The streambed and adjacent canyon walls sustain lush brush and tree growth. The brush is principally coyote bush, poison oak, and blackberries. A great variety of bromes, rye, oats, and other grasses partially cover the surrounding hills. Wildflowers, such as California poppy and lupine are abundant in early to late spring. The trees include coast live oak, madrone, sycamore, California laurel, willow, and big-leaf maple, as well as introduced varieties of pine and eucalyptus. A large growth of prickly-pear cactus cascades down the hillside from the right dam abutment. Cat-tails and rushes are abundant around portions of the lake and along the stream bed downstream from the dam.

Although public access to the area has been limited, man's impact upon the natural environment is quite evident. Past construction activities, as well as the dam itself, have significantly altered the original natural conditions. Fencing to limit public access, the presence of fishermen on and around the lake, and the appearance of cyclists and hikers along the "Lake Shore/West Shoreline" Trail have also altered the natural occurrence of wildlife in the area.

The project site is not unique since comparable areas and topography exist throughout the general area. However, valuable wildlife habitat is provided by the mixed combination of grass and woodland. In some areas, such as the pond and marshy area at the foot of the existing Spillway No. 1 and the cat-tail growths near Spillway No. 2, the vegetation provides rather special qualities conducive to localized wildlife.

There is a stand of white alders and a large coast live oak on the south side of the access road at the foot of the dam face. Also in the same area are two low spreading redberries, Rhamnus crocea, which would be threatened by construction. These might be removed and transplanted in an appropriate nearby habitat.

According to the records of the California Academy of Sciences, the rare Fritillaria liliacea once occurred in grassland near the dam.

A botanical inventory of the project area is included in Appendix B.

H. Existing Wildlife

The surrounding area supports a variety of native wildlife. Appendix A lists a wildlife inventory for the area. Blacktailed deer, skunks, raccoons, opossums, weasels, foxes, rabbits, squirrels, and gophers have been seen in the area. Reptiles and amphibians are found in abundance around the periphery of Lake Chabot and along San Leandro Creek. Birdlife includes vultures, hawks, owls, woodpeckers, jays, doves, swallows, California quail, sparrows, finches, blackbirds, and numerous other native birds, as well as seasonal populations of ducks and geese, which rest on the lake during migration. A large population of redwinged blackbirds nest each spring in the cat-tails between the dam and Spillway No. 3. Each year, swallows construct 20 to 50 nests on the exposed concrete undersurfaces of the existing spillway bridge. Native and introduced varieties of fish found in Lake Chabot include large mouth bass, channel catfish, carp, bluegill, trout and crappie. The cover near Spillway No. 3 is the spawning ground for large numbers of small mouth bass each year. Large 15 to 20-pound channel catfish are taken from the reservoir near the face of the existing dam.

The most obvious fragile population in Anthony Chabot Regional Park is the Great Blue Heron and Great Egret rookery, located on the northwest point of Las Cumbres Ridge directly east across the lake, about a mile from the proposed project site. Currently, 9 to 15 pairs of both shy species are known to use this rookery through the spring and summer months. Although the nests are inaccessible due to their location high in eucalyptus trees, human disturbance in the near vicinity may result in breeding failure. While these species are not rare or endangered, this colony is considered unusual enough to be considered "rare". The proposed project should have very little or no effect on this colony.

I. Rare or Endangered Species

The only rare or endangered species known to have existed on the proposed project construction site, is the Fragrant Fritillary, Fritillaria Liliacaei. This member of the lily family is only known to exist in five other locations, all of which are in California. The area where they were last sighted (in 1916) was on the downstream face of the existing Chabot Dam. In the last 60 years, since this species was last found, the dam has undergone several modifications, including the addition of the "fillet fill" on the downstream face. This additional embankment covered the area with about 10-20 feet of soil where the Fragrant Fritillary was last sighted. During a field survey in 1975, conducted by staff members from the District, a Naturalist and East Bay Regional Park District personnel, no evidence could be found of this species and it is believed that this species no longer exists on or near the the project site.

Other rare or endangered species that may be located near or dependent upon the proposed construction site include:

The California Tiger Salamander, a large, robust salamander that reaches 8 inches in total length. Scattered populations live in the vicinity of the Anthony Chabot Regional Park. Because they spend the majority of their lives in underground retreats (such as ground-squirrel burrows), are nocturnal and generally emerge only during rainy periods between late fall and early spring, the presence of the species is difficult to establish. The habitat of the adult species is diverse, ranging from oak woodland and grassland communities to semi-arid regions.

The Alameda Striped Racer is a rare species occurring in the valleys, foothills, and low mountains of the Coast Ranges east of San Francisco Bay, Alameda and Contra Costa Counties. A species with a very low population density, it has been greatly depleted as a result of construction of homes and roads throughout its original range. The Anthony Chabot Regional Park and surrounding open space offers suitable habitat to this species. If in the vicinity, the snake could be expected to retreat from the disturbance created by the proposed construction.

J. Historical and/or Archeological Sites

The closest known archeological site has been reported on the San Leandro Creek in the vicinity of the Southern Pacific Railroad crossing three miles west of the proposed site. Other archeological remains have been reported four miles to the southeast in the Mulford Gardens area in San Leandro.

Although no formal investigation has been conducted, there are no known historical or archeological evidences at the project site. Archeological finds would be unlikely at this site. Members of the Ohlone tribe which inhabitated the East Bay area have been characterized as hunters and gatherers. The proposed construction site, in the vicinity of San Leandro Creek, would not lend itself to utilization except as temporary resting place. The modifications of the site subsequent to the original construction of the dam would likely have obliterated any archeological remains.

Should such remains be encountered during construction activities, earth-moving work in the immediate area would be halted and a professional archeologist would be consulted to assess the situation and make recommendations for the preservation and/or salvage of all endangered archeological remains.

The historical significance of the Chabot Dam and Lake was recognized by the American Water Works Association (AWWA) when, in 1974, the site was designated as "American Water Landmark Number 24." The AWWA defines a landmark as follows:

> "According to AWWA, an American Water Landmark is a solid, tangible property--one you can see and admire--that is or has been directly related to water supply, treatment, distribution, or technical development.... It is at least 50 years old; is locally recognized as a landmark; and is kept up in a manner fitting to its significance. With those qualifications, a property can be proposed to AWWA for consideration and possible admission to this elite group."

In 1974, Chabot Dam and Reservoir also was designated as an Historical Civil Engineering Landmark by the San Francisco Section of the American Society of Civil Engineers.

These Landmark designations carry no restrictions relating to improvements, reconstruction, etc., and will not be affected by the proposed construction. The District's obligation would be to provide an appropriate location for plaques commemorating the historical background of the structure.

The intake structure to Tunnel No. 2 (the "Temple") and the remaining original portions of Chabot Center, would not be affected by the proposed project and would consequently be preserved for their historical significance.

K. Traffic Patterns

Vehicular access from the northwest, from the terminus of Estudillo Avenue, is restricted by locked gates to Chabot Park, a 5-ton capacity wooden trestle bridge, and locked gates to Chabot Center. As its eastern terminus, Estudillo Avenue serves as a minor access street to a small single-family residential neighborhood. West of Lake Chabot Road, Estudillo Avenue is a major four-lane thoroughfare running east-west to downtown San Leandro. Estudillo Avenue merges with Lake Chabot Road in a quiet residential neighborhood above the MacArthur Freeway near the Oakland-San Leandro city limits.

Lake Chabot Road links northern San Leandro with the largely residential Castro Valley area to the southeast, terminating at Castro Valley Boulevard, a four-lane commercially developed thoroughfare. From its intersection with Estudillo Avenue in San Leandro, Lake Chabot Road rises on the steep wooded hillside passing the operational San Leandro Rock Company quarry on the right, and continues to rise approximately 250 feet above the lake.

The winding two-lane road offers a number of panoramic views of the lake below and the hills of Anthony Chabot Regional Park. The road offers a scenic north-south secondary alternative to motorists wishing to travel between northern Castro Valley and San Leandro and points north. The more heavily used route for traffic now is the modern four-lane expressway, Fairmont Drive which joins Lake Chabot Road, near the southern end of Chabot Reservoir and 150th Avenue at the interchange with Freeway 580 in San Leandro.

L. Noise

Noise levels in the vicinity of the proposed project are fairly low. The existing dam has no power generating facilities or other noise sources. With the exception of noise generated by vehicular traffic on Lake Chabot Road, and heavy equipment noise when the San Leandro Rock Company quarry is in operation (a distance of 1,200 feet away), the noise level is similar to that of typical rural locations.

M. Open Space and Watershed

The region in the vicinity of the proposed project is designated as a Land Preserve in Primary Open Space in the Alameda County Open Space Element of the General Plan. According to the Open Space Element, published on May 30, 1973, "preserves" are described as follows:

> Preserves are permanent open space areas of irreplaceable natural or environmental resources or areas of outstanding beauty and consist primarily of existing and proposed major park and recreation areas shown on the County General Plan, which in turn include watershed lands and other public owned non-recreation lands. The East Bay Ridge north of Castro Valley, Roundtop Regional, Joaquin Miller, and Tilden Regional Parks, as well as East Bay Municipal Utility District lands are considered preserves.

The watershed above Chabot Dam has an area of over 42 square miles. Because both Upper San Leandro Reservoir and Chabot Reservoir are used for storage for domestic water services, land use is very restricted, although about four square miles is urbanized in the Moraga area. The greatest proportion of the watershed is owned by EBMUD and the EBRPD. Suitable portions of the watershed are leased for cattle grazing purposes. A trailway system limited to use by hikers, bicyclists, and equestrians is currently in use. The trailway system may be expanded in the future, but no specific plans have been finalized.

The aesthetic value of the open space is often a matter of personal taste. When considered in the broad context of the entire open space area, the disruption due to the proposed project would be small. The overall effect of the proposed project would be to maintain an appealing body of water (Chabot Reservoir) in a parklike setting. On the other hand, the immediate vicinity of the proposed project would be altered obviously.

There are few locations readily accessible to the public that offer the Chabot Dam as an object of interest in a panoramic view. The dam and spillway are generally shielded from public view by vegetation. A small portion of the site, primarily the right abutment upstream of the dam and the "temple" structure, can be seen briefly by motorists from Lake Chabot Road from only one or two locations.

Because of the dam's secluded location deep in a wooded canyon, its scenic impact is limited largely to surveying the dam from atop and immediately adjacent to the structure itself.

ENVIRONMENTAL IMPACT

A. Short-Term Impacts

The proposed project would require clearing and excavation in the area of the right abutment for the spillway, demolition or burial of the existing Spillway #1, construction of the proposed concrete spillway, placement and compaction of the embankment material on the crest and downstream face of the dam, and improvement of the narrow access road adjacent to the lake. Each of the above activities would have its own particular impact in the immediate vicinity of the construction undertaken.

Visual Aesthetics

The excavation, earthmoving, placement and concrete construction activities involved in the proposed project would have a significant adverse effect on the aesthetic quality of the project area. The proposed construction would expose bare rock and earth over a portion of the right abutment, the dam face, and portions of the access road paralleling the lake. While construction is under way, little can be done to mitigate the impact of such operations except to minimize the area disturbed, and to exercise strict erosion and dust control measures.

The secondary short-term visual/aesthetic impact of the proposed construction would be the temporary reduction of the lake level to construct the inlet channel to the spillway. A 15-foot reduction of the lake level below the spillway elevation would result in exposing 97 acres of the reservoir around the perimeter of the existing reservoir. This consequence of the proposed project probably would constitute the most adverse visual/aesthetic impact experienced by the public. The time that the lake would be lowered would be minimized by judicious scheduling of construction activities in the vicinity of the proposed spillway. The East Bay Regional Park District hopes this lowering of the reservoir level would have benefits to it in that it would facilitate required repairs and maintenance to EBRPD structures on the shores of Lake Chabot.

Clearing and Grubbing

Clearing and grubbing are an essential part of the proposed project. Vegetation on the right abutment within the limits of spillway construction would be stripped prior to excavation for the proposed spillway. The dam face would be stripped of its grasses and scattered brush prior to placement of suitable embankment material. Clearing and grubbing operations undertaken in the canyon bottom would be required in preparation of disposal sites and of the creek bed bottom prior to channelization and riprapping. Some relatively minor amounts of clearing and grubbing would be required along the access road adjacent to the lake in preparation of the narrow roadway for passage of heavy construction equipment.

A tabulation of the major trees that would be removed is as follows:

Pine: 1 at 66 inches, 1 at 60 inches, 1 at 22 inches, 2 at 20 inches, and 1 at 10 inches diameter.

Gum: 2 at 43 inches, 2 at 40 inches, 1 at 20 inches, 1 at 12 inches, and 1 at 9 inches diameter.

Oak: 2 at 36 inches, 1 at 30 inches, and 22 at 8 inches to 12 inches diameter.

Cypress: one 8 inches diameter

Cherry: one 8 inches diameter

Cactus: Large clump

Importation of Material

The approximate balance of cut and fill (excavation over emplacement) would eliminate the need of requiring large quantities of import fill material for emplacement on the crest and downstream face of the dam. However, imported select material may be required for the central impervious portion above the existing crest of the dam if an apparent local borrow source is not adequate. Rock riprap and bedding, and other granular material to be used as a base for the proposed road atop the new dam crest, would have to be imported. It is estimated that approximately 4000 cubic yards of riprap material and approximately 3000 cubic yards of bedding material would be required.

A major imported material would be concrete. It is estimated that the proposed spillway would require 8000 cubic yards of concrete.

Incidental

One of the concepts of the proposed project is to balance the amount of excavation against the proposed emplacement. This could be considered a mitigative measure itself. The amount of material requiring excavation and placement for the proposed project amounts to the most advantageous and possibly the most economical alternative available. As mitigative measures, every effort would be made to use the excavated materials and thus reduce the amount of material to be spoiled and to limit imported materials to those materials not available at the site.

Improvement of the narrow access road from Lake Chabot Road would be required to accommodate the increased travel by heavy construction equipment such as dump trucks, concrete trucks, and steel delivery trucks. To reduce the excavation required, the cuts and fills would be matched along the access road whenever possible.

Borings indicate the rhyolite bedrock in the vicinity of the proposed spillway is badly fractured, and that blasting would not be required. However, if blasting were to be required, the Contractor's plan would have to be approved by the District prior to any blasting. The amount of blasting, if any, or the blasting technique, would be determined during excavation and would depend on the nature, location and configuration of the rock mass to be removed.

Another factor in diminishing air quality during a typical earthmoving construction project would be fugitive dust. The most effective mitigative measure for treatment of fugitive dust would be water spraying of access and haul roads during dry weather. In the case of this project, the amount of dust is expected to be small because most of the required excavation is in rocky material.

In the context of construction for the proposed project, the earthwork would constitute the major significant impact, the creation of the proposed concrete spillway being second. The earthwork would require the use of large earth moving equipment. The type of equipment used on a project is usually left to the Contractor as is the particular method of accomplishing the work. Similar projects generally require the use of large bulldozers, large capacity dump trucks, sheepsfoot rollers, cranes, backhoes, loaders, graders, and scrapers.

Air Resources

Local air quality would be temporarily reduced slightly as a consequence of the proposed construction activity. The exhaust particulates and byproducts generated by equipment consumption of an estimated 90,000 gallons of fuel, would be the primary source of air pollutants (several hundred pounds, maximum, per day).

The degradation is slight when compared to the total emissions (1970 estimate of over 9000 tons per day) encountered in an average day in the nine-county Bay Area.

Noise

The temporary impact on the acoustic environment in the immediate vicinity of the project would be relatively significant and adverse when compared to the existing low ambient noise levels. The primary impact would result from the loud noises generated by the heavy construction equipment and haul trucks. This type of equipment may be expected to produce noise levels above 85 dB(A) (when measured at a distance of 50 feet) as compared to an existing ambient level below 50 dB(A).

The immediate vicinity is largely unpopulated, and the effect of high noise levels would be experienced primarily by the workers at the project site. People passing the project site along Lake Chabot Road would probably not hear the construction noise over the sound of their vehicles. Those fishing or hiking in Lake Chabot Regional Park would hear the noise, but because of their more distant location, the level is not considered to be significantly annoying.

The noise level at the project site, although high due to the use of heavy equipment, is not expected to exceed industrial noise standards administered by the State Department of Industrial Safety. Since this project has no unique requirements which differ from most earth moving or concrete construction projects, the noise generated is not expected to have a significant adverse effect on man.

The impact of noise on wildlife in the area can only be assumed. The disturbance created by noise would probably be a significant factor in causing the temporary displacement of all wildlife and perhaps even the abandonment of breeding functions for several species for a period of two to three breeding seasons. No permanent long-term effects are expected to result from the increases in noise levels.

Water Quality and Resources

The temporary 15-foot lowering of the Chabot Reservoir during construction activities in the vicinity of the proposed spillway would have significant impact. The reduction in available storage would amount to 1.5 billion gallons which would diminish the potential standby water service capabilities of Chabot Reservoir by 42%. The lowering of the lake would expose over 97 acres of shoreline much of which supports aquatic vegetation. Subsequent increase in the lake elevations to current levels would submerge the partially decomposed aquatic vegetation and any emergent aquatic vegetation, possibly having a minor short-term adverse effect on the water quality of Chabot Reservoir.

Reservoir Drawdown

Construction of the spillway crest and approach channel requires the lowering the reservoir by 15 feet, which results in a 29% reduction surface area and a 42% reduction in capacity. Lowering the reservoir by operating Chabot Filter Plant exclusively would take approximately fourteen months, while lowering the reservoir by releasing directly to San Leandro Creek via the blowoff would take a minimum of one month. To avoid wasting water, the District would use as much of the water as possible by operating Chabot Filter Plant. The reservoir would be maintained at the lower elevation for approximately 4 to 6 months until the construction is completed.

Consideration was given to using a cofferdam to permit maintaining lake elevation during construction, but this idea was quickly abandoned due to the high cost and safety problems possible with a full reservoir in the event of cofferdam failure.

Disturbance of Fish and Wildlife

Disturbance of fish and wildlife is dependent on two factors: the actual construction activity and the temporary lowering of the lake by 15 feet. In the greater context of the available open space, the disruption of wildlife by the actual construction would be small, but in the narrow perspective of the construction site itself, the disruption would be significant. The large animals would avoid the site during actual construction because of the noise and general presence of man. Smaller animals such as mice and birds, which have territorial needs that are within the area or are contiguous to the area, are likely to be affected and could be expected to perish or flee. Studies indicate that species of birds forced to flee their original established territories have great difficulty re-establishing themselves in nearby areas occupied by their own species. Small animals which have territory within the proposed construction site, that currently occupy the right abutment and the canyon bottom, would likely not survive the construction period. The freshwater marsh at the toe of the spillway would be eliminated. Some small animals could be expected to return to the site in limited numbers from undisturbed regions peripheral to the impacted area after completion of the project. Maintenance of Chabot Reservoir at a relatively stable level as a standby reservoir has encouraged the development of an ecosystem similar to that of a natural lake. Because the water elevation changes drastically in an on-line terminal reservoir a stable vegetative complex generally is not established. A stable lake elevation encourages a proliferation of species. Consequently, the temporary 15 foot lowering of the reservoir might have a short-term impact on the reservoir's ecosystem. The bass spawning grounds in the cove near Spillway No. 3 is a case in point. The bass have selected an optimum location for their spawning. After the eggs hatch, the immature bass require the cover afforded by underwater vegetation to escape the predation of birds and larger fish. When lake levels vary widely, warm water fish spawning may be disrupted. The eggs perish, the smaller adult and fry alike are easier prey to birds and larger fish, because the vegetation cover essential to their survival would be destroyed. The result could be considered favorable from the standpoint of some, for the severe condition would encourage the presence of larger, albeit fewer, fish in the lake.

LONG TERM IMPACT

General

The major long-term impact of the proposed project would be improvement of the existing dam and spillway complex to safely pass the maximum probable precipitation flood-flow (replacing one spillway with a larger, a new spillway) and to withstand the effect of the maximum credible earthquake (modifying dam embankment) thereby minimize the risk to life and property attributable to dam failure. The major distinction of the proposed project is that the dam would be rendered "safe" by today's standards.

The occurrence of a PMP storm would probably cause flooding of portions of Oakland and possibly San Leandro on lower reaches of the San Leandro Creek, even without any overflow from Chabot Dam. Erosion of the banks of unimproved portions of San Leandro Creek could result as well. The presence of Chabot Dam would continue to regulate the flows of San Leandro Creek, reducing the downstream discharge below the amount of inflow to the reservoir. Flood routing studies indicate that the peak discharge flows from the reservoir due to a 1-in-1000 year storm would be approximately 45% less than the peak reservoir inflow and be delayed for about eight hours by the regulating effect of the reservoir. For the PMP storm, the peak outflow would be 40% less than the peak inflow and the delay would be about six hours.

The occurrence of a major earthquake along the San Andreas or Hayward Faults in the Bay Area could cause major disruption of water transmission facilities to the areas west of the Berkeley Hills. In particular, a major shift along the Hayward Fault could damage major water distribution mains and tunnels in the East Bay. Under such conditions the water stored in Chabot Reservoir would become extremely important in meeting system requirements. For this reason, the proposed project would likely be regarded by most people as having primarily beneficial impacts in the interest of public safety.

Land Commitment Impact

The proposed project would permit continued use of the reservoir and surrounding area for water storage and water-related recreation purposes.

Visual/Aesthetic Impact

The visual/aesthetic impact of the proposed project, particularly immediately after completion, would be greater than the impact of the present dam and spillway system. The broadened access road would sweep from the left bank across the higher, broader crest, traverse the chute-like spillway and merge with the old access road on the right abutment. The proposed improved spillway would have a functional appearance. After the grass on the downstream slope is established, the appearance of the improved dam would be quite similar to the present dam. The entire project area would be evenly contoured, but somewhat devoid of vegetation. It would take several years for natural vegetation to re-establish itself.

There is little question that there will be a significant visual impact immediately after construction of the proposed project. Several years of weathering of the proposed facilities and the re-establishment of vegetation would tend to soften this unavoidable visual impact.

Wildlife and Fisheries Displacement and Loss of Habitat

The area excavated in the immediate vicinity of the proposed spillway would be permanently lost as cover, breeding or feeding area for local and visiting wildlife. Similar to the impact of the existing spillway, embankment and road improvements would diminish the vegetative diversity, thereby reducing the population and density of the wildlife dependent upon the vegetation at the site.

The proposed project may act as a barrier between individual communities as well as obliterating some of the existing ecotonal area in the immediate area of the project. Both of the above-mentioned factors could lead to a small but permanent reduction of wildlife in the immediate vicinity.

The reestablishment of the plant community in the marsh area and the canyon bottom after completion of the project would be attended by a similar reentry of small animals. However, the loss of 1/4 acre of habitat could discourage a complete return of vegetation. The reduction of vegetation could result in a reduction of population densities and a reduction of species in the creek bottom.

Replacement of the existing spillway bridge and removal of the existing trash rack structure, both of which presently provide ideal surfaces for the construction of swallow's nests, is not anticipated to adversely affect local swallow populations, since the new bridge would provide at least as many ideal nesting surfaces. The project is not anticipated to have any long-term adverse effect on any of the following:

1. Redwing blackbird population which nests in the cattails and rushes between the dam and Spillway No. 3.

2. The warm water fish spawning area.

3. The Great Blue Heron and Great Egret rookeries, located in the eucalyptus trees on the northwest point of Las Cumbres Ridge.

Open Space

The proposed project would help preserve the "Primary Open Space, Land Preserve" status of the surrounding area or currently designated in the Open Space Element of the General Plan of Alameda County. The proposed project is entirely within "open space". Although it would alter the general appearance of the terrain in the immediate vicinity of the dam, the project would conform to the objectives and principles of the open-space element of the General Plan.

Historical

The Chabot Dam was designated a California Civil Engineering Landmark on June 17, 1976, by the American Society of Civil Engineers (ASCE) in "landmark plaque" ceremonies at the site. The demolition and backfill of the existing Spillway No. 1 could be considered an adverse impact on the "hand-hewn" historical construction aspects of the existing structure.

Mitigation measures to protect the historical character of the site would include preservation of the "temple" structure and portions of the Chabot Center facilities nearby. The plaques commemorating the historical quality of the site would be placed at an appropriate location on a massive marker built of stones salvaged from the dam's spillway structure.

Growth Inducement

Since the proposed project would neither increase the storage of Chabot Reservoir nor increase the water treatment capacities of the Chabot Center, it would neither induce nor deter urban growth.

Water and Energy Use

Types of water use during the proposed construction activities would be varied. Water required for compaction of the embankment fill and for dust control will come from Chabot Reservoir.

The estimated energy use attendant to the proposed project would be 90,000 gallons of petroleum (diesel and/or gasoline). Energy consumption is estimated on construction equipment using approximately 0.04 gal/hr/hp. This energy represents an irretrievable resource commitment. There would be no long term energy use due to the project.

MITIGATION MEASURES

The general area surrounding the project site, and the site itself, are important as open-space elements of great natural beauty. Motorists traveling along Lake Chabot Road and visitors to Anthony Chabot Regional Park have a panoramic vista across Chabot Reservoir of expansive undisturbed hills which over-shadow the existing dam by their size and extent. Although the dam and proposed spillway excavation area beyond are visible from portions of Anthony Chabot Regional Park, as well as from one or two locations along Lake Chabot Road, the panoramic vista across Chabot Reservoir should not be degraded by the construction of the proposed project.

The following specific measures would be used to mitigate the construction, fish and wildlife, visual, and aesthetic impacts of the proposed project:

1) The cut slopes would be contoured to avoid "knife-cut" type surfaces and abrupt changes of slope would be "softened" by rounding off any sharp breaks in contours.

2) Large areas of exposed soil would be planted with a seed mixture of grasses.

3) Trees and shrubs would be planted as screening along those limited portions of Lake Chabot Road where the project can be viewed by passing motorists if there is an expressed public objection to the resulting visual impact.

4) The "barrier-effect" of the project would be lessened by providing vegetation corridors across the project at strategic locations.

5) Vegetation removal would be kept to an absolute minimum by thoughtful planning and careful construction practices.

6) The area would be replanted with ground cover and landscaped with trees and shrubs which could provide shelter, food, and habitation for wildlife.

7) Construction and haul activities would likely be limited to daylight hours on weekdays, except during unusual circumstances. Vehicles delivering materials to the site would be limited to the hours between 7 a.m. and 6 p.m. on weekdays, except in unusual circumstances of a limited duration. As much movement of equipment as possible would be carried out to avoid commute rush hours. Any on-site construction activities which might extend into nightime are not expected to disturb nearby residents.

8) Local ordinances pertaining to noise, dust, construction debris, and litter would be strictly enforced.

9) No equipment or employee vehicles would be allowed to block public streets.

10) Alameda County Public Works Department and the City of San Leandro would be contacted regarding existing patterns of traffic movements through the area and scheduling the movement of construction and haul vehicles would be made if necessary to avoid excessive interference.

11) For obvious reasons of public safety, the public would be prohibited from the project area during construction. After construction, portions of the project that would be accessible to the public would have appropriate safeguards to prevent injury.

12) Satisfactory muffling devices would be required on all equipment and vehicles.

13) In co-operation with the State Department of Fish and Game electroshocking fishery surveys might be made during the fall season after completion of the project. The results of such studies indicate age classes of fish as well as species counts. These surveys might be compared with previous studies to indicate the actual effect of the proposed project upon the fish population and suggest whether or not supplemental plants would be necessary to reestablish the population to pre-project level.

14) Disposal of unsuitable or otherwise unusable excavated material in the immediate vicinity would be preferred. This would serve to mitigate the impact of the proposed project. On-site disposal of construction wastes would be acceptable provided there is no potential for interference with possible future uses or contamination, otherwise the Contractor would offhaul solid wastes. Organic waste including trees and brush would probably require offhauling. As a further mitigative measure the Contractor could be required to offer cleared trees to the public as firewood.

15) Another factor in diminishing air quality during a typical earthmoving construction project would be fugitive dust. The most effective mitigative measure for treatment of fugitive dust, if it occurs, would be water spraying of access and haul roads during dry weather. It might be possible to use reclaimed water. In the case of this project, the amount of dust should be small because most of the required excavation is in rocky material.

ALTERNATIVES

There are a number of broad alternatives to the proposed project which were considered. The District could do nothing, but this would perpetuate the failure risk and would be imprudent and would not be allowed by the State Division of Safety of Dams. The forthcoming reevaluation of all dams under the Federal National Dam Safety Act would publically highlight both the spillway and seismic stability deficiencies. The dam could be removed completely -- but the expense and loss of the reservoir storage and public recreation facilities precluded this alternative. While it may be possible to replace the present dam and spillway with a new dam and spillway immediately downstream, this would be substantially more expensive and have even greater environmental impact and would serve no greater benefit than the proposed project. The dam could be sold to another agency, relieving the District of its responsibility if another such agency was available and willing to assume this responsibility; such a sale under these conditions is not likely. Even if it were to occur, the new owner would be obligated to eliminate the risk with the result that the same type of project being proposed by the District would likely be implemented by the new owner.

The other alternatives are more site related and consider the general purpose of the reservoir, the soundness of the dam, and the topography. A spillway of sufficient flood capacity could be rebuilt along the current alignment, or be replaced with a tunnel. The existing tunnel/chute configuration would be repeated or upgraded. An increase of dam freeboard by 5 feet to provide the necessary level of seismic safety could be accomplished by raising the dam, by lowering the reservoir water level, or by a combination of the two. Lowering the reservoir water level, of course, involves lowering the spillway elevation.

The comparison of costs of alternatives are preliminary estimates for construction in 1977. However, the relative cost of the alternatives given in percentages of the original estimate would remain valid for any other year. The particular alternatives are discussed below.

A. No Project

The "No Project" alternative would involve no cost to the District. However, it leaves unsolved the known problems of inadequacies in both spillway capacity and structural integrity with the attendant hazard to the safety of the dam. The State Division of Dam Safety is aware of these problems and would insist that the District carry out its commitment to achieve a solution. The State Division of Safety of Dams could soon issue an order to comply; i.e., to improve the spillway system and modify the crest of the dam. Failure to comply with this order would subject the District to legal action by the State to require the elimination of this risk to public safety. This alternative was considered unacceptable.

B. Sell the Dam Facilities

This alternative would involve transferring the reservoir to some other agency and possibly sharing costs of improvements with the agency. This alternative has the advantage of possibly avoiding some of the spillway construction cost if the agency accepting title to the dam and reservoir were willing to accept a share of these costs. The cost for this alternative could range from zero to $4.9 million, depending on the amount of costs the other agency would be willing to assume, and on whether or not the District would be able to maintain its rights to use the stored water. The $4.9 million figure consists of an estimated $2.5 million in construction costs and $2.4 million in loss of water supply. ($2.5 million in construction cost was an updated early 1973 estimate reflecting 1977 costs and other factors.) It is not likely that any agency would be willing to accept the problems and costs now borne by the District when the benefits are already available without ownership. The action could also jeopardize the District's emergency supply capability. In the event of an earthquake disaster, Chabot Reservoir can provide an early gravity supply of up to 15 MGD of chlorinated raw water for the southern end of the distribution system. The District's disaster preparedness program contemplates the future construction of a raw water pumping plant to increase that emergency supply capability to 40 MGD. Thus the alternative involving the sale of the dam facilities was dismissed as unacceptable.

C. Remove the Dam

This option would involve draining the reservoir and removing the dam. This would result in the loss of scenic features, recreational facilities, and standby storage. This would be an expensive solution at $5.2 million including costs of removal of the dam and disposal of the removed material, enlarging or re-excavating the creek channel through the reservoir and lining the sides and bottom with riprap, and planting low water using trees and shrubs to the bottom and sides of the reservoir basin, relocation of recreational facilities and the value of lost standby storage. Political, environmental, and recreational considerations, as well as the removal of vital emergency storage, make this alternative impractical. Chabot and USL Reservoirs are the only terminal reservoirs that do not have tunnels to the West-of-the-Hills portion of the District's distribution system which could be severed in the event of a large movement of the Hayward Fault. The lost inherent flood regulation functions would result in increased downstream flooding and could result in possible increased liability for the District.

D. Relocate the Dam Downstream

This alternative received little consideration. The present dam is at the optimum location on lower San Leandro Creek. Although no cost analysis of this alternative was undertaken, there is no question that the cost, even if a site was available, would far exceed the cost of the proposed project because an entirely new dam, spillway, and outlet tunnel would have to be constructed.

E. Lower Normal Reservoir Operating Level

With this alternative, the crest of the dam would not be raised. The reduction of the reservoir level by five feet would reduce the service capacity of the reservoir. The present recreation opportunities would likely be adversely affected since lowering the reservoir could require relocation of the docking facilities and would substantially reduce lake surface.

This alternative would require the excavation of a new spillway of sufficient capacity approximately five feet below the existing spillway level. A larger amount of excavation would be required from the right abutment, and since this material would not be needed to raise the dam, the entire amount would have to be spoiled with associated adverse environmental impact. Because of the added cost of the larger spillway excavation, and because of the adverse impact of permanently lowering the reservoir and disposal of the excavated material, further consideration of this alternative was discontinued without a further cost estimate.

F. Spillway Alternatives

1. Modify Existing Spillway System

Investigations of spillway alternatives have been undertaken in considerable detail a number of times, giving consideration to reworking not only Spillway No. 1, but also upgrading of Spillway No. 3 in order to pass flows associated with a probable maximum flood. The relatively high cost of tunnel work quickly led to abandoning consideration of a chute/tunnel combination similar to that which exists today. A chute spillway conforming to the alignment of Spillway No. 1, besides having poorer hydraulic characteristics, would be more expensive than the proposed project. Placement of the spillway on the proposed alignment would place the spillway almost entirely on firm bedrock, whereas a spillway alignment similar to the existing Spillway No. 1 could involve construction of the intake structure on the dam embankment. A curved spillway alignment offers more problems during construction, but the potential for operational problems was a key factor in choosing a straight alignment. Intrinsic to curved spillway design is the possible occurrence of standing waves, which would require additional freeboard on the channel walls. On the other hand, the flow characteristics of a straight spillway design are simpler. The small price advantage, as well as the advantage of placing the spillway further from the dam embankment, made the proposed alternative more attractive. Design of the stilling basin would have to be more conservative because of its proximity to the toe of the dam. Another key concern with the alignment along Spillway No. 1 is the necessity to complete the entire construction program within a single May-September construction period in order to provide adequate spillway capacity for even a nominal size storm. This involves a greater risk, more expensive and would cause greater disturbance to residential areas downstream because night shift operations would be essential. Another environmental impact is that an alternate borrow area would have to be opened up to provide a source of fill for the dam modifications; it is likely that the tree clearing and borrow area scar would have a greater visual impact away from the spillway site than if made at the dam site as proposed.

2. Tunnel Spillway

The $7.7 million cost of construction of a tunnel spillway capable of passing the required flow was prohibitive -- $4.5 million greater than the proposed project. This higher cost was judged to more than offset the only advantage of a tunnel spillway; a tunnel would not be as visible as the proposed chute spillway. However, the tunnel would not be entirely inobtrusive because it would require a crest type entrance structure as well as a dissipation structure. A disadvantage of a tunnel spillway is that it is subject to obstruction. Also, if the dam crest elevation is increased to provide the necessary freeboard, a separate borrow area must be opened up with associated impacts.

3. Alternative Alignments

a. Left Abutment

Any possibility of placing a new spillway on the left abutment was quickly discounted. The left abutment is very steep; excavation would probably require more extensive (and expensive) cuts possibly requiring realignment or abandonment of Lake Chabot Road above. It was quickly realized that this alternative was impractical and further investigation would be unnecessary. As a result, no cost analysis of a spillway alignment along the left abutment was attempted.

b. Right Abutment

Alignment of the proposed spillway on the right abutment received the greatest consideration and resulted in the final selection of the proposed project. A different alignment than that chosen for the proposed project (but with essentially the same environmental impacts and opportunities for mitigation) was investigated but its slightly greater cost, 3% over that of the proposed project, relegated it to secondary prominence.

The resistance of the geologic formation to erosion created a natural gorge on the creek which in turn created an optimum location for the dam. The right abutment provides the soundest foundation for a spillway capable of carrying a probable maximum flood safely past Chabot Dam.

G. Findings

The proposed project was chosen because it offered a number of advan tages. The relative simplicity of a straight chute spillway set on bedrock away from the dam embankment was crucial to the selection of the proposed project over all of the options investigated. The proposed project would allow safe passage of the estimated Maximum Probable Flood of 9500 cubic feet per second without endangering the Chabot Dam. The loss of freeboard during a maximum credible earthquake would be minimized by the addition of five feet of height to the crest of the dam, with an additional advantage of further buttressing the downstream face of Chabot Dam with the added fill. Other considerations which resulted in selecting the proposed project were the continued availability of Chabot Reservoir to the District as a standby terminal reservoir. The proposed project would fulfill its major objective of rendering Chabot Dam safe from the potential damage from a maximum probable flood and from a maximum credible earthquake.

There are a number of significant environmental impacts, most of which could be effectively mitigated. These impacts and mitigation measures have been discussed herein. Other impacts such as the temporary effect of reservoir lowering, temporary disturbance of local wildlife, permanent loss of the marsh at the downstream toe of the dam and the trees on the right abutment, and the visual impact of right abutment excavation and more prominent spillway structure are relatively minor.

APPENDIX A

A VERTEBRATE INVENTORY OF
LAKE CHABOT DAM & VICINITY

The following list of species around Lake Chabot was prepared by S. E. Abbors, E. B. R. P. D. Naturalist.

FISH:

White Sturgeon - Ocipenser transmontanus
Rainbow Trout - Salmo gairdneri
Brook Trout - Salvelinus fontinalis
Carp - Cyprinus carpio
Golden Shiner - Notemigonus crysoleucas
Western Sucker - Catostomus occidentalis
Brown Bullhead - Ictalurus nebulosus
White Catfish - Ictalurus catus
Channel Catfish - Ictaurus punctatus
Mosquitofish - Gambusia affinis
Threespine stickleback - Gasterosteus aculeatus
Green Sunfish - Lepomis cyanellus
Bluegill Sunfish - Lepomis macrochirus
Largemouth Bass - Micropterus salmoides
Florida Largemouth Bass - Micropterus salmoides Floridanus
Black Crappie - Pomoxis nigromaculatus
Fresh Water Sculpin - Cottus asper

AMPHIBIANS:

California Newt - Taricha torosa
California Slender Salamander - Batrachoseps attenuatus
Arboreal Salamander - Aneides lugubris
Western Toad - Bufo boreas
Pacific Treefrog - Hyla regilla
Red-Legged Frog - Rana aurora
Bullfrog - Rana catesbeiana

REPTILES:

Western Pond Turtle - Clemmys marmorata
Western Fence Lizard - Sceloporus occidentalis
Western Skink - Eumeces skiltonianus
Southern Alligator Lizard - Gerrhonotus multicarinatus
Northern Alligator Lizard - Gerrhonotus coeruleus
Rubber Boa - Charina bottae
Western Ringneck Snake - Diadophis amabilis
Sharp-tailed Snake - Contia tenuis
Racer - Coluber constrictor
Alameda Striped Racer - Masticophis lateralis euryxanthus
Gopher Snake - Pituophis catenifer
Common Kingsnake - Lampropeltis getulus
Western Terrestrial Garter Snake - Thamnophis elegans
Western Aquatic Garter Snake - Thamnophis couchi
Western Rattlesnake - Crotalus viridis

BIRDS:

Common Loon
Red-Throated Loon
Western Grebe
Pied-billed Grebe
Double-crested Cormorant
Whistling Swan
Canada Goose
Mallard
Pintail
American Widgeon
Shoveler
Green-winged Teal
Wood Duck
Canvasback
Lesser Scaup
Common Goldeneye
Bufflehead
Ruddy Duck
Common Merganser
Hooded Merganser
Turkey Vulture
Cooper's Hawk
Sharp-skinned Hawk
Red-tailed Hawk
Golden Eagle
Osprey
Sparrow Hawk
California Quail
Great Egret
Great Blue Heron
Green Heron
Black-crowned Night Heron
American Bittern
Sora
Common Gallinule
American Coot
American Avocet
Kildeer
Marbled Godwit
Spotted Sandpiper
Common Snipe
Glaucous-winged Gull
Western Gull
Herring Gull
California Gull
Ring-billed Gull
Mew Gull
Bonaparte's Gull
Caspian Tern
Bank-tailed Pigeon
Mourning Dove
Screech Owl
Great-Horned Owl
Barn Owl
White-throated Swift
Anna's Hummingbird
Allen's Hummingbird
Rufous Hummingbird
Belted Kingfisher
Common Flicker
Nuttall's Woodpecker
Yellow-belted Sapsucker
Hairy Woodpecker
Downy Woodpecker
Ash-throated Flycatcher
Black Phoebe
Western Flycatcher
Western Wood Pewee
Olive-skinned Flycatcher
Horned Lark
Barn Swallow
Cliff Swallow
Violet-green Swallow
Rough-winged Swallow
Steller's Jay
Scrub Jay
Chestnut-backed Chickadee
Plain Titmouse
Common Bushtit
Wrentit
White-breasted Nuthatch
Red-breasted Nuthatch
Brown Creeper
House Wren
Winter Wren
Bewick's Wren
California Thrasher
Robin
Varied Thrush
Hermit Thrush
Swainson's Thrush
Western Bluebird
Golden-crowned Kinglet
Ruby-crowned Kinglet
Water Pipit
Cedar Waxing
Loggerhead Shrike
Starling
Solitary Vireo
Hutton's Vireo
Warbling Vireo
Orange-crowned Warbler
Yellow Warbler
Yellow-rumped Warbler
Townsend's Warbler
Wilson's Warbler
Western Meadowlark
Red-winged Blackbird
Brewer's Blackbird
Brown-headed Cowbird
Northern Oriole
Black-headed Grosbeak
Purple Finch
House Finch
Pine Siskin
American Goldfinch
Lesser Goldfinch
Rufous-sided Towhee
Brown Towhee
Lark Sparrow
Dark-eyed Junco
Rufous-crowned Sparrow
White-crowned Sparrow
Golden-crowned Sparrow
Fox Sparrow
Song Sparrow

MAMMALS:

Opossum - Didelphis marsupialis
Western Mole - Scapanus latimanus
Trowbridge Shrew - Sorex trowbridgei
Ornate Shrew - Sorex ornatus
Little Brown Myotis - Myotis lucifugus
California Myotis - Myotis californicus
Big Brown Bat - Eptesicus fuscus
Pallid Bat - Antrozous pallidus
Hoary Bat - Lasiurus cinereus
Black-tailed Jackrabbit - Lepus californicus
Audubon Cottontail - Sylvilagus audobonii
Brush Rabbit - Salvilagus bachmani
Black-tailed Mule Deer - Odocoileus hemionus columbianus
Raccoon - Procyon lotor
Long-tailed Weasel - Mustela frenata
Striped Skunk - Mephitis mephitis
Gray Fox - Urocyon cinereoargenteus
Bobcat - Lynx rufus
Mountain Lion - Felis concolor
Fox Squirrel - Sciurus niger
Botta Pocket Gopher - Thomomys bottae
Harvest Mouse - Reithrodontomys megalotis
Deer Mouse - Peromyscus maniculatus
Pinon Mouse - Peromyscus truei
California Mouse - Peromyscus californicus
Dusky-footed Woodrat, Pack Rat - Neotoma fuscipes
California Meadow Mouse (Calif. vole) - Microtus californicus
House Mouse - Mus musculus
Norway Rat - Rattus norwegicus
Black Rat, Roof Rat - Rattus rattus
Broad-footed Mole - Scapanus latimonus

REFERENCES:

Bailey, Reeve M., 1970, A List of Common and Scientific Names of Fishes from the United States and Canada, Special Publication No. 6, American Fisheries Society

Ingles, Lloyd G., 1965, Mammals of the Pacific States, Stanford Univ. Press

Robbins, Chandler S., 1966, Birds of North America, Golden Press, New York

Stebbins, Robert C., 1966, A Field Guide to Western Reptiles and Amphibians, Houghton Mifflin Co., Boston

APPENDIX B

A BOTANICAL INVENTORY OF THE LAKE CHABOT DAM & VICINITY

FERNS:

Licorice Fern - Polypodium glycyrrhiza
Sword Fern - Polystichum manitum
Coastal Wood Fern - Dryopteris arguta
Giant Chain Fern - Woodwardia chamissoi
Goldenback Fern - Pityrogramma triangularis
Western Bracken (Fern) - Pteridium aquilinum pubescens
California Maidenhair (Fern) - Adiantum jordani
Coffee Fern - Pellaea andromedaifolia
Bird's Foot, Cliff Brake - Pellaea mucronata

TREES:

Monterey Pine - Pinus radiata
(A) Chinese Pine - Pinus yunnanensis
Redwood - Sequoia sempervirens
Monterey Cypress - Cupressus macrocarpa
Fremont Cottonwood - Populus fremontii
Yellow Willow - Salix lutea
Arroyo Willow - Salix lasiolepis
White Alder - Alnus rhombifolia
Coast Live Oak - Quercus agrifolia
California Laurel - Umbellularia californica
Sycamore - Platanus racemosa
Big-leaf Maple - Acer macrophyllum
Madrone - Arbutus menziesii
Blue-Gum Eucalyptus - Eucalyptus globulus

SHRUBS:

Naked-stemmed Buckwheat - Eriogonum nudum
Hillside Gooseberry - Grossularia californica
Pacific Ninebark - Physocarpus capitatus
California Blackberry - Rubus procerus
Toyon - Heteromeles arbutifolia
Photinia - Photinia serrulata
Pyracantha
Cotoneaster
Silver Lupine - Lupinus albifrons
French Broom - Cytisus monspessulanus
Deerweed - Hosackia glabra
Poison Oak - Rhus diversiloba
California Coffeeberry - Phamnus californica
Redberry - Phamnus crocea
Rock Rose - Cistus sp.
California Fuchsia - Zauschneria californica
Orange Bush Monkey Flower - Minulus aurantiacus
Wooly Indian Paint Brush - Castilleja foliolosa
Climbing bedstraw - Galium nuttalii
Blue Elderberry - Sambucus mexicana

SHRUBS: (cont'd.)

Common Snowberry - Symphoricarpos rivularis
Hairy Honeysuckle - Lonicera hispidula
Coast Sagebrush - Artemisia californica

HERBACEOUS AND MISCELLANEOUS PLANTS:

Narrow-leaved Cat-tail - Typha augustifolia
Broad-leaved Cat-tail - Typha latifolia
Wild Oat - Avena fatua
Giant Reed (Bamboo) - Arundo donex
Pampas Grass - Cortaderia selloana
Rye-Grass - Lolium sp.
Umbrella Sedge - Cyperus sp.
Spreading Rush - Juncus patens
Common Soap Plant - Chlorogalum pomeridianum
California Blue-eyed Grass - Sisyrinchium bellum
Hoary Nettle - Urtica holosericea
Fiddle Dock - Rumex pulcher
Hottentot Fig (Ideplant) - Mesembryanthemum edule
Miner's Lettuce - Montia perfoliata
Common Chickweed - Stellaria media
California Poppy - Eschscholzia californicus
Summer Mustard - Brassica geniculata
Alum Root - Heuchera micrantha
Annual Lupine - Lupinus sp.
American Vetch - Vicia americana
Cut-leaved Geranium - Geranium dissectum
Red-stemmed Filaree - Erodium cicutarium
Prickly Pear - Opuntia sp.
Pacific Sanicle - Sanicula crassicaulis
Mountain Sweet-cicely - Osmorhiza chilensis
Sweet Fennel - Foeniculum vulgare
Poison Hemlock, Parsley - Conioselinum chinense
Periwinkle - Vinca major
Western Morning-glory - Convolvulus occidentalis
Phacelia - Phacelia sp.
Hedge-Nettle - Stachys sp.
Coast Figwort - Scrophularia californica
English Plantain - Plantago Lanceolata
Goose Grass - Galium aparine
South American Conyza - Conyza bonariensis
Common Yarrow - Achillea millefolium
Wormwood - Artemesia doughlasiana
Audweed - Graphalium sp.
Milk Thistle - Silybum marianum
Bull Thistle - Cirsium vulgare
Yellow Star-thistle - Centaurea solstitialis
Prickly Sow-thistle - Sonchus asper

References:

Abrams, L. and Ferris, R. S., 1960, Illustrated Flora of the Pacifc States, Vol. I-IV, Stanford Univ. Press

McMinn, K.E., 1959, An Illustrated Manual of California Shrubs, Univ. of Calif. Press

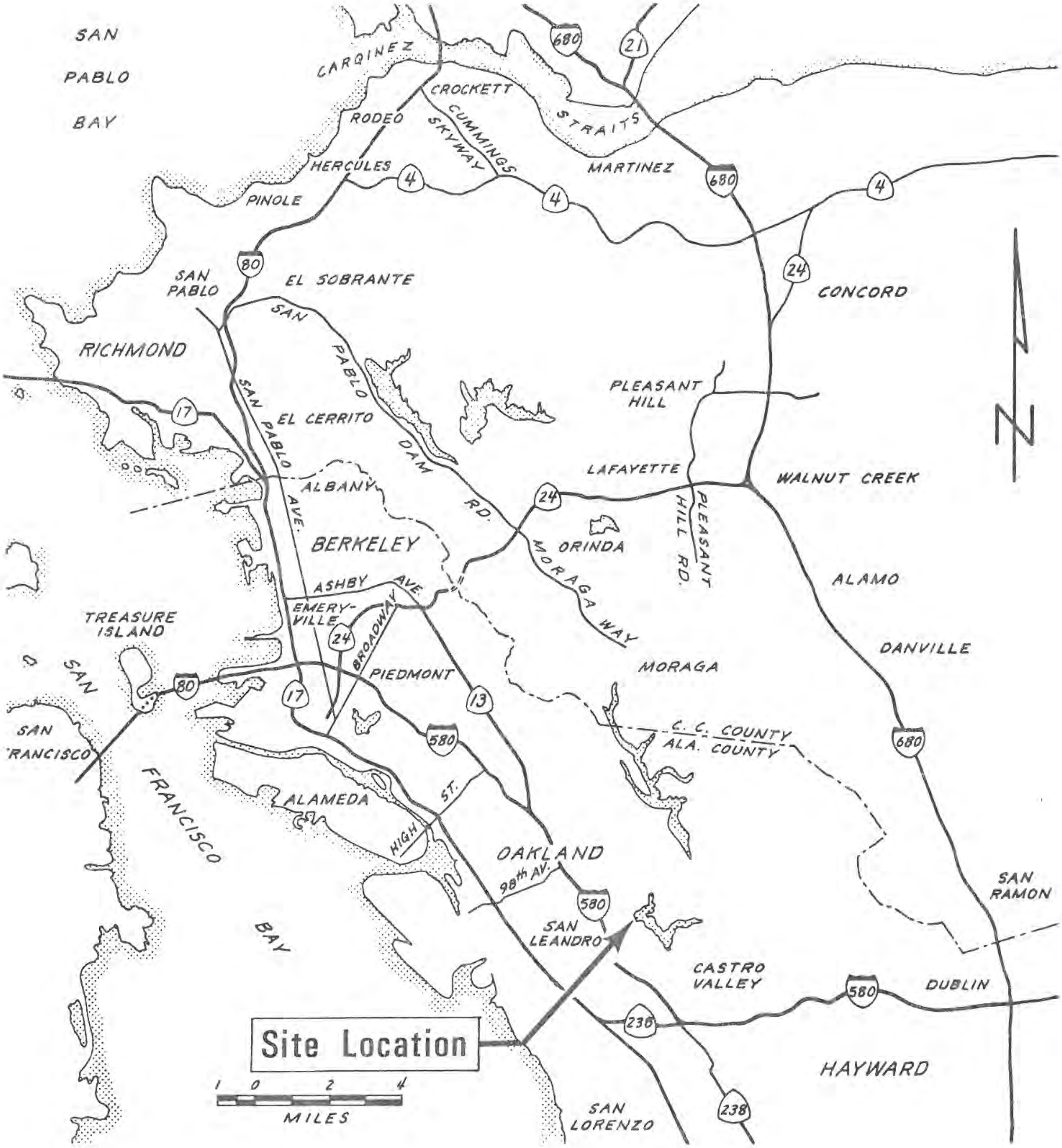
Munz, P.A., 1959, A California Flora, Univ. of Calif. Press.

Species identification confirmed by:

Mr. Walter Knight	)	
Mrs. Irja Knight	)	Flora
Dr. Elizabeth Mc Clintock	)	
Mr. John Thomas Howell	)	Fauna
Stephen E. Abbors	)	

Compiled by:

Stephen E. Abbors, naturalist for East Bay Regional Park District



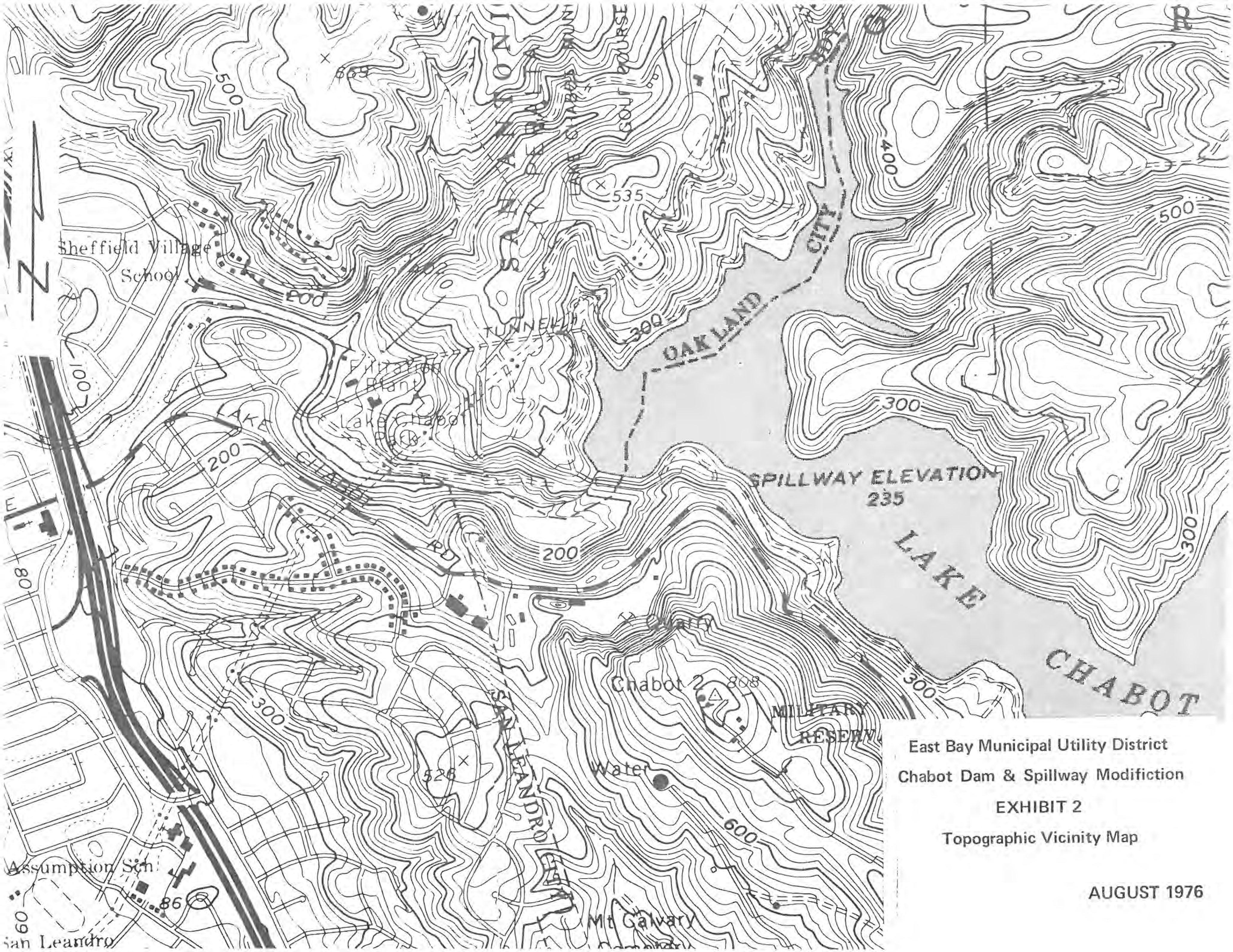
East Bay Municipal Utility District

Chabot Dam & Spillway Modifiction

EXHIBIT 1

Regional Location Map

AUGUST 1976



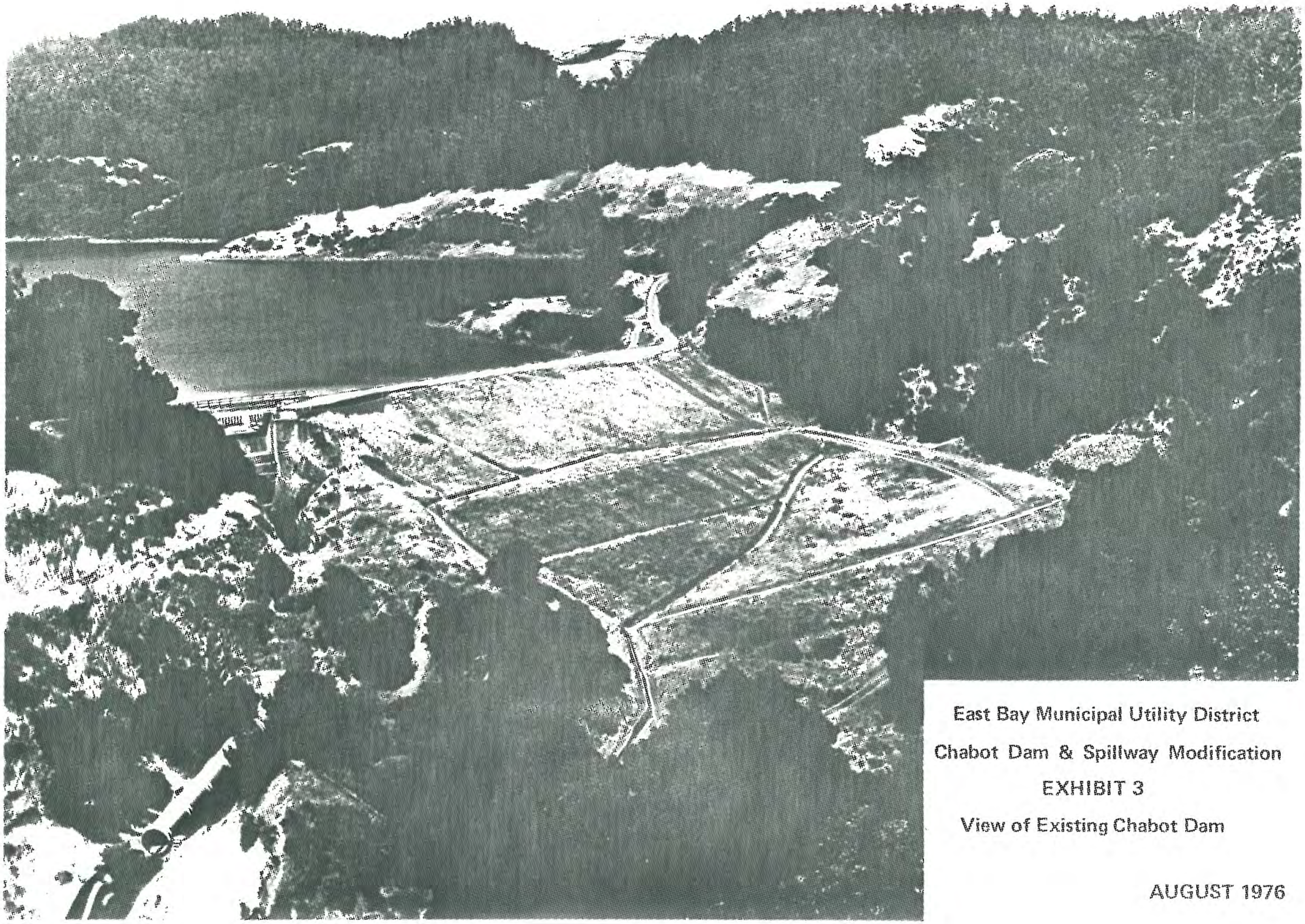
East Bay Municipal Utility District

Chabot Dam & Spillway Modifiction

EXHIBIT 2

Topographic Vicinity Map

AUGUST 1976



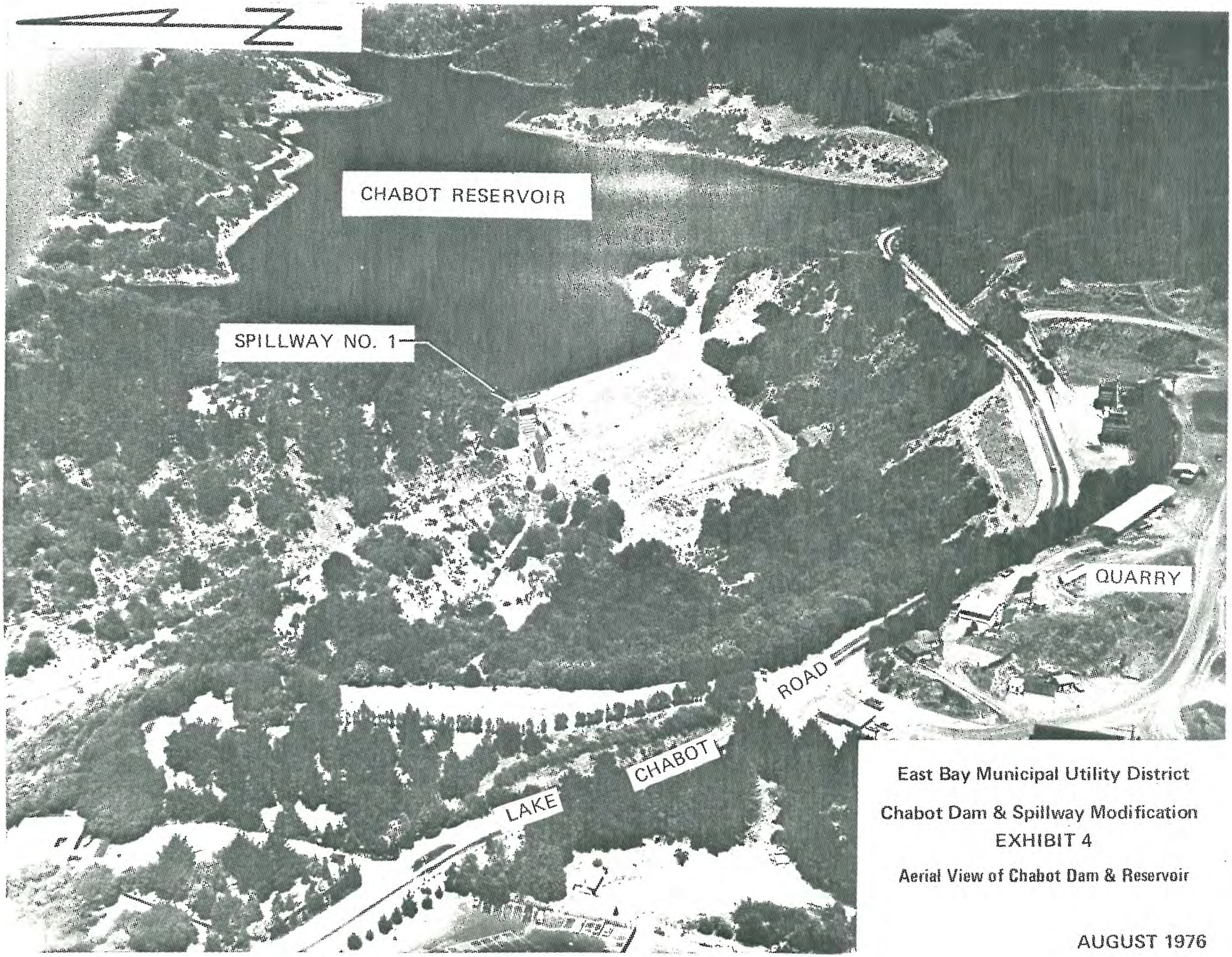
East Bay Municipal Utility District

Chabot Dam & Spillway Modification

EXHIBIT 3

View of Existing Chabot Dam

AUGUST 1976

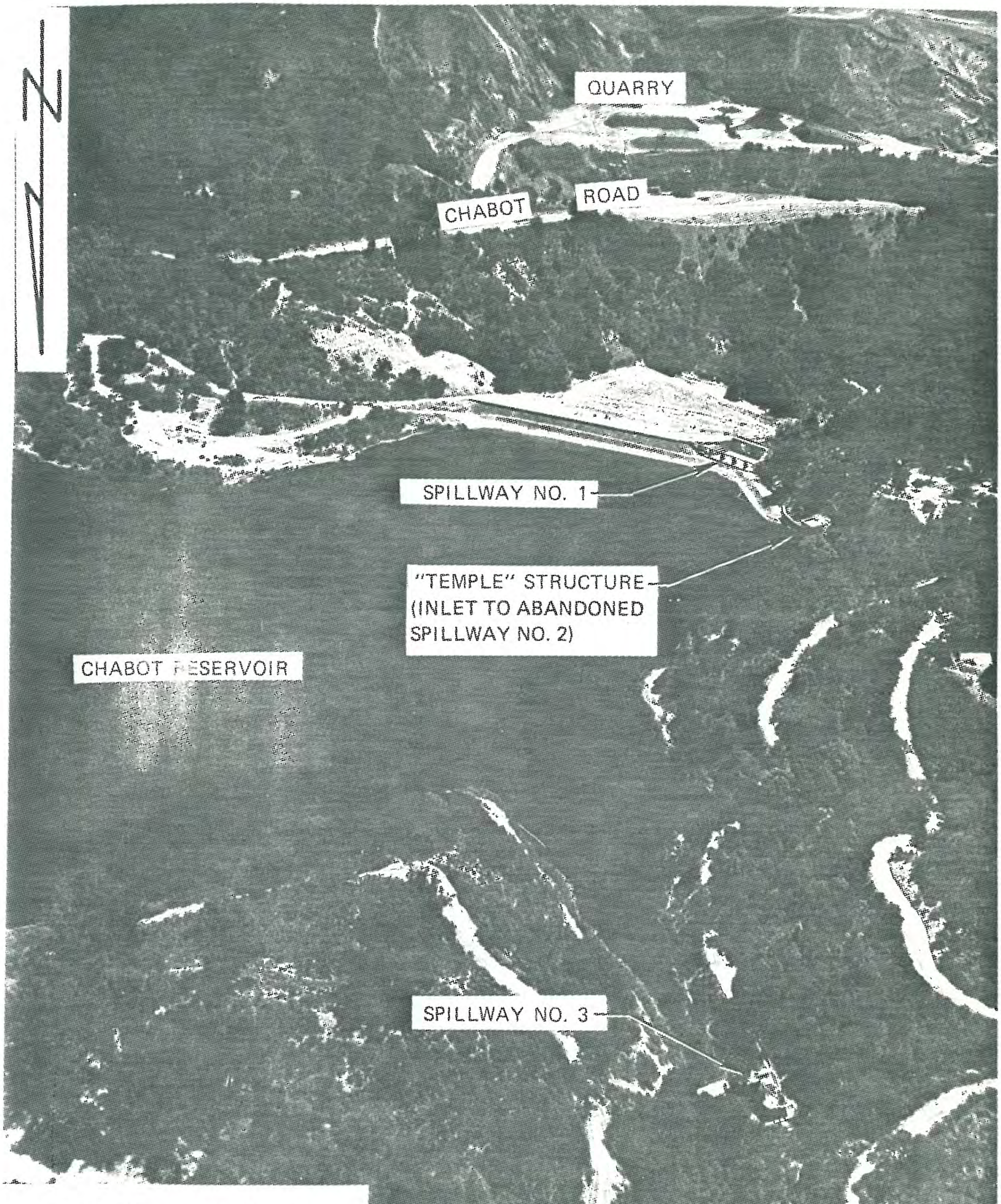


East Bay Municipal Utility District

Chabot Dam & Spillway Modification
EXHIBIT 4

Aerial View of Chabot Dam & Reservoir

AUGUST 1976



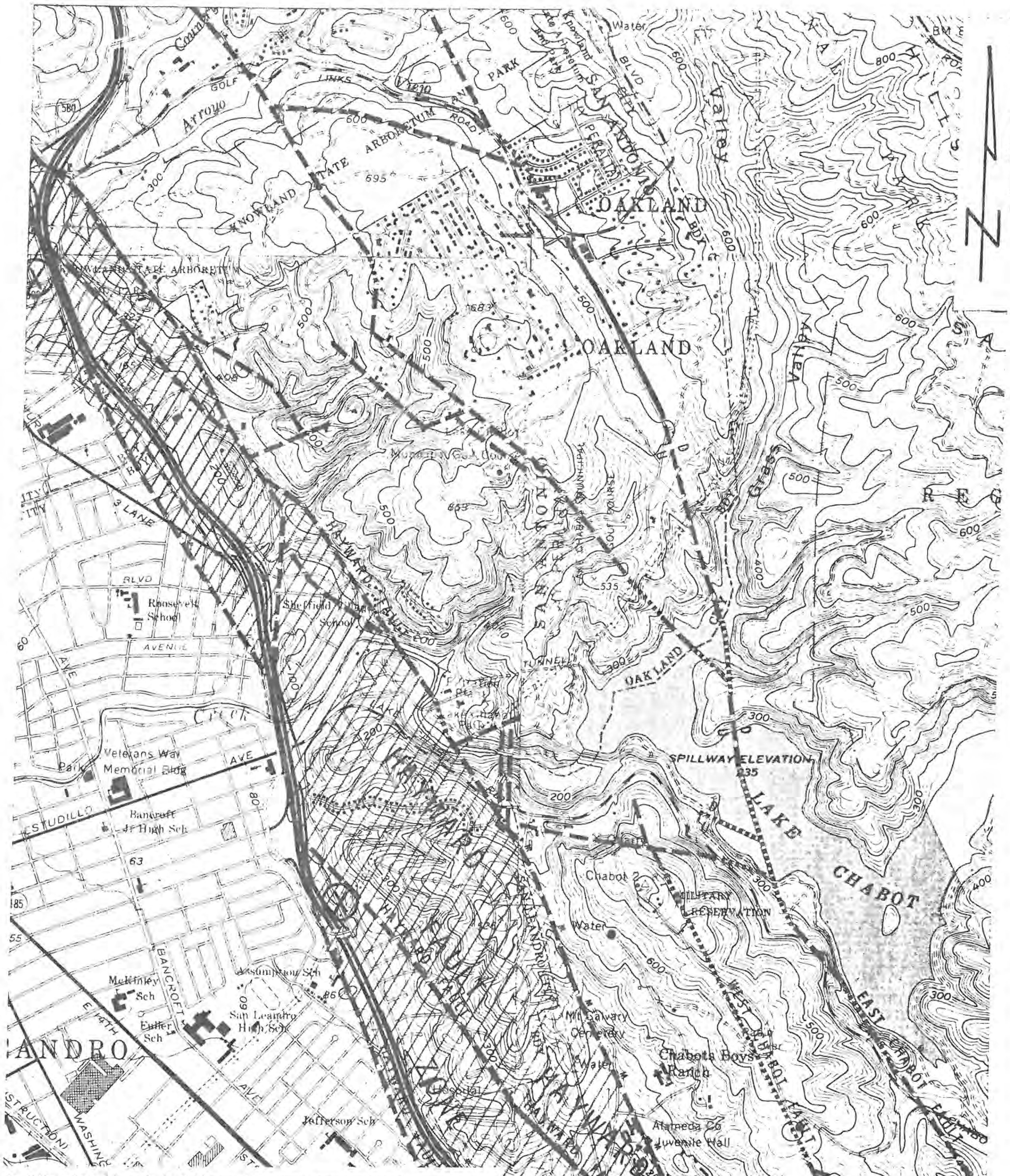
East Bay Municipal Utility District

Chabot Dam & Spillway Modification

EXHIBIT 5

Aerial View of Chabot Dam & Reservoir

AUGUST 1976



Fault lines traced from G. D. Robinson, 1956 report (except as noted)

SYMBOLS

- Fault
- Fault, approximately located
- Concealed fault
- Fault, showing relative movement
- Doubtful or probable fault
- High angle fault (U, upthrown side; D, downthrown side)

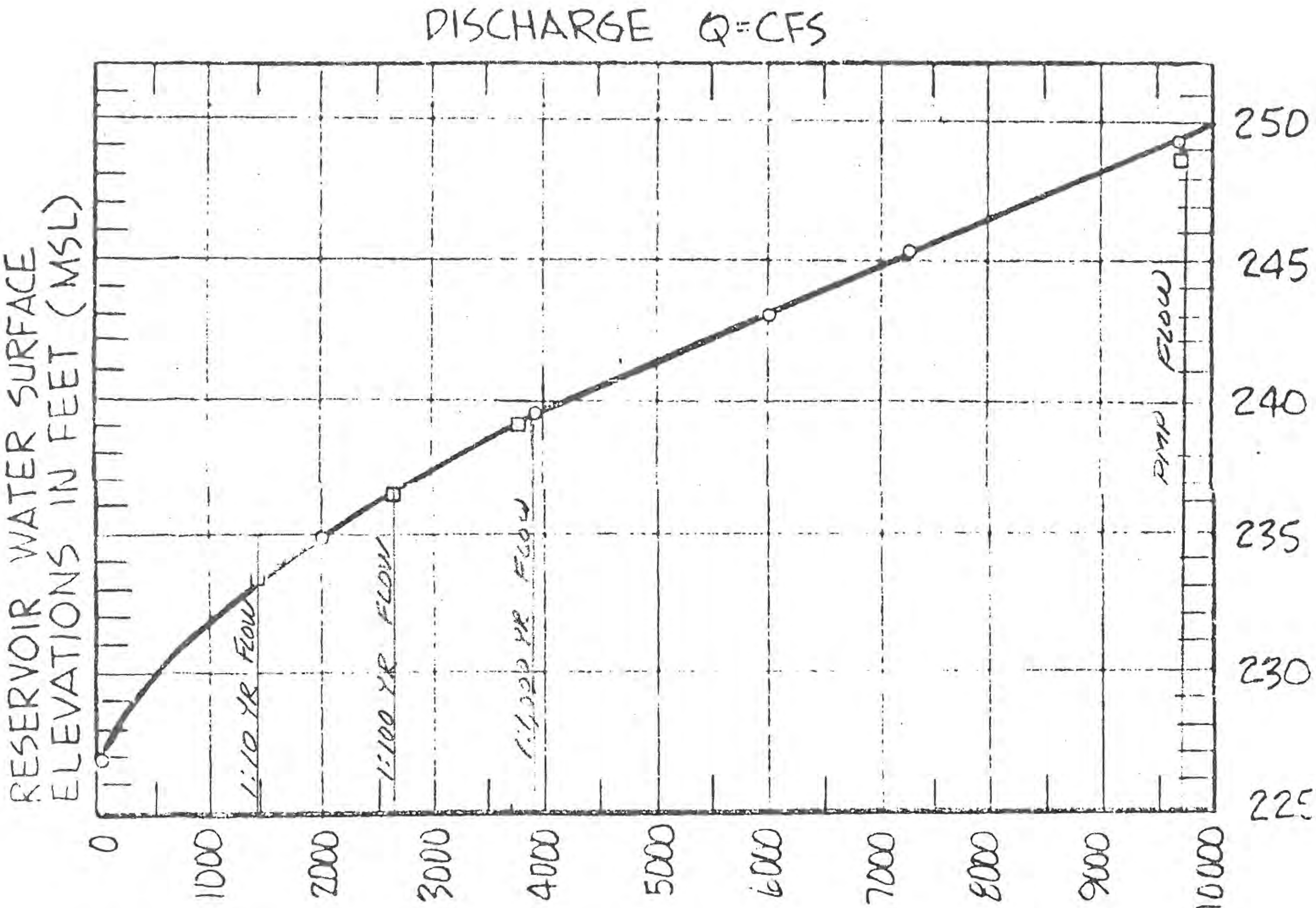
East Bay Municipal Utility District

Chabot Dam & Spillway Modification

EXHIBIT 6

Seismic Fault Map

AUGUST 1976



DISCHARGE RATING CURVE

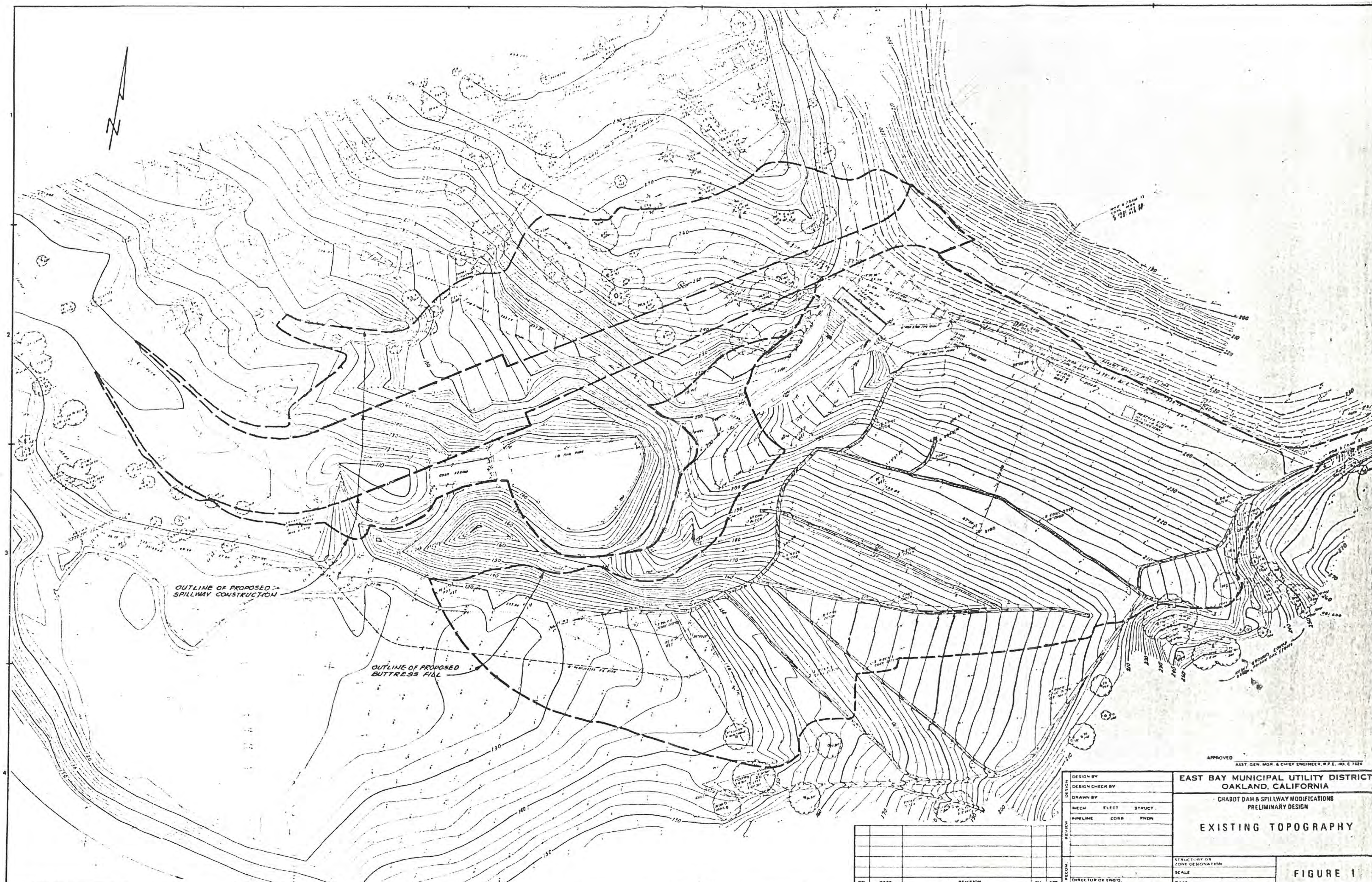
SYMBOLS

○ RECOMENDED DESIGN

□ EXISTING CHABOT SPILLWAY (PROTOTYPE CHARACTERISTICS)

EXHIBIT 7

Chabot Spillway Discharge Rating Curve



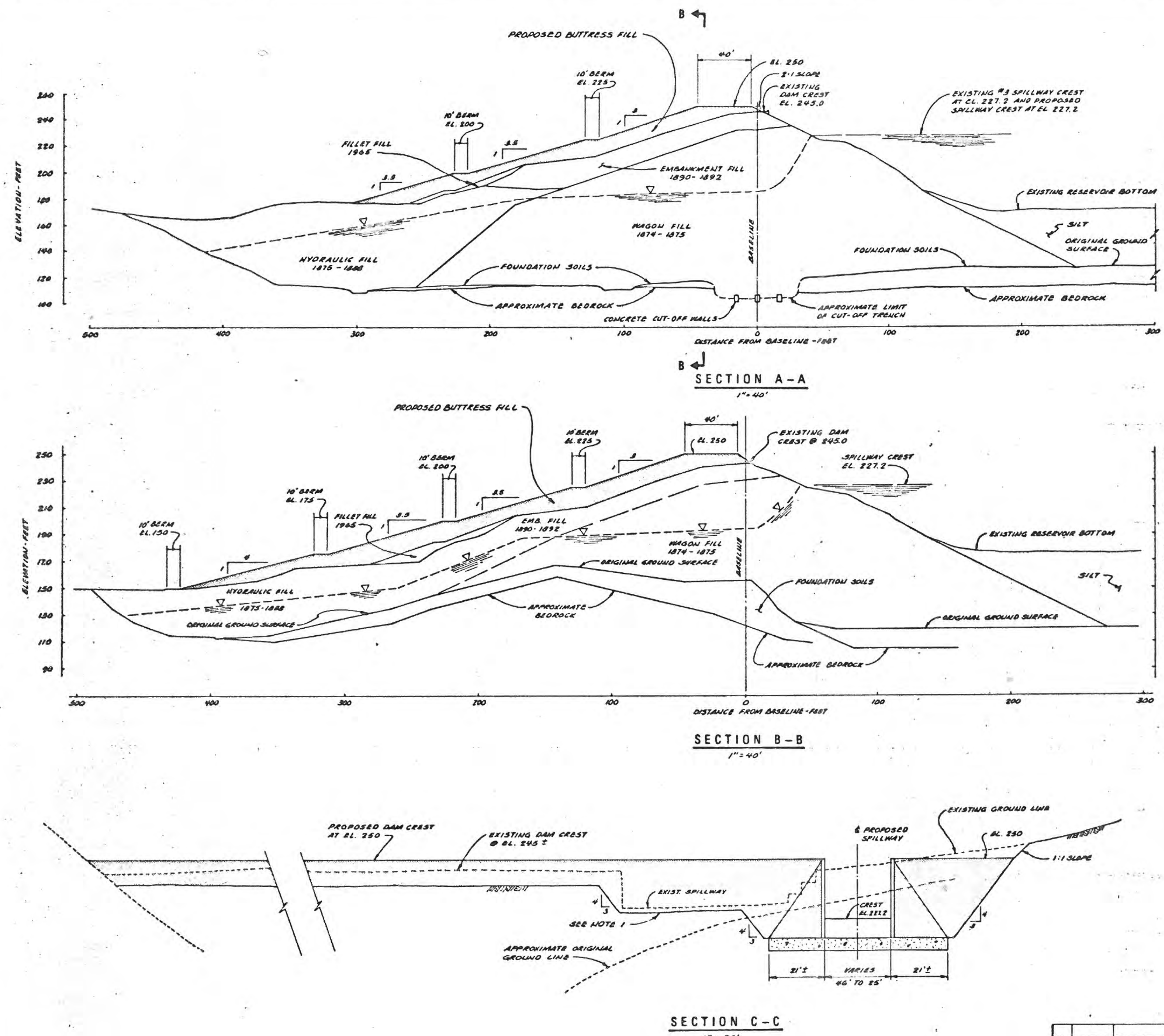
OUTLINE OF PROPOSED SPILLWAY CONSTRUCTION
OUTLINE OF PROPOSED BUTTRESS FILL
APPROVED
ASST. GEN. MGR. & CHIEF ENGINEER, R.P.E. NO. C 7626
DESIGN BY
DESIGN CHECK BY
DRAWN BY
MECH ELECT STRUCT.
PIPELINE CORR FNDN
DIRECTOR OF ENG'G. R.P.E. NO. C 13447
NO DATE REVISION BY APP
EAST BAY MUNICIPAL UTILITY DISTRICT
OAKLAND, CALIFORNIA
CHABOT DAM & SPILLWAY MODIFICATIONS
PRELIMINARY DESIGN
EXISTING TOPOGRAPHY
STRUCTURE OR ZONE DESIGNATION
SCALE
DATE
FIGURE 1
E-160

EAST BAY MUNICIPAL UTILITY DISTRICT
OAKLAND, CALIFORNIA

CHABOT DAM & SPILLWAY MODIFICATIONS
PRELIMINARY DESIGN

PROJECT LAYOUT

FIGURE 2



NOTES

1. REMOVE EXISTING SPILLWAY STRUCTURE AND UNSUITABLE MATERIAL UNDER THE SPILLWAY CREST STRUCTURE. BACKFILL WITH BUTTRESS FILL MATERIAL.

APPROVED
ASST. GEN. MGR. & CHIEF ENGINEER, R.P.E. NO. C 7624

DESIGN BY B.L. KONG, T.J. LINVILLE
DESIGN CHECK BY J. TOM
DRAWN BY T. BYRNE & J. WONG

EAST BAY MUNICIPAL UTILITY DISTRICT
OAKLAND, CALIFORNIA

CHABOT DAM & SPILLWAY MODIFICATIONS
PRELIMINARY DESIGN

DAM MODIFICATION SECTIONS

FIGURE 3

NO.	DATE	REVISION	BY	APP

RECIPIENTS OF DRAFT EIR

Alameda County Flood Control and
Water Conservation District
Attention Mr. Paul Lanferman, Director
Alameda County Public Works Building
399 Elmhurst Street
Hayward, CA 94544

Alameda County Parks Advisory Committee
399 Elmhurst Street
Hayward, CA 94544

Alameda County Planning Department
399 Elmhurst Street
Hayward, CA 94544

Alameda County
Public Works Department
399 Elmhurst Street
Hayward, CA 94544

Alameda County Taxpayers Association
1404 Franklin Street
Oakland, CA 94612

Alameda Historical Society
c/o Alameda Main Library
Santa Clara & Oak Streets
Alameda, CA 94501
Attn: Violet Soares, President

Alameda Victorian Preservation Society
P. O. Box 1677
Alameda, CA 94501
Attn: Mr. Nick Peroti, President

Association of Bay Area Governments
Hotel Claremont
Ashby and Domingo Avenues
Berkeley, CA 94705
Attn: Mr. Revan Tranter

Bay Area Air Pollution Control District
939 Ellis Street
San Francisco, CA 94109

State of California
Department of Fish and Game
Attention Eugene V. Toffoli, Regional Mgr.
Region 3
Yountville, CA 94599

California Native Plant Society
Suite D
2380 Ellsworth
Berkeley, CA 94704

State of California
Clearinghouse
1400 Tenth Street
Sacramento, CA 95814

Chief, Division of Safety of Dams
Department of Water Resources
P. O. Box 388
Sacramento, CA 95802

East Bay Regional Park District
11500 Skyline Boulevard
Oakland, CA 94618

Environmental Protection Agency
100 California
San Francisco, CA 94111

Mr. William H. Fraley, Director
Alameda County Planning Department
399 Elmhurst Street
Hayward, CA 94544

Thomas L. Jackson, Archaeologist
Treganza Anthropology Museum
San Francisco State University
1600 Holloway Avenue
San Francisco, CA 94132

Mr. D. Klevesahl
California Historical Society
2090 Jackson Street
San Francisco, CA 94109

Landmarks Preservation Advisory Board
City Hall
Oakland, CA 94612

League of Women Voters of California
126 Post Street
San Francisco, CA 94108

Mr. Norman J. Lind, Planning Director
City of Oakland
City Hall
Oakland, CA 94612

Mr. James E. McCarty
Director of Public Works
City of Oakland
City Hall
Oakland, CA 94612

Mosquito Abatement District
3024 East Seventh
Oakland, CA

Regional Water Quality Control Board
1111 Jackson Street, Room 306
Oakland, CA 94607
Attn: Executive Officer, Mr. Fred H. Dierker

City of San Leandro
Department of Public Works
San Leandro, CA 94577

Sierra Club
East Bay Chapter
5608 College Avenue
Oakland, CA 94618

U. S. Army Engineer District, San Francisco
Corps of Engineers
100 New Montgomery
San Francisco, CA

Castro Valley Chamber of Commerce
3601 Jamison Way
Castro Valley, CA 94546

Bay-O-Vista Homeowners Association
1680 Regent Street
San Leandro, CA 94577
Attn: Mr. William Corbett

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Appendix 3.9: Historic Environmental Documentation (Draft and Final EIR) for Lake Chabot Modifications Undertaken in the Late 1970s

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ENVIRONMENTAL IMPACT REPORT FOR CHABOT DAM AND SPILLWAY MODIFICATION PROJECT

3-78

EAST BAY MUNICIPAL UTILITY DISTRICT
P. O. BOX 24055 · OAKLAND, CA 94623 · (415) 835-3000

FINAL

ENVIRONMENTAL IMPACT REPORT

FOR

CHABOT DAM AND SPILLWAY

MODIFICATION PROJECT

EAST BAY MUNICIPAL UTILITY DISTRICT

P. O. Box 24055

Oakland, CA 94623

Prepared by the Staff

of the East Bay Municipal Utility District

REVIEWED AND APPROVED BY THE DISTRICT'S
ENVIRONMENTAL COMMITTEE
on March 29, 1978

K. D. McCLOSKEY
Chairman
Environmental Committee

Comments received through consultation pursuant to Section 21153 of the California Environmental Quality Act of 1977 from January 23, 1978 to March 8, 1978 are included in this document. This report adopted and the project authorized to continue by Board Resolution dated April 25, 1978.

FINAL EIR - CHABOT DAM AND SPILLWAY

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SUMMARY

The purpose of the proposed Chabot Dam and Spillway Modification Project is to increase the hydraulic capacity to safely pass the flood resulting from the probable maximum precipitation (PMP) storm and to increase the structural integrity of the dam and spillway to withstand the maximum credible earthquake, thereby providing a higher degree of safety and welfare for the public located below the dam.[1] The proposed project would involve construction of a chute spillway capable of carrying a flow of 9,500 cubic feet per second from Chabot Reservoir to San Leandro Creek 116 feet below without endangering the earth-fill dam. In addition, the proposed project would raise the dam crest by about 5 feet. This increase in dam freeboard would mitigate the risk of the dam being overtopped in the event of slumping of the crest or extensive surface sloughing of the upstream face during a maximum credible earthquake. The events which could potentially cause such damage to the dam would be large earthquakes exceeding the maximum credible earthquake on either the Hayward Fault ($7\frac{1}{2}$ magnitude), 0.5 miles to the west, or on the San Andreas Fault (8+ magnitude), 19 miles to the west.

The proposed project would permit continued use of Chabot Reservoir as a standby terminal reservoir. The reservoir represents approximately 7% of the District's terminal reservoir storage capacity. Chabot Reservoir, a scenic adjunct to Anthony Chabot Regional Park, would continue to offer recreational opportunities (boating and fishing) to residents of the Bay Area as part of Alameda County's Open Space Inventory.

The proposed project, estimated to cost $2.9 million, would construct a new spillway, requiring removal of approximately 100,000 cubic yards of rock and soil from the right abutment, and placement of most of this excavated material on the crest and downstream face of the dam, thereby raising the available free-board by 5 feet. The new concrete chute spillway would vary from 25 to 46 feet in width and would be 520 feet in overall length, with vertical walls from 8 to 31 feet in height. The proposed spillway would cut through the right abutment to the right of the existing spillway at about a 45° angle to the dam axis. The spillway would consist of an 8 foot high ogee control weir at the upstream end, a steeply sloped chute section, and a dissipation structure at the downstream end capable of safely passing the estimated PMP storm flow of 9500 cfs.

The proposed project would have some significant adverse environmental impacts. Overriding public safety considerations necessitate implementation of the project. Short-term adverse impacts during construction would include temporary reduction of the lake level by approximately 15 feet to allow feasible construction of the upper end of the spillway, disruption of fisheries and wildlife habitat by construction activities, and inconvenience to the public due to increased truck traffic in the vicinity of the site.

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1 The maximum credible earthquake is the maximum earthquake that, in the judgment of seismic consultants, appears capable of occurring under the conditions of the presently known geologic framework. It is a rational and believable event even though its frequency of recurrence may be very low; it is a sensible event based on our present state of knowledge. In determining the maximum credible earthquake, there is little regard to its probability of occurrence, except that its likelihood of occurring is great enough to be of concern.

The long-term adverse environmental impact of the proposed project would be the partial obliteration of an ASCE and AWWA historical landmark, the loss of some wildlife habitat in the area around the dam and right abutment, the loss of the marsh located at the foot of the existing dam and some visual impact due to the new spillway.

Several alternatives to the project were analyzed. Each of these consisted of modification of the dam or some alternate treatment of the spillway alignment. The proposed project was selected because of the preferred design of a straight chute spillway set on bedrock away from the dam embankment. The new spillway and additional freeboard ensures safe passage of the PMP flow of 9500 cfs over the spillway as well as increased safety against overtopping by the reservoir water in the event of a maximum credible earthquake.

PROJECT DESCRIPTION

The proposed project would require clearing and excavation in the area of the right abutment for the spillway, demolition or burial of the existing Spillway #1, construction of the proposed concrete spillway, placement and compaction of the embankment material on the crest and downstream face of the dam, and improvement of the narrow access road adjacent to the lake.

Chabot Reservoir Complex

The Chabot Reservoir is located on San Leandro Creek, which passes through the Oakland Hills, just east of the City of San Leandro in Alameda County, California. The complex consists of the dam and the impoundment reservoir, the Chabot Center (a standby water treatment plant in operation during the current drought), and a chute spillway. Exhibits 3 and 4 show the general area of the proposed project. Exhibit 5 shows the existing spillway locations.

The history of Chabot Reservoir, formerly San Leandro Reservoir, extends back over 100 years. Population growth in the East Bay area in the late 1800's required more water than wells were able to supply. Chabot Reservoir was the second major impoundment of local runoff, created after Lake Temescal to the north. The potential of the relatively narrow, deep San Leandro Creek canyon close to a suitable quarry was recognized early as an optimum location for an impoundment of local runoff.

The dam is not widely visible to the public, although portions of the structure can be seen by passing motorists from two short segments of Lake Chabot Road which passes to the south of the reservoir. The "Temple" structure of pseudo Greco-Roman architecture can be seen north of the dam, serving as the entrance to Tunnel No. 2. The existing dam and spillways can be seen by boat from Chabot Reservoir although buoys prevent boaters from approaching closer than 1500 feet. Chabot Park, a small park leased by the City of San Leandro, is 700 feet downstream and west of the dam. Vehicle access to the dam and the Chabot Filter Plant (Chabot Center) can be gained from this park from the terminus of Estudillo Avenue in San Leandro across a small bridge. The dam site can be approached from the south from a narrow unpaved road which enters District property from Anthony Chabot Regional Park. The entire area is frequented by hikers, bicyclists and boaters. The area is marked by numerous unpaved roads and trails.

Existing Dam and Spillway

The existing earth dam has been modified many times in its history. Today, the dam rises 130 feet from the original creek bottom and is about 700 feet wide at its base. From its broad base, the dam gradually slopes upward to a 500 foot long, 30 foot wide crest at elevation 243 feet with a concrete parapet wall at elevation 245 feet. It is estimated that the dam contains 622,000 cubic yards of earthfill material.

The upstream slope of the dam is faced with grouted riprap from elevation 200 feet to 240 feet. The downstream slope of the dam is terraced with occasional berms to accommodate small concrete lined drainage ditches which carry off surface water during rains thereby limiting erosion of the face. Erosion is further controlled by the grass and scattered brush which grows on the downstream face. The area below the dam is a dense tangle of brush. This verdant growth, characterized as "moist chaparral", is fed by seepage.

The right abutment is a very steep hillside supporting native and introduced species. (Right and left are defined as one views the project looking downstream.) In the proposed project area, there are introduced species such as pine (6 specimens), red gum eucalyptus (7 specimens), a solitary cherry tree and a large clump of prickly-pear cactus which cascades down the right abutment. Also present at the proposed construction site are indigeneous species well adapted to their particular habitat. The most prominent native trees are a large clump of California bay laurel and scattered Coast Live Oak ranging up to 36" in diameter.

Original construction of the present dam was begun in 1874 and completed in 1876. The construction technique involved bringing soil and rock particles to the site in carts and wagons, spreading thin layers of the clay rich soil mixture, and compacting each successive lift with teams of horses and some team driven wagons. The fill deposited in this manner is referred to as "wagon fill". Although the material placed in the center core of the original dam was selected, the final section was an earth-filled dam of rather homogenous material. When originally constructed, the dam crest elevation was 218 feet, but in 1885, to increase reservoir capacity, the crest elevation was increased to 233 feet using the same construction technique. Intermittently between 1875 and 1891, a hydraulic fill buttress was placed on the downstream face to thicken and reinforce the dam. "Hydraulic fill" refers to the method of construction whereby soil and rock particles are transported to a site by sluicing (mixing with fast moving water). The water is permitted to drain away, leaving the soil and rock particles. Between 1891 and 1892, additional wagon fill was placed atop the dam to bring the dam up to its present crest elevation of 243 feet. During 1892 to 1895, in order to protect the upstream face of the dam from erosion, sandstone riprap was laid. The dam was not damaged during the 1906 San Francisco Earthquake which caused severe devastation in nearby San Francisco.

The riprap was grouted in place in 1912 when the existing parapet wall was added, bringing the dam crest to elevation 245 feet. Although other modifications of the dam facilities were carried out, no further work on the dam was required until 1964 when a buttress fill was added to the downstream face after a study of its stability was made by Shannon & Wilson, geotechnical consultants engaged by the District. For this analysis, the consultant used the "pseudostatic" method of analysis, which was the existing state-of-the-art method. As a result, approximately 5,000 cubic yards of fill was strategically placed to improve the stability of the dam. Some surface and sub-surface drains were also installed in conjunction with the fill operation.

The crest of Spillway No. 3 is located 1300 feet north of the dam on a narrow inlet of Chabot Reservoir. The capacity of Tunnel No. 3 is estimated to be 2,000 cubic feet per second. The spillway crest is at a nominal elevation of 227 feet. The 1,433 foot long spillway tunnel exits on the hill just north of Chabot Center into a concrete and masonry-lined channel leading to San Leandro Creek.

Spillway No. 1 is the most visible spillway located adjacent to the dam on the right abutment. This has been modified at various times in the 100-year history of the dam. Upstream of the access road concrete bridge (built in 1954) there is a 100 foot wide trash rack structure, built in 1933. The nominal spillway lip elevation is 233 feet, about 6 feet higher than Spillway No. 3 to the north.

Just beneath the bridge, the 50 foot wide Spillway No. 1 drops abruptly over masonry steps through a vertical distance of about 43 feet. The masonry steps serve as a combined energy dissipator and transition structure, and they narrow rapidly to a 16 foot deep channel. The concrete-lined channel drops at a 5% slope and curves slightly for a distance of 172 feet to enter a tunnel structure excavated into the right abutment.

The concrete lined tunnel structure slopes rather abruptly to a 10-foot diameter steel pipe some 45 feet below. It is this tunnel-pipe structure, in particular, which limits Spillway No. 1 safe flow capacity to an estimated 2,600 cfs. The 10-foot pipe, which has a slight slope and directs the spillway's discharge over a sloped concrete apron approximately 20 feet wide with 16-foot vertical walls, drops abruptly into a small round pool approximately 8 feet below.

Other than the masonry steps, this 8-foot drop-off is the only feature available to dissipate the kinetic energy of flood waters dropping the entire 123 feet to the pool and creek below. The stream bed was riprapped originally but the work is not evident today due to the lush vegetation which has overgrown the site over the past 40 years. At present, a slow trickle of water seeps continuously into the spillway from the right abutment up near the bridge overpass. This flow helps to maintain the pond and the associated marsh downstream.

The existing spillway system has operated in 23 of the last 50 years, safely dissipating flood waters from Chabot Reservoir to San Leandro Creek downstream. The maximum flow that has occurred was 1,626 cfs in 1958. This flow consisted of 722 cfs at Spillway No. 1, and 904 cfs at Spillway No. 3, which serves as the primary spillway. It is 6 feet lower than Spillway No. 1. As a result, Spillway No. 1 has carried flood waters only once in the last 50 years. The combined safe spillway maximum capacity of 3600 cfs is considered insufficient by current standards. The inadequacy of the spillway system has been recognized for some time and the proposed project would remedy these known deficiencies in operation. Both the No. 1 and No. 3 spillways are subject to obstruction by floating debris.

Reservoir and Water Supply Functions

The reservoir created by Anthony Chabot has served as a source of domestic water since the summer of 1875 when the first tap was turned on. Originally, the raw water was brought from the lake bottom (Tunnel No. 1) and was processed at a small screening plant at the portal of Tunnel No. 1. This screen did little more than remove the larger matter from the water. Problems with taste and odor soon occurred -- supposedly because the contractor had neglected to remove an orchard from the lake, thus tainting the water. The continuing public furor and the persistence of Dr. George C. Pardee forced the Contra Costa Water Company (then a private concern) to install a filtering system in 1888.

The "filtering reservoir", as it was called then, (presently used as a sedimentation basin) did little to remove the offensive tastes and odors, but the nine "Hyatt Filters" installed soon after did improve the water quality substantially. The Chabot Filter Plant complex (Chabot Center) was upgraded in 1910 and changed little up to 1931.

The filter plant was upgraded by the District in 1931 and the Center remained in service until the late 30's. Filtering operations ceased at that time, but resumed in the early 40's and continued until the middle 60's. Since then the reservoir has served as a standby terminal reservoir except for a brief period between July and September of 1973 and again during the present drought.

A number of factors contributed to the "standby" terminal reservoir status of Chabot Reservoir. With completion of the First Mokelumne Aqueduct in 1929 the need for Chabot water was reduced. This new source of water from Pardee Reservoir in the Sierra Nevada foothills offered a stable source of excellent quality water. The changeover from dependence on local runoff to the distant Sierra Nevada source and changes in water service requirements made operation of the Chabot Center uneconomical. The relatively high turbidity and organic content of Chabot also creates a greater potential for water quality problems. The reservoir level is such that after the water has been filtered, all water treated at this plant has to be pumped into the distribution system. The relatively high cost of Chabot water thus was a crucial factor in the decision to place Chabot Reservoir on a standby basis.

As a standby terminal reservoir, Chabot Reservoir serves the following purposes:

1. Should the need arise because of drought, fire, or earthquake emergency, provisions have been made to route chlorinated raw lake water directly into the District's major distribution system, bypassing the filter plant.

2. The Chabot Center has a maximum capacity of 7 million gallons per day which can be used to deliver filtered and chlorinated water from Chabot Reservoir to the southern portion of the District's service area. Thus, the Chabot Filter Plant has the potential of providing limited service to portions of Oakland, San Leandro, San Lorenzo, and Castro Valley.

3. The lake is utilized for recreational fishing and boating, and is a scenic adjunct to Anthony Chabot Regional Park.

Chabot Reservoir and its filter plant have been utilized during the current drought.

Purpose and Nature of the Project

The proposed dam and spillway modification project would be undertaken to improve the dam safety in the event of extreme flood conditions, or a severe earthquake. The modifications proposed consist basically of raising the crest of the dam to gain freeboard and building a new spillway capable of safely passing the PMP flow or PMP flood.

In 1974, an evaluation of the seismic stability of Chabot Dam using the recently developed "dynamic analysis" method was conducted by Woodward-Clyde Consultants (then operating under their former corporate name of "Woodward Lundgren and Associates"), an independent consulting firm for EBMUD. A summary of that report stated:

"Based on the results of this evaluation, it appears that during a magnitude 8+ earthquake originating along the San Andreas Fault or a magnitude $7\frac{1}{2}$ earthquake originating on the Hayward Fault there is a possibility of surface sloughing on the upstream face of the Chabot Dam and hence an ultimate slumping of the crest. This could result in some reduction of freeboard."

The report went on to say that 10 to 15 feet of additional freeboard would be desirable, but that the specific amount would have to be determined when additional analyses were made for the necessary modification to the dam. The report further mentioned the favorable response of the dam during the 1906 San Francisco Earthquake on the San Andreas Fault, which has been estimated to be 8.2 magnitude on the Modified Richter Scale. The dam was in full operation at that time and suffered no apparent damage.

Woodward-Clyde Consultants submitted a subsequent report in 1977 on their evaluation of the seismic stability of Chabot Dam with the modifications proposed by the District's Engineering Department. This evaluation was based on new studies conducted at the University of California at Berkeley which resulted in a refinement of the dynamic properties of the embankment materials. A re-evaluation of the behavior of the embankment during the postulated San Andreas event, using the refined dynamic properties, showed a much improved picture of the behavior of the embankment in terms of potential settlement and permanent deformations.

On the basis of an assessment of the revised computations of strain potential, it was concluded that the maximum settlements of the embankment at the mid-section due to an event of magnitude 8+ occurring along the San Andreas Fault are not expected to exceed about 3 to 5 ft. The consultants therefore recommended raising the elevation of the crest of the dam by 5 ft. to accommodate the possible loss of freeboard.

The Corps of Engineers' guidelines developed under the 1972 National Dam Safety Act classifies Chabot Dam as a large dam with "high hazard" potential (because there is the potential for a large loss of life and extensive economic loss). Because of its large size and high hazard potential, the guidelines recommend that the spillway should be capable of passing the probable maximum flood (PMF).

In a letter to the District, July 18, 1975, the Division of Safety of Dams stated that "The Division's present practice requires that the spillway for a dam and reservoir with the physical size and downstream population and property as at Chabot Dam should be designed to safely pass a probable maximum flood (PMF)." This letter stated further that "We believe the flows associated with a PMF are considerably in excess of what could be safely passed by portions of the existing Spillway No. 1, even for relatively brief periods of maximum flow".

A study conducted by the Water Resources Planning Division of EBMUD established the magnitude of such a flood. Factors considered were: basin urbanization, watershed soil conditions, a probable maximum precipitation storm over the entire watershed, and full Upper San Leandro and Chabot Reservoirs. The estimated probable maximum precipitation (PMP) storm for the Chabot Reservoir watershed area (approximately 42 square miles) would have a rainfall of approximately 14.5 inches in a 24-hour period. Based on the above, runoff from the PMP storm was routed into and regulated through Upper San Leandro Reservoir and spilled over the newly modified USL dam and spillway. This Upper San Leandro outflow was combined with the intermediate Chabot basin runoff to become the inflow to Chabot Reservoir. The results were a peak

Chabot inflow of 16,000 cubic feet per second (CFS) and a regulated peak outflow over the dam and spillway of 9,500 CFS.

As proposed, the spillway modifications would noticeably change the existing dam and right abutment (Figure 1). The structures on Spillway No. 1 that would have to be removed include the present broad spillway entrance, the trash racks, the stop log structure, and the bridge. The upper portion of Spillway No. 1 would be excavated down to suitable embankment material and would be backfilled with selected and suitably compacted material from the adjacent spillway excavation and other borrow sources, and would become a part of the dam embankment. The Spillway No. 1 tunnel structure would be plugged with concrete or removed and the pipe downstream of the tunnel would be removed. The concrete discharge apron would be leveled. The masonry steps and adjacent lined channel and the discharge apron downstream of the tunnel would be covered with compacted material from the required spillway excavation.

The vegetation, including trees, on a portion of the right abutment would be removed and offhauled. Construction of the proposed spillway would require excavation of 96,500 cubic yards of material. To minimize the amount of material that must be disposed of, cut and fill quantities would be balanced as much as possible by flattening fill slopes on the downstream side or by widening the dam crest. Surface soils containing organic material would be temporarily stockpiled for later use on selected graded surfaces to facilitate growth of grass. It is anticipated that most of the excavated soil and rock would be used for raising the downstream face of the dam to the new crest elevation. Any excavated material encountered which is unsuitable would probably be disposed of on site.

The on-site disposal area for excess or unsuitable excavated material would be at the toe of the dam, on a gently sloping area on the left side of the creek, and in the hollow where the 10-foot diameter pipe is now located. The dam fill to be added would cover the existing crest and the upper portion of the existing downstream face of the old dam. No placement of material on the upstream face of the dam is proposed. The fill would be placed to increase the height of the dam by five feet. The new dam crest would be 40 feet wide. Two thousand three hundred cubic yards of impervious core material in the crest addition will come from a borrow area on the left abutment near the crest. A new road and bridge would be installed over the new crest and new spillway to provide continued access across the dam. Berms on the downstream face would control erosion damage and allow easy access to the drainage ditches created to carry off surface water during heavy rains.

The general features of construction are illustrated in Exhibits 7 through 9.

The proposed spillway would be a large reinforced concrete structure capable of conducting safely waters of a probable maximum precipitation past Chabot Dam. Capable of carrying 9,500 cfs, the proposed spillway would be approximately 500 feet long, 25 to 72 feet wide, and 8 to 31 feet deep with a control weir at the upstream end and an energy dissipating structure at the downstream end. The configuration has been carefully checked by hydraulic model studies conducted at the Santa Clara laboratory of HRS (Hydro Research Science) under the direction of Dr. Alexander Rudesky.

The proposed spillway would be oriented approximately 45° from the base line of the dam, would be excavated into the right abutment, and would end just downstream of the existing 60-foot apron and small pool. The entire structure, with the possible exception of the upstream apron section would be founded on bedrock. A broad 100-foot wide flat apron would narrow to a 25-foot wide "ogee" weir 8 feet high with a crest elevation of 227 feet, thereby maintaining the present lake elevation.

The proposed stilling basin located approximately 116 feet lower in elevation than the spillway crest, would be approximately 90 feet long, 30 feet deep, and 72 feet wide. The proposed stilling basin essentially converts the shallow, high velocity flow from the steep chute to a deep low velocity flow. The special design incorporated in the basin permits this to be accomplished in a much shorter distance than a conventional "hydraulic jump" stilling basin. The hydraulic model studies indicate that erosive velocities from the proposed spillway design would be minimal, but erosion to the streambed would be further prevented by rock riprapping the creek channel for a short distance downstream of the stilling basin. The cutoff wall required at the end of the new spillway stilling basin would extend 30 feet on either side of the basin and extend down to a depth of 10 feet or to bedrock.

The existing creek downstream of the spillway stilling basin would be altered for a distance of approximately 300 feet. The existing vegetation, particularly downstream of the spillway, would be removed and disposed of and the existing unlined stilling pool would be filled. The creek bed would be graded in preparation for placement of large riprap rock. The bed downstream of the stilling basin would be improved and riprapped for approximately 100 feet to protect the streambed and creek valley walls from erosion. The creek channel would be improved (requiring the removal of some trees) for another 900 feet to allow the flood flows to pass unrestricted.

A primary consideration in the design of the proposed new spillway was the criterion that no significant increases in either downstream flood discharges or in reservoir elevation over those that would have occurred from the existing spillway system (if there had been adequate free board and structural soundness) would result from the new spillway. To accomplish this, the new spillway crest was designed to have a discharge rating curve closely matching that of the existing spillway system. This rating curve was subsequently verified by hydraulic model studies and the closeness of matching can be seen on Exhibit 7. The peak discharge and maximum water surface elevation for a range of infrequent storms with the present spillway system and the proposed spillway are also noted on the figure. These results are based on reservoir routing studies of the flood inflows for the various frequency events.

For a proposed project of this magnitude and complexity, considerable amounts of material, manpower, and equipment would be required. The spillway would require about 8,000 cubic yards of concrete and 1,250,000 pounds of steel reinforcing bars. The removal of approximately 96,000 cubic yards of rock from the steep right abutment for the spillway and the subsequent placement of this material on the dam embankment and the disposal sites would require heavy earth moving equipment. This equipment would require widening and some possible reconstruction of a narrow access road which starts from Lake Chabot Road upstream of the dam. Access from Estudillo Avenue in San Leandro would be limited to relatively light vehicles because of the limited capacity (5 ton) of the wooden trestle bridge leading to Chabot Park.

ENVIRONMENTAL SETTING

The environmental setting of the proposed project is complex. It will be discussed below under several separate classifications.

A. Hydrology

The proposed project is located entirely within the watershed of San Leandro Creek. Due to the existence of the present dam, a substantial portion of the runoff from the watershed above the dam is impounded in the reservoir. Normally, no controlled releases are made into the creek downstream. There is some very small flow into the stream from seepage around and through the dam.

The District holds water rights to the Upper San Leandro Creek watershed above Chabot Dam, and has no obligation to maintain flow in the creek below Chabot Dam. There are no known downstream users that depend on water from the creek in this area.

The site receives, on the average, about 27 inches of rainfall per year. Data collected by the District indicates that runoff from the watershed above the dam is important but is not of major significance in terms of the District's total water demands.

Groundwater in the San Leandro Creek Valley area is not a significant factor. The existing Chabot Reservoir intercepts the stream flow or groundwater from San Leandro Creek valleys below the existing USL Dam, and from Grass Valley to the northeast of Chabot Dam.

The total drainage area above Chabot Dam is 42.35 square miles. Of this amount, 30.36 square miles is above Upper San Leandro (USL) Dam. Urbanization in the Moraga and Orinda area accounts for approximately 13% or 4 square miles of the drainage into USL Reservoir.

There are six principal drainages into the basin above Chabot Reservoir which all flow intermittently. San Leandro Creek drains the unincorporated community of Canyon. Moraga Creek drains much of the town of Moraga and forms the Valle Vista arm of USL Reservoir. Redwood Creek drains Redwood Canyon. Buckhorn and Kaiser Creeks drain a large area northeast of USL Reservoir. Miller Creek drains the canyon south of Riley Ridge and enters San Leandro Creek immediately downstream of the new USL Dam. These streams, plus the upstream releases from USL Reservoir, account for more than 90% of the inflows to Chabot Reservoir. The remaining inflow comes from smaller intermittent streams to the northeast and south of the reservoir.

B. Water Quality

The District routinely carries out chemical analysis of water from its terminal reservoirs. Tests indicate that the water from Chabot Reservoir has a consistently higher mineral content than other terminal reservoirs. Chemical analysis taken in 1974 indicated that Chabot water alkalinity and hardness (reported as CaCO in mg/ℓ) was over 10 times that reported for Pardee water, the major source of the District. It is the higher turbidity and organic content of untreated Chabot Resrvoir water that requires its more elaborate treatment, thereby increasing its cost.

The water quality available to the District from the Mokelumne Aqueducts is excellent (low in turbidity and organic matter), thus is less expensive to treat. With a normally adequate supply of excellent quality water for its customers at lower cost, the District has elected to use the Chabot Reservoir only as a standby terminal reservoir.

C. Flood Control

Both Upper San Leandro and Chabot Reservoirs serve to store the watershed runoff carried by San Leandro Creek. The District does not operate these reservoirs for flood control purposes and has no commitment to do so. As a water supplier and water right holder, every effort is made to avoid spills through good planning.

D. Sediment Transport

An incidental benefit afforded by the Chabot Dam is the retention of silt that would otherwise be carried to the lower reaches of San Leandro Creek. The reservoir serves to reduce possible channel maintenance costs for removal of silt from the portions of San Leandro Creek below the dam.

According to survey information, silt has been deposited to an elevation of 175 feet in the vicinity of the dam. According to early surveys, the quantity of silt that has been deposited in the Chabot Reservoir is about 4 million cubic yards. This sedimentation has reduced the storage capacity by an equivalent volume of 800 million gallons, or 2,500 acre-feet. The rate of sedimentation of the lake was reduced as a result of construction of the USL Dam. When completed, the proposed project would alter sedimentation transport very little, except by reducing erosion of the stream bed downstream of the dam.

E. Soils and Geology

Field explorations and geological analyses indicated that the right abutment where the proposed spillway would be located, has a soil mantle which ranges in depth from 0 to 15 feet above firm bedrock. The soil mantle is generally derived from weathering of the bedrock beneath. At the bottom of the canyon, the soil is deeper alluvium deposited by San Leandro Creek throughout its history.

A report by the District's Consulting Geologist, Burton H. Marlaive, indicated that:

> A wide variety of rock types is found at the Chabot Dam site and identification is complicated by surface weathering and by alteration due to metamorphic processes. The oldest rocks are from the Franciscan Group which is here represented by meta-volcanics or greenstones and by intrusive gabbros and ultrabasic intrusives. The ultrabasic intrusives are partially altered to serpentine, talc, and magnesite, and near the surface may be weathered to a blue grey clay in places. Cretaceous and jurassic sediments found upstream of the site are predominately blue grey clay shales with some sandstone and conglomerate. Some massive clay shales of the same formation are also found downstream

of the left abutment. Quaternary rhyolitic dike rock has intruded along an old fault contact between the older Franciscan igneous rocks to the west and the younger Knoxville and Chico sedimentary rocks to the east. A volcanic flow of rhyolite caps much of the ridge a quarter-mile southeast of the dam.

Geologic structure in the area is controlled by the northwesterly trending Chabot and Hayward Faults and by cross-faulting between them. A half-mile downstream of the dam, the San Leandro Creek is offset over 1000 feet by the Hayward Fault, the west side of the fault moving northerly. The east Chabot Fault cuts the peninsula across Chabot Reservoir from the dam, while the west Chabot Fault is offset by cross-faulting that passes along the axis of the dam. Most indications of the old cross-faults have been destroyed by the intrusion of the rhyolitic dike rock along their traces. No fault movement in the rhyolitic rocks can be detected other than minor slip planes along the southern contact so it may be assumed that the faults are inactive.

F. Seismicity

A seismic fault map is shown for the area of the proposed project on Exhibit 6. The most significant active faults affecting the general area are the active Hayward Fault one-half mile to the west; the active San Andreas Fault 19 miles to the west; and the active Franklin-Calaveras Fault nine miles to the east. Inactive faults in the vicinity of the project include the Miller Creek Fault three miles to the east and the East and West Chabot Faults, both located within 2000 feet of the proposed project. Woodward-Clyde Consultants made a thorough evaluation of faults and earthquake potential affecting this area and indicated that the Hayward and San Andreas Faults pose the greatest potential threat to Chabot Dam. These consultants, in cooperation with Professor H. B. Seed, Program Consultant to EBMUD for the seismic re-evaluation of dams, chose "design earthquakes", which are generally accepted as the maximum credible earthquakes capable of occurring along the Hayward and San Andreas Faults. The "design earthquakes" were established as M = 7-1/2 on the Richter Scale for the Hayward Fault, and M = 8+ for the San Andreas Fault. These are the levels of magnitude which the modified embankment would be designed to withstand. Woodward-Clyde Consultants estimated the recurrance of such earthquakes at 500-1000 years for both the San Andreas and Hayward events. They also noted that these recurrence estimates were based on a statistical analysis of earthquake events that have occurred in the past, and that both design earthquakes are "sensible" events based on present state of knowledge.

G. Vegetation Patterns

The area around Chabot Reservoir is generally classified as chaparral and mixed woodlands. The original streambed immediately downstream of the project site has been characterized as "moist chaparral."

The streambed and adjacent canyon walls sustain lush brush and tree growth. The brush is principally coyote bush, poison oak, and blackberries. A great variety of bromes, rye, oats, and other grasses partially cover the surrounding hills. Wildflowers, such as California poppy and lupine are abundant in early to late spring. The trees include coast live oak, madrone, sycamore, California laurel, willow, and big-leaf maple, as well as introduced varieties of pine and eucalyptus. A large growth of prickly-pear cactus cascades down the hillside from the right dam abutment. Cat-tails and rushes are abundant around portions of the lake and along the stream bed downstream from the dam.

Although public access to the area has been limited, man's impact upon the natural environment is quite evident. Past construction activities, as well as the dam itself, have significantly altered the original natural conditions. Fencing to limit public access, the presence of fishermen on and around the lake, and the appearance of cyclists and hikers along the "Lake Shore/West Shoreline" Trail have also altered the natural occurrence of wildlife in the area.

The project site is not unique since comparable areas and topography exist throughout the general area. However, valuable wildlife habitat is provided by the mixed combination of grass and woodland. In some areas, such as the pond and marshy area at the foot of the existing Spillway No. 1 and the cat-tail growths near Spillway No. 2, the vegetation provides rather special qualities conducive to localized wildlife.

There is a stand of white alders and a large coast live oak on the south side of the access road at the foot of the dam face. Also in the same area are two low spreading redberries, Rhamnus crocea, which would be threatened by construction. These might be removed and transplanted in an appropriate nearby habitat.

According to the records of the California Academy of Sciences, the rare Fritillaria liliacea once occurred in grassland near the dam.

A botanical inventory of the project area is included in Appendix B.

H. Existing Wildlife

The surrounding area supports a variety of native wildlife. Appendix A lists a wildlife inventory for the area. Blacktailed deer, skunks, raccoons, opossums, weasels, foxes, rabbits, squirrels, and gophers have been seen in the area. Reptiles and amphibians are found in abundance around the periphery of Lake Chabot and along San Leandro Creek. Birdlife includes vultures, hawks, owls, woodpeckers, jays, doves, swallows, California quail, sparrows, finches, blackbirds, and numerous other native birds, as well as seasonal populations of ducks and geese, which rest on the lake during migration. A large population of redwinged blackbirds nest each spring in the cat-tails between the dam and Spillway No. 3. Each year, swallows construct 20 to 50 nests on the exposed concrete undersurfaces of the existing spillway bridge. Native and introduced varieties of fish found in Lake Chabot include large mouth bass, channel catfish, carp, bluegill, trout and crappie. The cover near Spillway No. 3 is the spawning ground for large numbers of small mouth bass each year. Large 15 to 20-pound channel catfish are taken from the reservoir near the face of the existing dam.

The most obvious fragile population in Anthony Chabot Regional Park is the Great Blue Heron and Great Egret rookery, located on the northwest point of Las Cumbres Ridge directly east across the lake, about a mile from the proposed project site. Currently, 9 to 15 pairs of both shy species are known to use this rookery through the spring and summer months. Although the nests are inaccessible due to their location high in eucalyptus trees, human disturbance in the near vicinity may result in breeding failure. While these species are not rare or endangered, this colony is considered unusual enough to be considered "rare". The proposed project should have very little or no effect on this colony.

I. Rare or Endangered Species

The only rare or endangered species known to have existed on the proposed project construction site, is the Fragrant Fritillary, Fritillaria Liliacaei. This member of the lily family is only known to exist in five other locations, all of which are in California. The area where they were last sighted (in 1916) was on the downstream face of the existing Chabot Dam. In the last 60 years, since this species was last found, the dam has undergone several modifications, including the addition of the "fillet fill" on the downstream face. This additional embankment covered the area with about 10-20 feet of soil where the Fragrant Fritillary was last sighted. During a field survey in 1975, conducted by staff members from the District, a Naturalist and East Bay Regional Park District personnel, no evidence could be found of this species and it is believed that this species no longer exists on or near the the project site.

Other rare or endangered species that may be located near or dependent upon the proposed construction site include:

The California Tiger Salamander, a large, robust salamander that reaches 8 inches in total length. Scattered populations live in the vicinity of the Anthony Chabot Regional Park. Because they spend the majority of their lives in underground retreats (such as ground-squirrel burrows), are nocturnal and generally emerge only during rainy periods between late fall and early spring, the presence of the species is difficult to establish. The habitat of the adult species is diverse, ranging from oak woodland and grassland communities to semi-arid regions.

The Alameda Striped Racer is a rare species occurring in the valleys, foothills, and low mountains of the Coast Ranges east of San Francisco Bay, Alameda and Contra Costa Counties. A species with a very low population density, it has been greatly depleted as a result of construction of homes and roads throughout its original range. The Anthony Chabot Regional Park and surrounding open space offers suitable habitat to this species. If in the vicinity, the snake could be expected to retreat from the disturbance created by the proposed construction.

J. Historical and/or Archeological Sites

The closest known archeological site has been reported on the San Leandro Creek in the vicinity of the Southern Pacific Railroad crossing three miles west of the proposed site. Other archeological remains have been reported four miles to the southeast in the Mulford Gardens area in San Leandro.

Although no formal investigation has been conducted, there are no known historical or archeological evidences at the project site. Archeological finds would be unlikely at this site. Members of the Ohlone tribe which inhabitated the East Bay area have been characterized as hunters and gatherers. The proposed construction site, in the vicinity of San Leandro Creek, would not lend itself to utilization except as temporary resting place. The modifications of the site subsequent to the original construction of the dam would likely have obliterated any archeological remains.

Should such remains be encountered during construction activities, earth-moving work in the immediate area would be halted and a professional archeologist would be consulted to assess the situation and make recommendations for the preservation and/or salvage of all endangered archeological remains.

The historical significance of the Chabot Dam and Lake was recognized by the American Water Works Association (AWWA) when, in 1974, the site was designated as "American Water Landmark Number 24." The AWWA defines a landmark as follows:

> "According to AWWA, an American Water Landmark is a solid, tangible property--one you can see and admire--that is or has been directly related to water supply, treatment, distribution, or technical development.... It is at least 50 years old; is locally recognized as a landmark; and is kept up in a manner fitting to its significance. With those qualifications, a property can be proposed to AWWA for consideration and possible admission to this elite group."

In 1974, Chabot Dam and Reservoir also was designated as an Historical Civil Engineering Landmark by the San Francisco Section of the American Society of Civil Engineers.

These Landmark designations carry no restrictions relating to improvements, reconstruction, etc., and will not be affected by the proposed construction. The District's obligation would be to provide an appropriate location for plaques commemorating the historical background of the structure.

The intake structure to Tunnel No. 2 (the "Temple") and the remaining original portions of Chabot Center, would not be affected by the proposed project and would consequently be preserved for their historical significance.

K. Traffic Patterns

Vehicular access from the northwest, from the terminus of Estudillo Avenue, is restricted by locked gates to Chabot Park, a 5-ton capacity wooden trestle bridge, and locked gates to Chabot Center. As its eastern terminus, Estudillo Avenue serves as a minor access street to a small single-family residential neighborhood. West of Lake Chabot Road, Estudillo Avenue is a major four-lane thoroughfare running east-west to downtown San Leandro. Estudillo Avenue merges with Lake Chabot Road in a quiet residential neighborhood above the MacArthur Freeway near the Oakland-San Leandro city limits.

Lake Chabot Road links northern San Leandro with the largely residential Castro Valley area to the southeast, terminating at Castro Valley Boulevard, a four-lane commercially developed thoroughfare. From its intersection with Estudillo Avenue in San Leandro, Lake Chabot Road rises on the steep wooded hillside passing the operational San Leandro Rock Company quarry on the right, and continues to rise approximately 250 feet above the lake.

The winding two-lane road offers a number of panoramic views of the lake below and the hills of Anthony Chabot Regional Park. The road offers a scenic north-south secondary alternative to motorists wishing to travel between northern Castro Valley and San Leandro and points north. The more heavily used route for traffic now is the modern four-lane expressway, Fairmont Drive which joins Lake Chabot Road, near the southern end of Chabot Reservoir and 150th Avenue at the interchange with Freeway 580 in San Leandro.

L. Noise

Noise levels in the vicinity of the proposed project are fairly low. The existing dam has no power generating facilities or other noise sources. With the exception of noise generated by vehicular traffic on Lake Chabot Road, and heavy equipment noise when the San Leandro Rock Company quarry is in operation (a distance of 1,200 feet away), the noise level is similar to that of typical rural locations.

M. Open Space and Watershed

The region in the vicinity of the proposed project is designated as a Land Preserve in Primary Open Space in the Alameda County Open Space Element of the General Plan. According to the Open Space Element, published on May 30, 1973, "preserves" are described as follows:

> Preserves are permanent open space areas of irreplaceable natural or environmental resources or areas of outstanding beauty and consist primarily of existing and proposed major park and recreation areas shown on the County General Plan, which in turn include watershed lands and other public owned non-recreation lands. The East Bay Ridge north of Castro Valley, Roundtop Regional, Joaquin Miller, and Tilden Regional Parks, as well as East Bay Municipal Utility District lands are considered preserves.

The watershed above Chabot Dam has an area of over 42 square miles. Because both Upper San Leandro Reservoir and Chabot Reservoir are used for storage for domestic water services, land use is very restricted, although about four square miles is urbanized in the Moraga area. The greatest proportion of the watershed is owned by EBMUD and the EBRPD. Suitable portions of the watershed are leased for cattle grazing purposes. A trailway system limited to use by hikers, bicyclists, and equestrians is currently in use. The trailway system may be expanded in the future, but no specific plans have been finalized.

The aesthetic value of the open space is often a matter of personal taste. When considered in the broad context of the entire open space area, the disruption due to the proposed project would be small. The overall effect of the proposed project would be to maintain an appealing body of water (Chabot Reservoir) in a parklike setting. On the other hand, the immediate vicinity of the proposed project would be altered obviously.

There are few locations readily accessible to the public that offer the Chabot Dam as an object of interest in a panoramic view. The dam and spillway are generally shielded from public view by vegetation. A small portion of the site, primarily the right abutment upstream of the dam and the "temple" structure, can be seen briefly by motorists from Lake Chabot Road from only one or two locations.

Because of the dam's secluded location deep in a wooded canyon, its scenic impact is limited largely to surveying the dam from atop and immediately adjacent to the structure itself.

ENVIRONMENTAL IMPACT

A. Short-Term Impacts

The proposed project would require clearing and excavation in the area of the right abutment for the spillway, demolition or burial of the existing Spillway #1, construction of the proposed concrete spillway, placement and compaction of the embankment material on the crest and downstream face of the dam, and improvement of the narrow access road adjacent to the lake. Each of the above activities would have its own particular impact in the immediate vicinity of the construction undertaken.

Visual Aesthetics

The excavation, earthmoving, placement and concrete construction activities involved in the proposed project would have a significant adverse effect on the aesthetic quality of the project area. The proposed construction would expose bare rock and earth over a portion of the right abutment, the dam face, and portions of the access road paralleling the lake. While construction is under way, little can be done to mitigate the impact of such operations except to minimize the area disturbed, and to exercise strict erosion and dust control measures.

The secondary short-term visual/aesthetic impact of the proposed construction would be the temporary reduction of the lake level to construct the inlet channel to the spillway. A 15-foot reduction of the lake level below the spillway elevation would result in exposing 97 acres of the reservoir around the perimeter of the existing reservoir. This consequence of the proposed project probably would constitute the most adverse visual/aesthetic impact experienced by the public. The time that the lake would be lowered would be minimized by judicious scheduling of construction activities in the vicinity of the proposed spillway. The East Bay Regional Park District hopes this lowering of the reservoir level would have benefits to it in that it would facilitate required repairs and maintenance to EBRPD structures on the shores of Lake Chabot.

Clearing and Grubbing

Clearing and grubbing are an essential part of the proposed project. Vegetation on the right abutment within the limits of spillway construction would be stripped prior to excavation for the proposed spillway. The dam face would be stripped of its grasses and scattered brush prior to placement of suitable embankment material. Clearing and grubbing operations undertaken in the canyon bottom would be required in preparation of disposal sites and of the creek bed bottom prior to channelization and riprapping. Some relatively minor amounts of clearing and grubbing would be required along the access road adjacent to the lake in preparation of the narrow roadway for passage of heavy construction equipment.

A tabulation of the major trees that would be removed is as follows:

Pine: 1 at 66 inches, 1 at 60 inches, 1 at 22 inches, 2 at 20 inches, and 1 at 10 inches diameter.

Gum: 2 at 43 inches, 2 at 40 inches, 1 at 20 inches, 1 at 12 inches, and 1 at 9 inches diameter.

Oak: 2 at 36 inches, 1 at 30 inches, and 22 at 8 inches to 12 inches diameter.

Cypress: one 8 inches diameter

Cherry: one 8 inches diameter

Cactus: Large clump

Importation of Material

The approximate balance of cut and fill (excavation over emplacement) would eliminate the need of requiring large quantities of import fill material for emplacement on the crest and downstream face of the dam. However, imported select material may be required for the central impervious portion above the existing crest of the dam if an apparent local borrow source is not adequate. Rock riprap and bedding, and other granular material to be used as a base for the proposed road atop the new dam crest, would have to be imported. It is estimated that approximately 4000 cubic yards of riprap material and approximately 3000 cubic yards of bedding material would be required.

A major imported material would be concrete. It is estimated that the proposed spillway would require 8000 cubic yards of concrete.

Incidental

One of the concepts of the proposed project is to balance the amount of excavation against the proposed emplacement. This could be considered a mitigative measure itself. The amount of material requiring excavation and placement for the proposed project amounts to the most advantageous and possibly the most economical alternative available. As mitigative measures, every effort would be made to use the excavated materials and thus reduce the amount of material to be spoiled and to limit imported materials to those materials not available at the site.

Improvement of the narrow access road from Lake Chabot Road would be required to accommodate the increased travel by heavy construction equipment such as dump trucks, concrete trucks, and steel delivery trucks. To reduce the excavation required, the cuts and fills would be matched along the access road whenever possible.

Borings indicate the rhyolite bedrock in the vicinity of the proposed spillway is badly fractured, and that blasting would not be required. However, if blasting were to be required, the Contractor's plan would have to be approved by the District prior to any blasting. The amount of blasting, if any, or the blasting technique, would be determined during excavation and would depend on the nature, location and configuration of the rock mass to be removed.

Another factor in diminishing air quality during a typical earthmoving construction project would be fugitive dust. The most effective mitigative measure for treatment of fugitive dust would be water spraying of access and haul roads during dry weather. In the case of this project, the amount of dust is expected to be small because most of the required excavation is in rocky material.

In the context of construction for the proposed project, the earthwork would constitute the major significant impact, the creation of the proposed concrete spillway being second. The earthwork would require the use of large earth moving equipment. The type of equipment used on a project is usually left to the Contractor as is the particular method of accomplishing the work. Similar projects generally require the use of large bulldozers, large capacity dump trucks, sheepsfoot rollers, cranes, backhoes, loaders, graders, and scrapers.

Air Resources

Local air quality would be temporarily reduced slightly as a consequence of the proposed construction activity. The exhaust particulates and byproducts generated by equipment consumption of an estimated 90,000 gallons of fuel, would be the primary source of air pollutants (several hundred pounds, maximum, per day).

The degradation is slight when compared to the total emissions (1970 estimate of over 9000 tons per day) encountered in an average day in the nine-county Bay Area.

Noise

The temporary impact on the acoustic environment in the immediate vicinity of the project would be relatively significant and adverse when compared to the existing low ambient noise levels. The primary impact would result from the loud noises generated by the heavy construction equipment and haul trucks. This type of equipment may be expected to produce noise levels above 85 dB(A) (when measured at a distance of 50 feet) as compared to an existing ambient level below 50 dB(A).

The immediate vicinity is largely unpopulated, and the effect of high noise levels would be experienced primarily by the workers at the project site. People passing the project site along Lake Chabot Road would probably not hear the construction noise over the sound of their vehicles. Those fishing or hiking in Lake Chabot Regional Park would hear the noise, but because of their more distant location, the level is not considered to be significantly annoying.

The noise level at the project site, although high due to the use of heavy equipment, is not expected to exceed industrial noise standards administered by the State Department of Industrial Safety. Since this project has no unique requirements which differ from most earth moving or concrete construction projects, the noise generated is not expected to have a significant adverse effect on man.

The impact of noise on wildlife in the area can only be assumed. The disturbance created by noise would probably be a significant factor in causing the temporary displacement of all wildlife and perhaps even the abandonment of breeding functions for several species for a period of two to three breeding seasons. No permanent long-term effects are expected to result from the increases in noise levels.

Water Quality and Resources

The temporary 15-foot lowering of the Chabot Reservoir during construction activities in the vicinity of the proposed spillway would have significant impact. The reduction in available storage would amount to 1.5 billion gallons which would diminish the potential standby water service capabilities of Chabot Reservoir by 42%. The lowering of the lake would expose over 97 acres of shoreline much of which supports aquatic vegetation. Subsequent increase in the lake elevations to current levels would submerge the partially decomposed aquatic vegetation and any emergent aquatic vegetation, possibly having a minor short-term adverse effect on the water quality of Chabot Reservoir.

Reservoir Drawdown

Construction of the spillway crest and approach channel requires the lowering the reservoir by 15 feet, which results in a 29% reduction surface area and a 42% reduction in capacity. Lowering the reservoir by operating Chabot Filter Plant exclusively would take approximately fourteen months, while lowering the reservoir by releasing directly to San Leandro Creek via the blowoff would take a minimum of one month. To avoid wasting water, the District would use as much of the water as possible by operating Chabot Filter Plant. The reservoir would be maintained at the lower elevation for approximately 4 to 6 months until the construction is completed.

Consideration was given to using a cofferdam to permit maintaining lake elevation during construction, but this idea was quickly abandoned due to the high cost and safety problems possible with a full reservoir in the event of cofferdam failure.

Disturbance of Fish and Wildlife

Disturbance of fish and wildlife is dependent on two factors: the actual construction activity and the temporary lowering of the lake by 15 feet. In the greater context of the available open space, the disruption of wildlife by the actual construction would be small, but in the narrow perspective of the construction site itself, the disruption would be significant. The large animals would avoid the site during actual construction because of the noise and general presence of man. Smaller animals such as mice and birds, which have territorial needs that are within the area or are contiguous to the area, are likely to be affected and could be expected to perish or flee. Studies indicate that species of birds forced to flee their original established territories have great difficulty re-establishing themselves in nearby areas occupied by their own species. Small animals which have territory within the proposed construction site, that currently occupy the right abutment and the canyon bottom, would likely not survive the construction period. The freshwater marsh at the toe of the spillway would be eliminated. Some small animals could be expected to return to the site in limited numbers from undisturbed regions peripheral to the impacted area after completion of the project. Maintenance of Chabot Reservoir at a relatively stable level as a standby reservoir has encouraged the development of an ecosystem similar to that of a natural lake. Because the water elevation changes drastically in an on-line terminal reservoir a stable vegetative complex generally is not established. A stable lake elevation encourages a proliferation of species. Consequently, the temporary 15 foot lowering of the reservoir might have a short-term impact on the reservoir's ecosystem. The bass spawning grounds in the cove near Spillway No. 3 is a case in point. The bass have selected an optimum location for their spawning. After the eggs hatch, the immature bass require the cover afforded by underwater vegetation to escape the predation of birds and larger fish. When lake levels vary widely, warm water fish spawning may be disrupted. The eggs perish, the smaller adult and fry alike are easier prey to birds and larger fish, because the vegetation cover essential to their survival would be destroyed. The result could be considered favorable from the standpoint of some, for the severe condition would encourage the presence of larger, albeit fewer, fish in the lake.

LONG TERM IMPACT

General

The major long-term impact of the proposed project would be improvement of the existing dam and spillway complex to safely pass the maximum probable precipitation flood-flow (replacing one spillway with a larger, a new spillway) and to withstand the effect of the maximum credible earthquake (modifying dam embankment) thereby minimize the risk to life and property attributable to dam failure. The major distinction of the proposed project is that the dam would be rendered "safe" by today's standards.

The occurrence of a PMP storm would probably cause flooding of portions of Oakland and possibly San Leandro on lower reaches of the San Leandro Creek, even without any overflow from Chabot Dam. Erosion of the banks of unimproved portions of San Leandro Creek could result as well. The presence of Chabot Dam would continue to regulate the flows of San Leandro Creek, reducing the downstream discharge below the amount of inflow to the reservoir. Flood routing studies indicate that the peak discharge flows from the reservoir due to a 1-in-1000 year storm would be approximately 45% less than the peak reservoir inflow and be delayed for about eight hours by the regulating effect of the reservoir. For the PMP storm, the peak outflow would be 40% less than the peak inflow and the delay would be about six hours.

The occurrence of a major earthquake along the San Andreas or Hayward Faults in the Bay Area could cause major disruption of water transmission facilities to the areas west of the Berkeley Hills. In particular, a major shift along the Hayward Fault could damage major water distribution mains and tunnels in the East Bay. Under such conditions the water stored in Chabot Reservoir would become extremely important in meeting system requirements. For this reason, the proposed project would likely be regarded by most people as having primarily beneficial impacts in the interest of public safety.

Land Commitment Impact

The proposed project would permit continued use of the reservoir and surrounding area for water storage and water-related recreation purposes.

Visual/Aesthetic Impact

The visual/aesthetic impact of the proposed project, particularly immediately after completion, would be greater than the impact of the present dam and spillway system. The broadened access road would sweep from the left bank across the higher, broader crest, traverse the chute-like spillway and merge with the old access road on the right abutment. The proposed improved spillway would have a functional appearance. After the grass on the downstream slope is established, the appearance of the improved dam would be quite similar to the present dam. The entire project area would be evenly contoured, but somewhat devoid of vegetation. It would take several years for natural vegetation to re-establish itself.

There is little question that there will be a significant visual impact immediately after construction of the proposed project. Several years of weathering of the proposed facilities and the re-establishment of vegetation would tend to soften this unavoidable visual impact.

Wildlife and Fisheries Displacement and Loss of Habitat

The area excavated in the immediate vicinity of the proposed spillway would be permanently lost as cover, breeding or feeding area for local and visiting wildlife. Similar to the impact of the existing spillway, embankment and road improvements would diminish the vegetative diversity, thereby reducing the population and density of the wildlife dependent upon the vegetation at the site.

The proposed project may act as a barrier between individual communities as well as obliterating some of the existing ecotonal area in the immediate area of the project. Both of the above-mentioned factors could lead to a small but permanent reduction of wildlife in the immediate vicinity.

The reestablishment of the plant community in the marsh area and the canyon bottom after completion of the project would be attended by a similar reentry of small animals. However, the loss of 1/4 acre of habitat could discourage a complete return of vegetation. The reduction of vegetation could result in a reduction of population densities and a reduction of species in the creek bottom.

Replacement of the existing spillway bridge and removal of the existing trash rack structure, both of which presently provide ideal surfaces for the construction of swallow's nests, is not anticipated to adversely affect local swallow populations, since the new bridge would provide at least as many ideal nesting surfaces. The project is not anticipated to have any long-term adverse effect on any of the following:

1. Redwing blackbird population which nests in the cattails and rushes between the dam and Spillway No. 3.

2. The warm water fish spawning area.

3. The Great Blue Heron and Great Egret rookeries, located in the eucalyptus trees on the northwest point of Las Cumbres Ridge.

Open Space

The proposed project would help preserve the "Primary Open Space, Land Preserve" status of the surrounding area or currently designated in the Open Space Element of the General Plan of Alameda County. The proposed project is entirely within "open space". Although it would alter the general appearance of the terrain in the immediate vicinity of the dam, the project would conform to the objectives and principles of the open-space element of the General Plan.

Historical

The Chabot Dam was designated a California Civil Engineering Landmark on June 17, 1976, by the American Society of Civil Engineers (ASCE) in "landmark plaque" ceremonies at the site. The demolition and backfill of the existing Spillway No. 1 could be considered an adverse impact on the "hand-hewn" historical construction aspects of the existing structure.

Mitigation measures to protect the historical character of the site would include preservation of the "temple" structure and portions of the Chabot Center facilities nearby. The plaques commemorating the historical quality of the site would be placed at an appropriate location on a massive marker built of stones salvaged from the dam's spillway structure.

Growth Inducement

Since the proposed project would neither increase the storage of Chabot Reservoir nor increase the water treatment capacities of the Chabot Center, it would neither induce nor deter urban growth.

Water and Energy Use

Types of water use during the proposed construction activities would be varied. Water required for compaction of the embankment fill and for dust control will come from Chabot Reservoir.

The estimated energy use attendant to the proposed project would be 90,000 gallons of petroleum (diesel and/or gasoline). Energy consumption is estimated on construction equipment using approximately 0.04 gal/hr/hp. This energy represents an irretrievable resource commitment. There would be no long term energy use due to the project.

MITIGATION MEASURES

The general area surrounding the project site, and the site itself, are important as open-space elements of great natural beauty. Motorists traveling along Lake Chabot Road and visitors to Anthony Chabot Regional Park have a panoramic vista across Chabot Reservoir of expansive undisturbed hills which over-shadow the existing dam by their size and extent. Although the dam and proposed spillway excavation area beyond are visible from portions of Anthony Chabot Regional Park, as well as from one or two locations along Lake Chabot Road, the panoramic vista across Chabot Reservoir should not be degraded by the construction of the proposed project.

The following specific measures would be used to mitigate the construction, fish and wildlife, visual, and aesthetic impacts of the proposed project:

1) The cut slopes would be contoured to avoid "knife-cut" type surfaces and abrupt changes of slope would be "softened" by rounding off any sharp breaks in contours.

2) Large areas of exposed soil would be planted with a seed mixture of grasses.

3) Trees and shrubs would be planted as screening along those limited portions of Lake Chabot Road where the project can be viewed by passing motorists if there is an expressed public objection to the resulting visual impact.

4) The "barrier-effect" of the project would be lessened by providing vegetation corridors across the project at strategic locations.

5) Vegetation removal would be kept to an absolute minimum by thoughtful planning and careful construction practices.

6) The area would be replanted with ground cover and landscaped with trees and shrubs which could provide shelter, food, and habitation for wildlife.

7) Construction and haul activities would likely be limited to daylight hours on weekdays, except during unusual circumstances. Vehicles delivering materials to the site would be limited to the hours between 7 a.m. and 6 p.m. on weekdays, except in unusual circumstances of a limited duration. As much movement of equipment as possible would be carried out to avoid commute rush hours. Any on-site construction activities which might extend into nightime are not expected to disturb nearby residents.

8) Local ordinances pertaining to noise, dust, construction debris, and litter would be strictly enforced.

9) No equipment or employee vehicles would be allowed to block public streets.

10) Alameda County Public Works Department and the City of San Leandro would be contacted regarding existing patterns of traffic movements through the area and scheduling the movement of construction and haul vehicles would be made if necessary to avoid excessive interference.

11) For obvious reasons of public safety, the public would be prohibited from the project area during construction. After construction, portions of the project that would be accessible to the public would have appropriate safeguards to prevent injury.

12) Satisfactory muffling devices would be required on all equipment and vehicles.

13) In co-operation with the State Department of Fish and Game electro-shocking fishery surveys might be made during the fall season after completion of the project. The results of such studies indicate age classes of fish as well as species counts. These surveys might be compared with previous studies to indicate the actual effect of the proposed project upon the fish population and suggest whether or not supplemental plants would be necessary to reestablish the population to pre-project level.

14) Disposal of unsuitable or otherwise unusable excavated material in the immediate vicinity would be preferred. This would serve to mitigate the impact of the proposed project. On-site disposal of construction wastes would be acceptable provided there is no potential for interference with possible future uses or contamination, otherwise the Contractor would offhaul solid wastes. Organic waste including trees and brush would probably require offhauling. As a further mitigative measure the Contractor could be required to offer cleared trees to the public as firewood.

15) Another factor in diminishing air quality during a typical earthmoving construction project would be fugitive dust. The most effective mitigative measure for treatment of fugitive dust, if it occurs, would be water spraying of access and haul roads during dry weather. It might be possible to use reclaimed water. In the case of this project, the amount of dust should be small because most of the required excavation is in rocky material.

ALTERNATIVES

There are a number of broad alternatives to the proposed project which were considered. The District could do nothing, but this would perpetuate the failure risk and would be imprudent and would not be allowed by the State Division of Safety of Dams. The forthcoming reevaluation of all dams under the Federal National Dam Safety Act would publically highlight both the spillway and seismic stability deficiencies. The dam could be removed completely -- but the expense and loss of the reservoir storage and public recreation facilities precluded this alternative. While it may be possible to replace the present dam and spillway with a new dam and spillway immediately downstream, this would be substantially more expensive and have even greater environmental impact and would serve no greater benefit than the proposed project. The dam could be sold to another agency, relieving the District of its responsibility if another such agency was available and willing to assume this responsibility; such a sale under these conditions is not likely. Even if it were to occur, the new owner would be obligated to eliminate the risk with the result that the same type of project being proposed by the District would likely be implemented by the new owner.

The other alternatives are more site related and consider the general purpose of the reservoir, the soundness of the dam, and the topography. A spillway of sufficient flood capacity could be rebuilt along the current alignment, or be replaced with a tunnel. The existing tunnel/chute configuration would be repeated or upgraded. An increase of dam freeboard by 5 feet to provide the necessary level of seismic safety could be accomplished by raising the dam, by lowering the reservoir water level, or by a combination of the two. Lowering the reservoir water level, of course, involves lowering the spillway elevation.

The comparison of costs of alternatives are preliminary estimates for construction in 1977. However, the relative cost of the alternatives given in percentages of the original estimate would remain valid for any other year. The particular alternatives are discussed below.

A. No Project

The "No Project" alternative would involve no cost to the District. However, it leaves unsolved the known problems of inadequacies in both spillway capacity and structural integrity with the attendant hazard to the safety of the dam. The State Division of Dam Safety is aware of these problems and would insist that the District carry out its commitment to achieve a solution. The State Division of Safety of Dams could soon issue an order to comply; i.e., to improve the spillway system and modify the crest of the dam. Failure to comply with this order would subject the District to legal action by the State to require the elimination of this risk to public safety. This alternative was considered unacceptable.

B. Sell the Dam Facilities

This alternative would involve transferring the reservoir to some other agency and possibly sharing costs of improvements with the agency. This alternative has the advantage of possibly avoiding some of the spillway construction cost if the agency accepting title to the dam and reservoir were willing to accept a share of these costs. The cost for this alternative could range from zero to $4.9 million, depending on the amount of costs the other agency would be willing to assume, and on whether or not the District would be able to maintain its rights to use the stored water. The $4.9 million figure consists of an estimated $2.5 million in construction costs and $2.4 million in loss of water supply. ($2.5 million in construction cost was an updated early 1973 estimate reflecting 1977 costs and other factors.) It is not likely that any agency would be willing to accept the problems and costs now borne by the District when the benefits are already available without ownership. The action could also jeopardize the District's emergency supply capability. In the event of an earthquake disaster, Chabot Reservoir can provide an early gravity supply of up to 15 MGD of chlorinated raw water for the southern end of the distribution system. The District's disaster preparedness program contemplates the future construction of a raw water pumping plant to increase that emergency supply capability to 40 MGD. Thus the alternative involving the sale of the dam facilities was dismissed as unacceptable.

C. Remove the Dam

This option would involve draining the reservoir and removing the dam. This would result in the loss of scenic features, recreational facilities, and standby storage. This would be an expensive solution at $5.2 million including costs of removal of the dam and disposal of the removed material, enlarging or re-excavating the creek channel through the reservoir and lining the sides and bottom with riprap, and planting low water using trees and shrubs to the bottom and sides of the reservoir basin, relocation of recreational facilities and the value of lost standby storage. Political, environmental, and recreational considerations, as well as the removal of vital emergency storage, make this alternative impractical. Chabot and USL Reservoirs are the only terminal reservoirs that do not have tunnels to the West-of-the-Hills portion of the District's distribution system which could be severed in the event of a large movement of the Hayward Fault. The lost inherent flood regulation functions would result in increased downstream flooding and could result in possible increased liability for the District.

D. Relocate the Dam Downstream

This alternative received little consideration. The present dam is at the optimum location on lower San Leandro Creek. Although no cost analysis of this alternative was undertaken, there is no question that the cost, even if a site was available, would far exceed the cost of the proposed project because an entirely new dam, spillway, and outlet tunnel would have to be constructed.

E. Lower Normal Reservoir Operating Level

With this alternative, the crest of the dam would not be raised. The reduction of the reservoir level by five feet would reduce the service capacity of the reservoir. The present recreation opportunities would likely be adversely affected since lowering the reservoir could require relocation of the docking facilities and would substantially reduce lake surface.

This alternative would require the excavation of a new spillway of sufficient capacity approximately five feet below the existing spillway level. A larger amount of excavation would be required from the right abutment, and since this material would not be needed to raise the dam, the entire amount would have to be spoiled with associated adverse environmental impact. Because of the added cost of the larger spillway excavation, and because of the adverse impact of permanently lowering the reservoir and disposal of the excavated material, further consideration of this alternative was discontinued without a further cost estimate.

F. Spillway Alternatives

1. Modify Existing Spillway System

Investigations of spillway alternatives have been undertaken in considerable detail a number of times, giving consideration to reworking not only Spillway No. 1, but also upgrading of Spillway No. 3 in order to pass flows associated with a probable maximum flood. The relatively high cost of tunnel work quickly led to abandoning consideration of a chute/tunnel combination similar to that which exists today. A chute spillway conforming to the alignment of Spillway No. 1, besides having poorer hydraulic characteristics, would be more expensive than the proposed project. Placement of the spillway on the proposed alignment would place the spillway almost entirely on firm bedrock, whereas a spillway alignment similar to the existing Spillway No. 1 could involve construction of the intake structure on the dam embankment. A curved spillway alignment offers more problems during construction, but the potential for operational problems was a key factor in choosing a straight alignment. Intrinsic to curved spillway design is the possible occurrence of standing waves, which would require additional freeboard on the channel walls. On the other hand, the flow characteristics of a straight spillway design are simpler. The small price advantage, as well as the advantage of placing the spillway further from the dam embankment, made the proposed alternative more attractive. Design of the stilling basin would have to be more conservative because of its proximity to the toe of the dam. Another key concern with the alignment along Spillway No. 1 is the necessity to complete the entire construction program within a single May-September construction period in order to provide adequate spillway capacity for even a nominal size storm. This involves a greater risk, more expensive and would cause greater disturbance to residential areas downstream because night shift operations would be essential. Another environmental impact is that an alternate borrow area would have to be opened up to provide a source of fill for the dam modifications; it is likely that the tree clearing and borrow area scar would have a greater visual impact away from the spillway site than if made at the dam site as proposed.

2. Tunnel Spillway

The $7.7 million cost of construction of a tunnel spillway capable of passing the required flow was prohibitive -- $4.5 million greater than the proposed project. This higher cost was judged to more than offset the only advantage of a tunnel spillway; a tunnel would not be as visible as the proposed chute spillway. However, the tunnel would not be entirely inobtrusive because it would require a crest type entrance structure as well as a dissipation structure. A disadvantage of a tunnel spillway is that it is subject to obstruction. Also, if the dam crest elevation is increased to provide the necessary freeboard, a separate borrow area must be opened up with associated impacts.

3. Alternative Alignments

a. Left Abutment

Any possibility of placing a new spillway on the left abutment was quickly discounted. The left abutment is very steep; excavation would probably require more extensive (and expensive) cuts possibly requiring realignment or abandonment of Lake Chabot Road above. It was quickly realized that this alternative was impractical and further investigation would be unnecessary. As a result, no cost analysis of a spillway alignment along the left abutment was attempted.

b. Right Abutment

Alignment of the proposed spillway on the right abutment received the greatest consideration and resulted in the final selection of the proposed project. A different alignment than that chosen for the proposed project (but with essentially the same environmental impacts and opportunities for mitigation) was investigated but its slightly greater cost, 3% over that of the proposed project, relegated it to secondary prominence.

The resistance of the geologic formation to erosion created a natural gorge on the creek which in turn created an optimum location for the dam. The right abutment provides the soundest foundation for a spillway capable of carrying a probable maximum flood safely past Chabot Dam.

G. Findings

The proposed project was chosen because it offered a number of advan tages. The relative simplicity of a straight chute spillway set on bedrock away from the dam embankment was crucial to the selection of the proposed project over all of the options investigated. The proposed project would allow safe passage of the estimated Maximum Probable Flood of 9500 cubic feet per second without endangering the Chabot Dam. The loss of freeboard during a maximum credible earthquake would be minimized by the addition of five feet of height to the crest of the dam, with an additional advantage of further buttressing the downstream face of Chabot Dam with the added fill. Other considerations which resulted in selecting the proposed project were the continued availability of Chabot Reservoir to the District as a standby terminal reservoir. The proposed project would fulfill its major objective of rendering Chabot Dam safe from the potential damage from a maximum probable flood and from a maximum credible earthquake.

There are a number of significant environmental impacts, most of which could be effectively mitigated. These impacts and mitigation measures have been discussed herein. Other impacts such as the temporary effect of reservoir lowering, temporary disturbance of local wildlife, permanent loss of the marsh at the downstream toe of the dam and the trees on the right abutment, and the visual impact of right abutment excavation and more prominent spillway structure are relatively minor.

APPENDIX A

A VERTEBRATE INVENTORY OF LAKE CHABOT DAM & VICINITY

The following list of species around Lake Chabot was prepared by S. E. Abbors, E. B. R. P. D. Naturalist.

FISH:

White Sturgeon - Ocipenser transmontanus
Rainbow Trout - Salmo gairdneri
Brook Trout - Salvelinus fontinalis
Carp - Cyprinus carpio
Golden Shiner - Notemigonus crysoleucas
Western Sucker - Catostomus occidentalis
Brown Bullhead - Ictalurus nebulosus
White Catfish - Ictalurus catus
Channel Catfish - Ictaurus punctatus
Mosquitofish - Gambusia affinis
Threespine stickleback - Gasterosteus aculeatus
Green Sunfish - Lepomis cyanellus
Bluegill Sunfish - Lepomis macrochirus
Largemouth Bass - Micropterus salmoides
Florida Largemouth Bass - Micropterus salmoides Floridanus
Black Crappie - Pomoxis nigromaculatus
Fresh Water Sculpin - Cottus asper

AMPHIBIANS:

California Newt - Taricha torosa
California Slender Salamander - Batrachoseps attenuatus
Arboreal Salamander - Aneides lugubris
Western Toad - Bufo boreas
Pacific Treefrog - Hyla regilla
Red-Legged Frog - Rana aurora
Bullfrog - Rana catesbeiana

REPTILES:

Western Pond Turtle - Clemmys marmorata
Western Fence Lizard - Sceloporus occidentalis
Western Skink - Eumeces skiltonianus
Southern Alligator Lizard - Gerrhonotus multicarinatus
Northern Alligator Lizard - Gerrhonotus coeruleus
Rubber Boa - Charina bottae
Western Ringneck Snake - Diadophis amabilis
Sharp-tailed Snake - Contia tenuis
Racer - Coluber constrictor
Alameda Striped Racer - Masticophis lateralis euryxanthus
Gopher Snake - Pituophis catenifer
Common Kingsnake - Lampropeltis getulus
Western Terrestrial Garter Snake - Thamnophis elegans
Western Aquatic Garter Snake - Thamnophis couchi
Western Rattlesnake - Crotalus viridis

BIRDS:

Common Loon
Red-Throated Loon
Western Grebe
Pied-billed Grebe
Double-crested Cormorant
Whistling Swan
Canada Goose
Mallard
Pintail
American Widgeon
Shoveler
Green-winged Teal
Wood Duck
Canvasback
Lesser Scaup
Common Goldeneye
Bufflehead
Ruddy Duck
Common Merganser
Hooded Merganser
Turkey Vulture
Cooper's Hawk
Sharp-skinned Hawk
Red-tailed Hawk
Golden Eagle
Osprey
Sparrow Hawk
California Quail
Great Egret
Great Blue Heron
Green Heron
Black-crowned Night Heron
American Bittern
Sora
Common Gallinule
American Coot
American Avocet
Kildeer
Marbled Godwit
Spotted Sandpiper
Common Snipe
Glaucous-winged Gull
Western Gull
Herring Gull
California Gull
Ring-billed Gull
Mew Gull
Bonaparte's Gull
Caspian Tern
Bank-tailed Pigeon
Mourning Dove
Screech Owl
Great-Horned Owl
Barn Owl
White-throated Swift
Anna's Hummingbird
Allen's Hummingbird
Rufous Hummingbird
Belted Kingfisher
Common Flicker
Nuttall's Woodpecker
Yellow-belted Sapsucker
Hairy Woodpecker
Downy Woodpecker
Ash-throated Flycatcher
Black Phoebe
Western Flycatcher
Western Wood Pewee
Olive-skinned Flycatcher
Horned Lark
Barn Swallow
Cliff Swallow
Violet-green Swallow
Rough-winged Swallow
Steller's Jay
Scrub Jay
Chestnut-backed Chickadee
Plain Titmouse
Common Bushtit
Wrentit
White-breasted Nuthatch
Red-breasted Nuthatch
Brown Creeper
House Wren
Winter Wren
Bewick's Wren
California Thrasher
Robin
Varied Thrush
Hermit Thrush
Swainson's Thrush
Western Bluebird
Golden-crowned Kinglet
Ruby-crowned Kinglet
Water Pipit
Cedar Waxing
Loggerhead Shrike
Starling
Solitary Vireo
Hutton's Vireo
Warbling Vireo
Orange-crowned Warbler
Yellow Warbler
Yellow-rumped Warbler
Townsend's Warbler
Wilson's Warbler
Western Meadowlark
Red-winged Blackbird
Brewer's Blackbird
Brown-headed Cowbird
Northern Oriole
Black-headed Grosbeak
Purple Finch
House Finch
Pine Siskin
American Goldfinch
Lesser Goldfinch
Rufous-sided Towhee
Brown Towhee
Lark Sparrow
Dark-eyed Junco
Rufous-crowned Sparrow
White-crowned Sparrow
Golden-crowned Sparrow
Fox Sparrow
Song Sparrow

MAMMALS:

Opossum - Didelphis marsupialis
Western Mole - Scapanus latimanus
Trowbridge Shrew - Sorex trowbridgei
Ornate Shrew - Sorex ornatus
Little Brown Myotis - Myotis lucifugus
California Myotis - Myotis californicus
Big Brown Bat - Eptesicus fuscus
Pallid Bat - Antrozous pallidus
Hoary Bat - Lasiurus cinereus
Black-tailed Jackrabbit - Lepus californicus
Audubon Cottontail - Sylvilagus audobonii
Brush Rabbit - Salvilagus bachmani
Black-tailed Mule Deer - Odocoileus hemionus columbianus
Raccoon - Procyon lotor
Long-tailed Weasel - Mustela frenata
Striped Skunk - Mephitis mephitis
Gray Fox - Urocyon cinereoargenteus
Bobcat - Lynx rufus
Mountain Lion - Felis concolor
Fox Squirrel - Sciurus niger
Botta Pocket Gopher - Thomomys bottae
Harvest Mouse - Reithrodontomys megalotis
Deer Mouse - Peromyscus maniculatus
Pinon Mouse - Peromyscus truei
California Mouse - Peromyscus californicus
Dusky-footed Woodrat, Pack Rat - Neotoma fuscipes
California Meadow Mouse (Calif. vole) - Microtus californicus
House Mouse - Mus musculus
Norway Rat - Rattus norwegicus
Black Rat, Roof Rat - Rattus rattus
Broad-footed Mole - Scapanus latimonus

REFERENCES:

Bailey, Reeve M., 1970, A List of Common and Scientific Names of Fishes from the United States and Canada, Special Publication No. 6, American Fisheries Society

Ingles, Lloyd G., 1965, Mammals of the Pacific States, Stanford Univ. Press

Robbins, Chandler S., 1966, Birds of North America, Golden Press, New York

Stebbins, Robert C., 1966, A Field Guide to Western Reptiles and Amphibians, Houghton Mifflin Co., Boston

APPENDIX B

A BOTANICAL INVENTORY OF THE LAKE CHABOT DAM & VICINITY

FERNS:

Licorice Fern - Polypodium glycyrrhiza
Sword Fern - Polystichum manitum
Coastal Wood Fern - Dryopteris arguta
Giant Chain Fern - Woodwardia chamissoi
Goldenback Fern - Pityrogramma triangularis
Western Bracken (Fern) - Pteridium aquilinum pubescens
California Maidenhair (Fern) - Adiantum jordani
Coffee Fern - Pellaea andromedaifolia
Bird's Foot, Cliff Brake - Pellaea mucronata

TREES:

Monterey Pine - Pinus radiata
(A) Chinese Pine - Pinus yunnanensis
Redwood - Sequoia sempervirens
Monterey Cypress - Cupressus macrocarpa
Fremont Cottonwood - Populus fremontii
Yellow Willow - Salix lutea
Arroyo Willow - Salix lasiolepis
White Alder - Alnus rhombifolia
Coast Live Oak - Quercus agrifolia
California Laurel - Umbellularia californica
Sycamore - Platanus racemosa
Big-leaf Maple - Acer macrophyllum
Madrone - Arbutus menziesii
Blue-Gum Eucalyptus - Eucalyptus globulus

SHRUBS:

Naked-stemmed Buckwheat - Eriogonum nudum
Hillside Gooseberry - Grossularia californica
Pacific Ninebark - Physocarpus capitatus
California Blackberry - Rubus procerus
Toyon - Heteromeles arbutifolia
Photinia - Photinia serrulata
Pyracantha
Cotoneaster
Silver Lupine - Lupinus albifrons
French Broom - Cytisus monspessulanus
Deerweed - Hosackia glabra
Poison Oak - Rhus diversiloba
California Coffeeberry - Phamnus californica
Redberry - Phamnus crocea
Rock Rose - Cistus sp.
California Fuchsia - Zauschneria californica
Orange Bush Monkey Flower - Minulus aurantiacus
Wooly Indian Paint Brush - Castilleja foliolosa
Climbing bedstraw - Galium nuttalii
Blue Elderberry - Sambucus mexicana

SHRUBS: (cont'd.)

Common Snowberry - Symphoricarpos rivularis
Hairy Honeysuckle - Lonicera hispidula
Coast Sagebrush - Artemisia californica

HERBACEOUS AND MISCELLANEOUS PLANTS:

Narrow-leaved Cat-tail - Typha augustifolia
Broad-leaved Cat-tail - Typha latifolia
Wild Oat - Avena fatua
Giant Reed (Bamboo) - Arundo donex
Pampas Grass - Cortaderia selloana
Rye-Grass - Lolium sp.
Umbrella Sedge - Cyperus sp.
Spreading Rush - Juncus patens
Common Soap Plant - Chlorogalum pomeridianum
California Blue-eyed Grass - Sisyrinchium bellum
Hoary Nettle - Urtica holosericea
Fiddle Dock - Rumex pulcher
Hottentot Fig (Ideplant) - Mesembryanthemum edule
Miner's Lettuce - Montia perfoliata
Common Chickweed - Stellaria media
California Poppy - Eschscholzia californicus
Summer Mustard - Brassica geniculata
Alum Root - Heuchera micrantha
Annual Lupine - Lupinus sp.
American Vetch - Vicia americana
Cut-leaved Geranium - Geranium dissectum
Red-stemmed Filaree - Erodium cicutarium
Prickly Pear - Opuntia sp.
Pacific Sanicle - Sanicula crassicaulis
Mountain Sweet-cicely - Osmorhiza chilensis
Sweet Fennel - Foeniculum vulgare
Poison Hemlock, Parsley - Conioselinum chinense
Periwinkle - Vinca major
Western Morning-glory - Convolvulus occidentalis
Phacelia - Phacelia sp.
Hedge-Nettle - Stachys sp.
Coast Figwort - Scrophularia californica
English Plantain - Plantago Lanceolata
Goose Grass - Galium aparine
South American Conyza - Conyza bonariensis
Common Yarrow - Achillea millefolium
Wormwood - Artemesia doughlasiana
Audweed - Graphalium sp.
Milk Thistle - Silybum marianum
Bull Thistle - Cirsium vulgare
Yellow Star-thistle - Centaurea solstitialis
Prickly Sow-thistle - Sonchus asper

References:

Abrams, L. and Ferris, R. S., 1960, Illustrated Flora of the Pacifc States, Vol. I-IV, Stanford Univ. Press

McMinn, K. E., 1959, An Illustrated Manual of California Shrubs, Univ. of Calif. Press

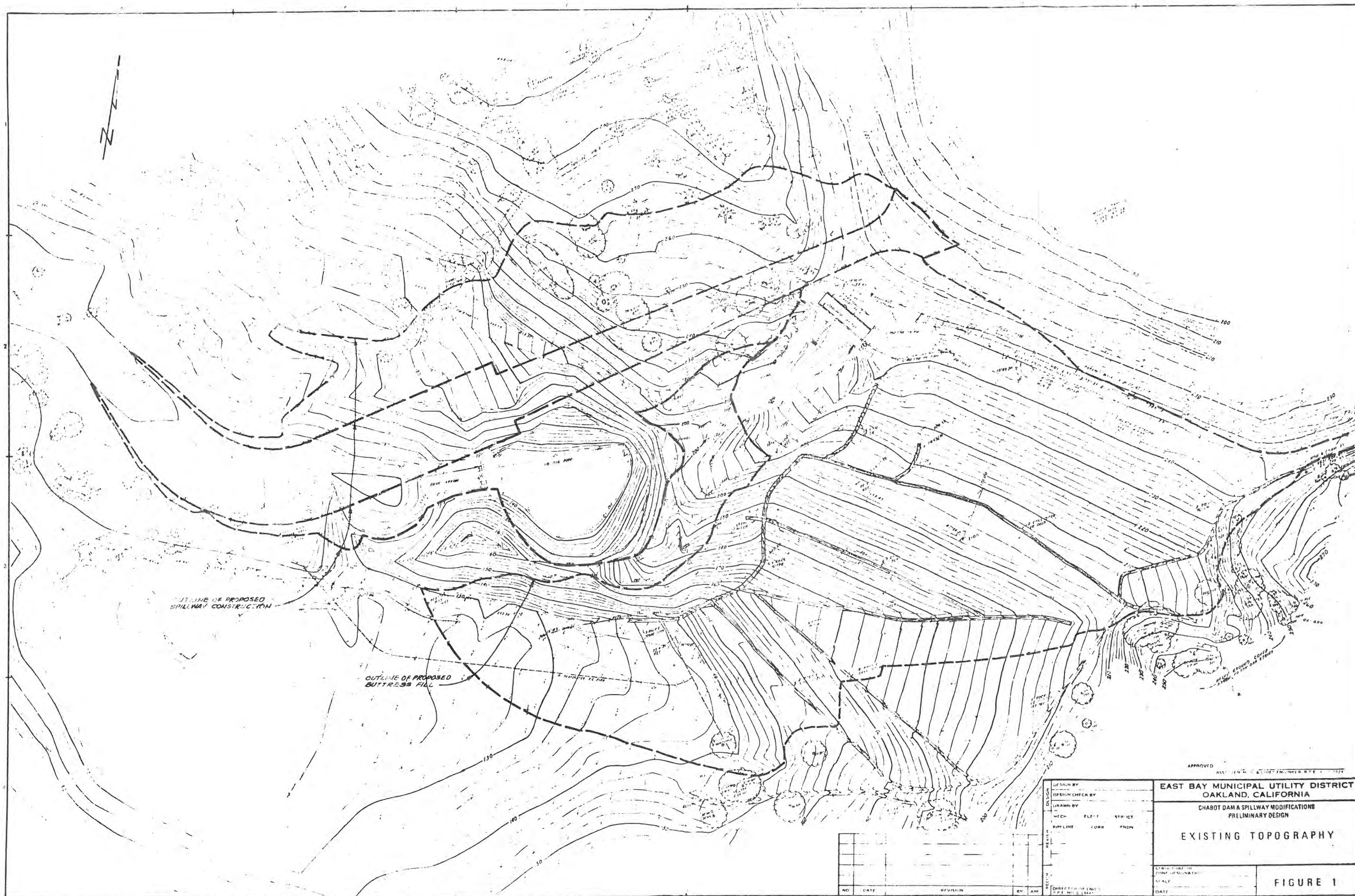
Munz, P. A., 1959, A California Flora, Univ. of Calif. Press.

Species identification confirmed by:

Mr. Walter Knight	)	
Mrs. Irja Knight	)	Flora
Dr. Elizabeth Mc Clintock	)	
Mr. John Thomas Howell	)	Fauna
Stephen E. Abbors	)	

Compiled by:

Stephen E. Abbors, naturalist for East Bay Regional Park District


OUTLINE OF PROPOSED SPILLWAY CONSTRUCTION
OUTLINE OF PROPOSED BUTTRESS FILL
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DESIGN CHECK BY
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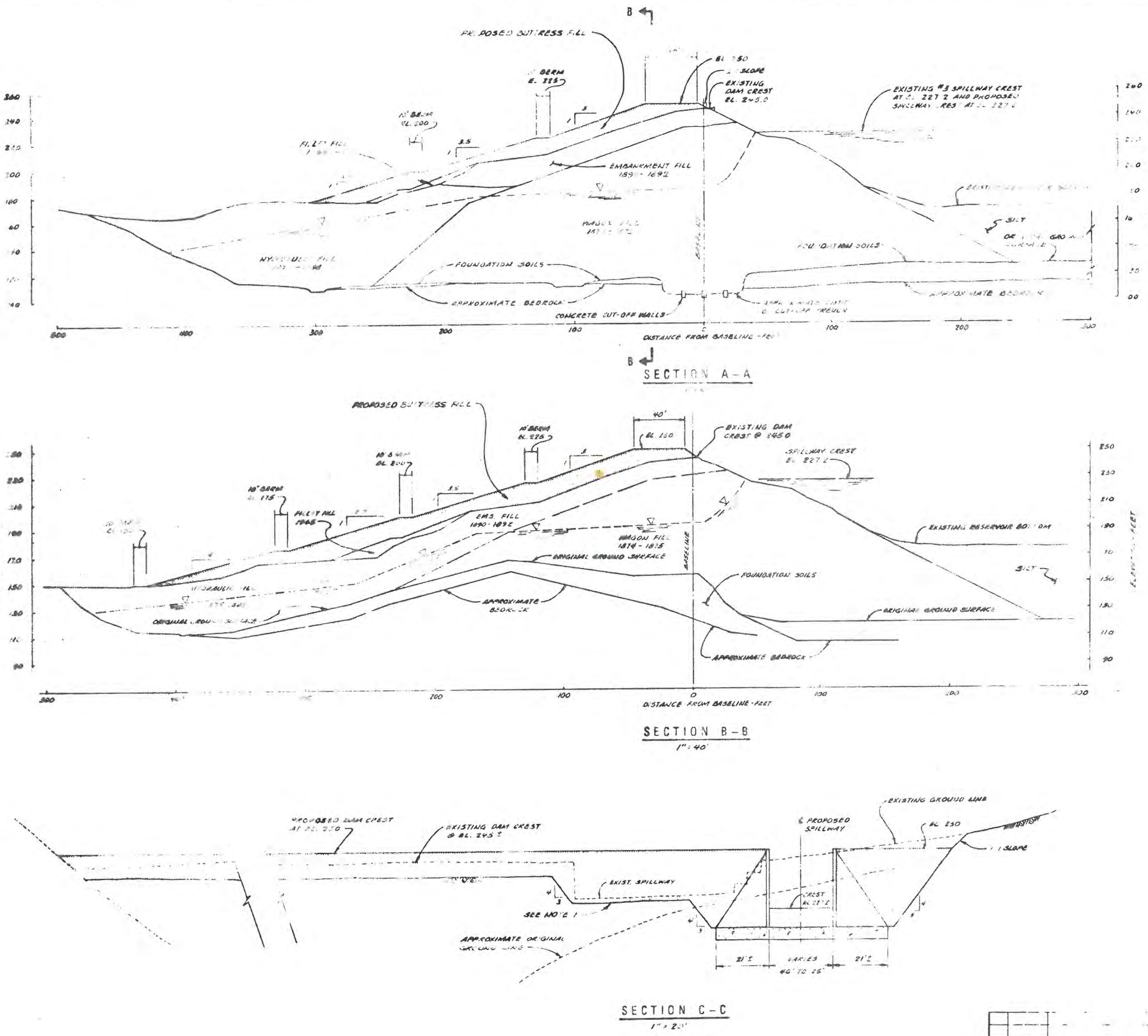
BY
APP
EAST BAY MUNICIPAL UTILITY DISTRICT
OAKLAND, CALIFORNIA
CHABOT DAM & SPILLWAY MODIFICATIONS
PRELIMINARY DESIGN
EXISTING TOPOGRAPHY
SCALE
DATE
FIGURE 1

EAST BAY MUNICIPAL UTILITY DISTRICT
OAKLAND CALIFORNIA

PROJECT LAYOUT

FIGURE 2



NOTES

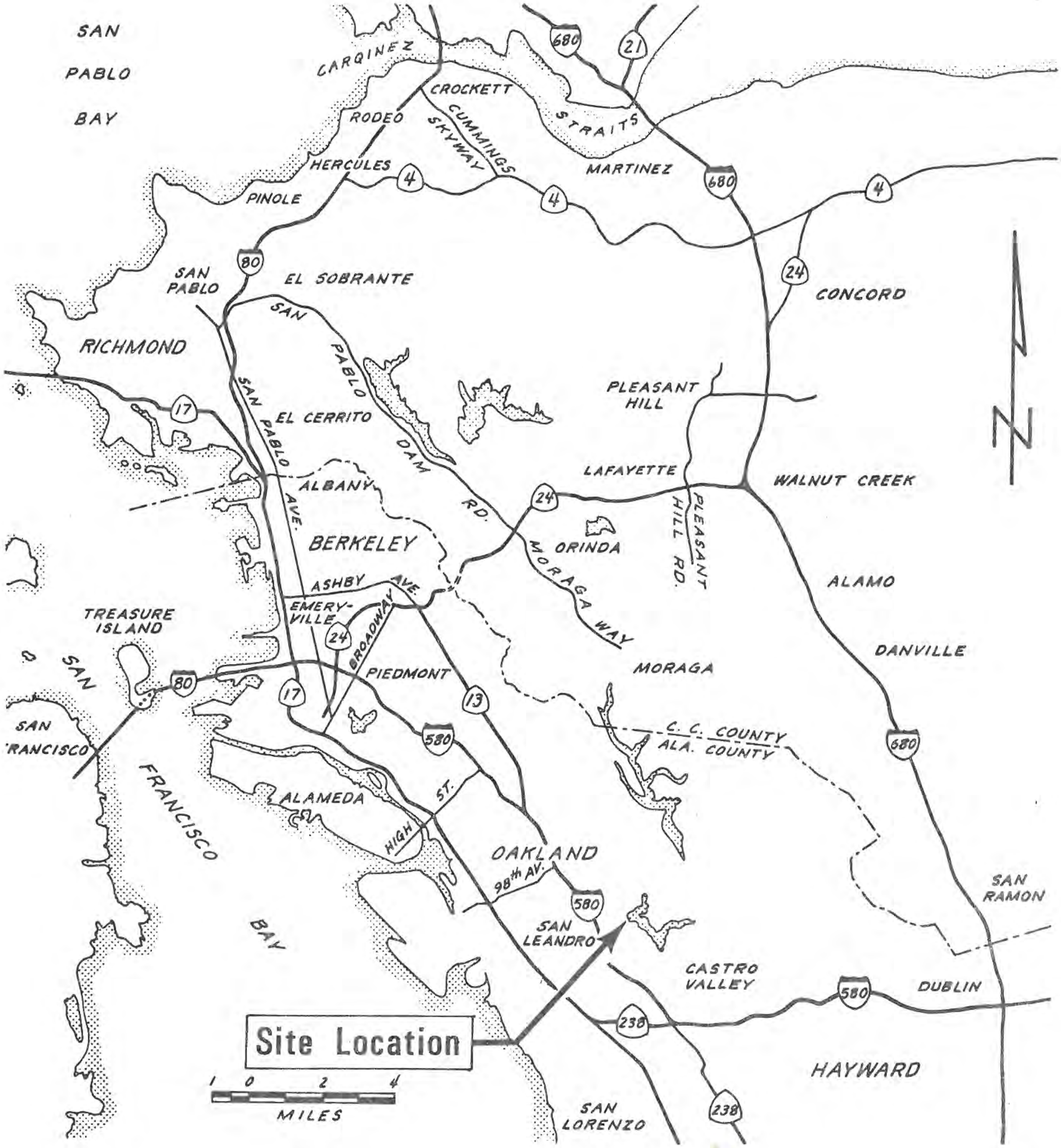
1. REMOVE EXISTING SPILLWAY STRUCTURE AND UNSUITABLE MATERIAL UNDER THE SPILLWAY CREST STRUCTURE. BACKFILL WITH BUTTRESS FILL MATERIAL.

NO.	DATE	REVISION	BY

EAST BAY MUNICIPAL UTILITY DISTRICT
OAKLAND, CALIFORNIA

DAM MODIFICATION SECTIONS

FIGURE 3



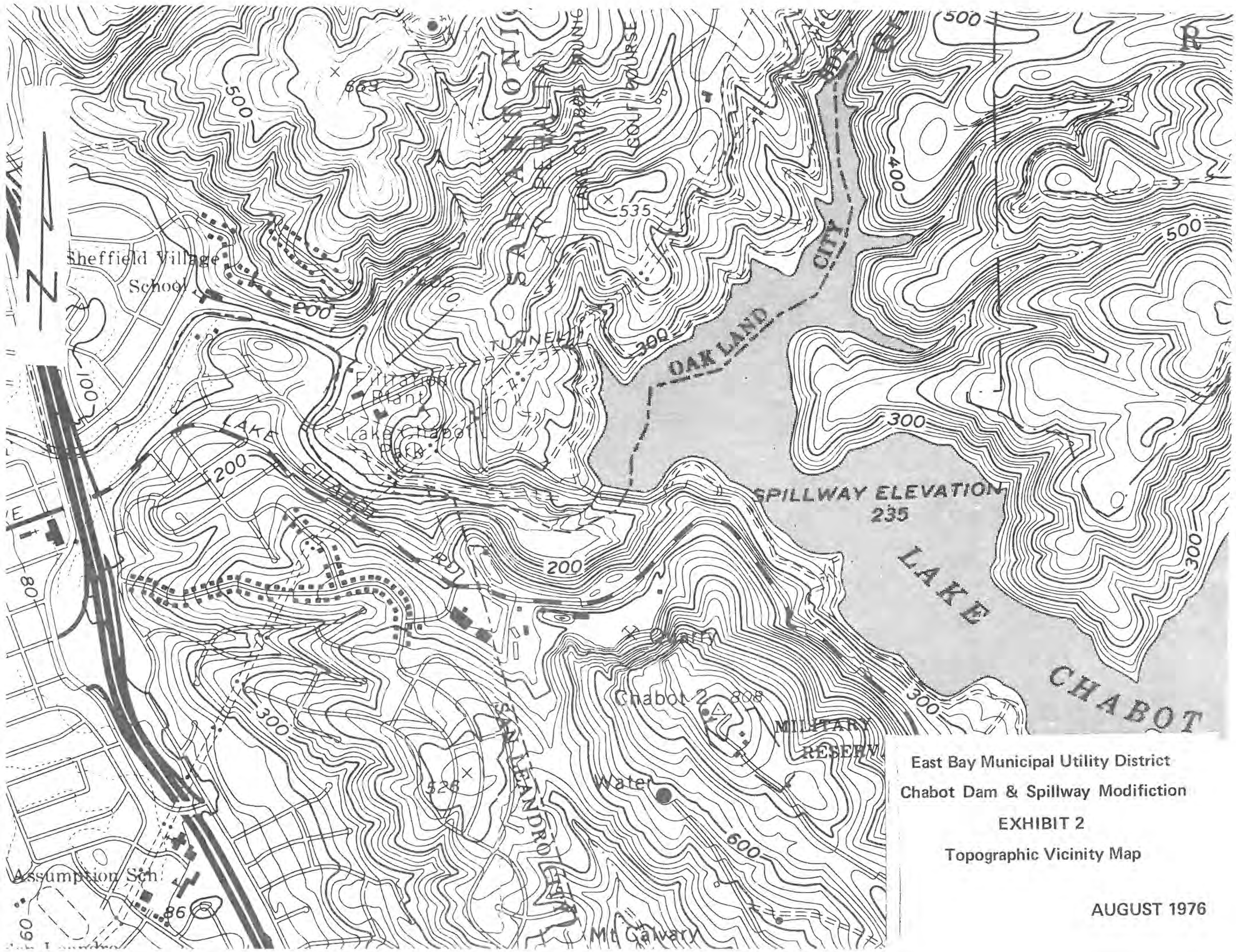
East Bay Municipal Utility District

Chabot Dam & Spillway Modifiction

EXHIBIT 1

Regional Location Map

AUGUST 1976



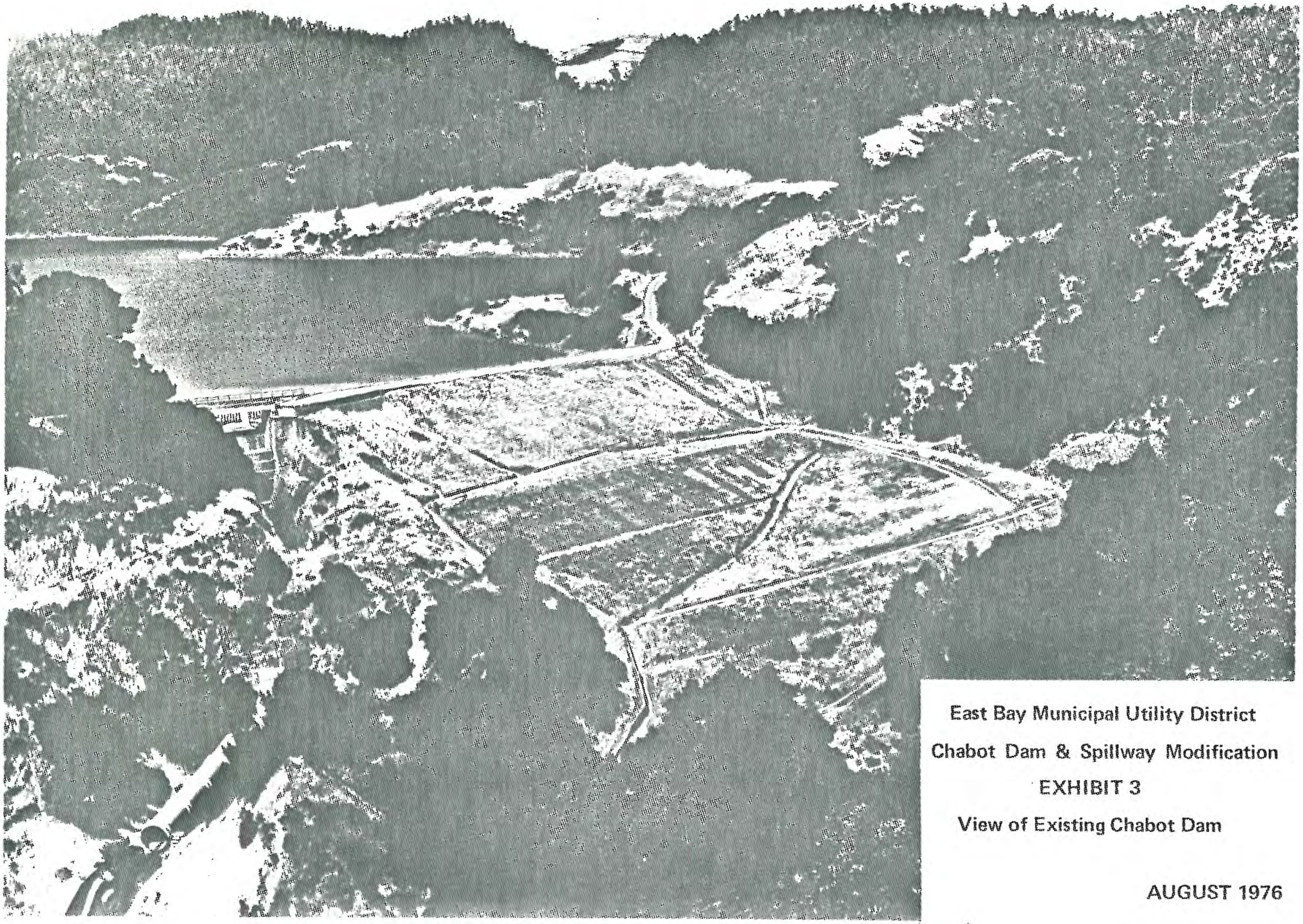
East Bay Municipal Utility District

Chabot Dam & Spillway Modifiction

EXHIBIT 2

Topographic Vicinity Map

AUGUST 1976



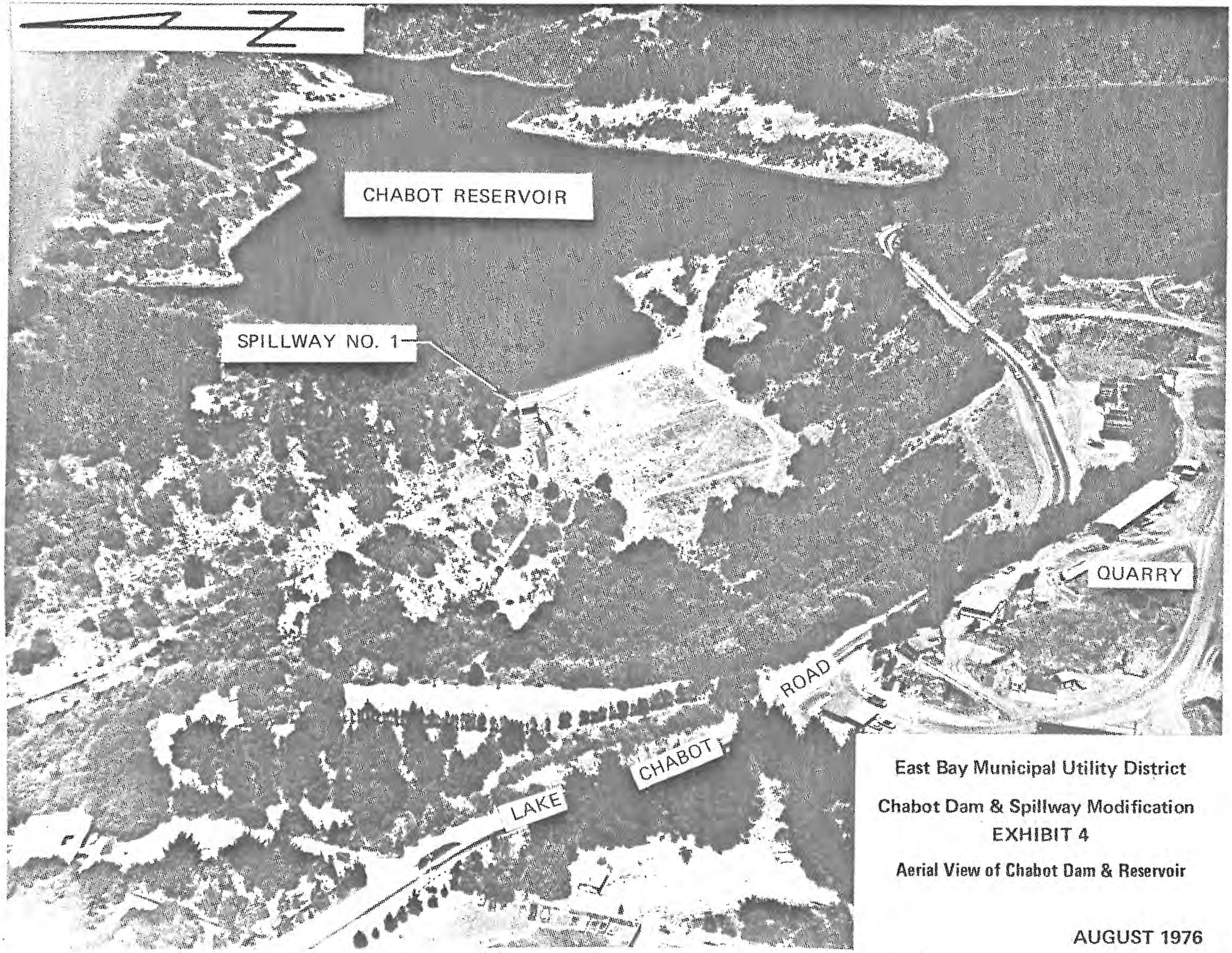
East Bay Municipal Utility District

Chabot Dam & Spillway Modification

EXHIBIT 3

View of Existing Chabot Dam

AUGUST 1976

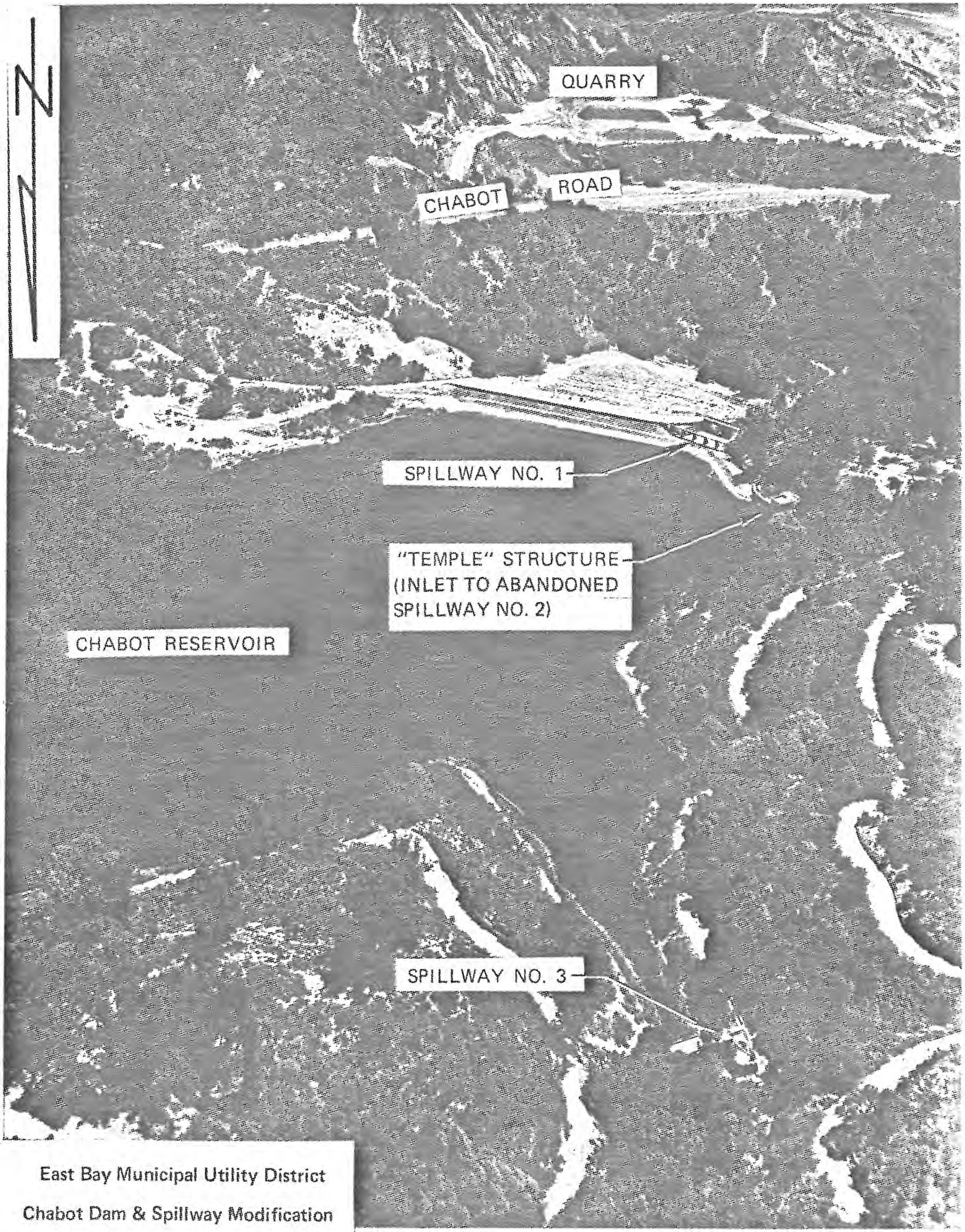


East Bay Municipal Utility District

Chabot Dam & Spillway Modification
EXHIBIT 4

Aerial View of Chabot Dam & Reservoir

AUGUST 1976



East Bay Municipal Utility District

Chabot Dam & Spillway Modification

EXHIBIT 5

Aerial View of Chabot Dam & Reservoir

AUGUST 1976

Fault lines traced from G. D. Robinson, 1956 report (except as noted)

SYMBOLS

Symbol	Meaning
solid line	Fault
dashed line	Fault, approximately located
dotted line	Concealed fault
line with arrows	Fault, showing relative movement
— ? — — ? —	Doubtful or probable fault
U / D	High angle fault (U, upthrown side; D, downthrown side)
M M M M	Per B. H. Marliave

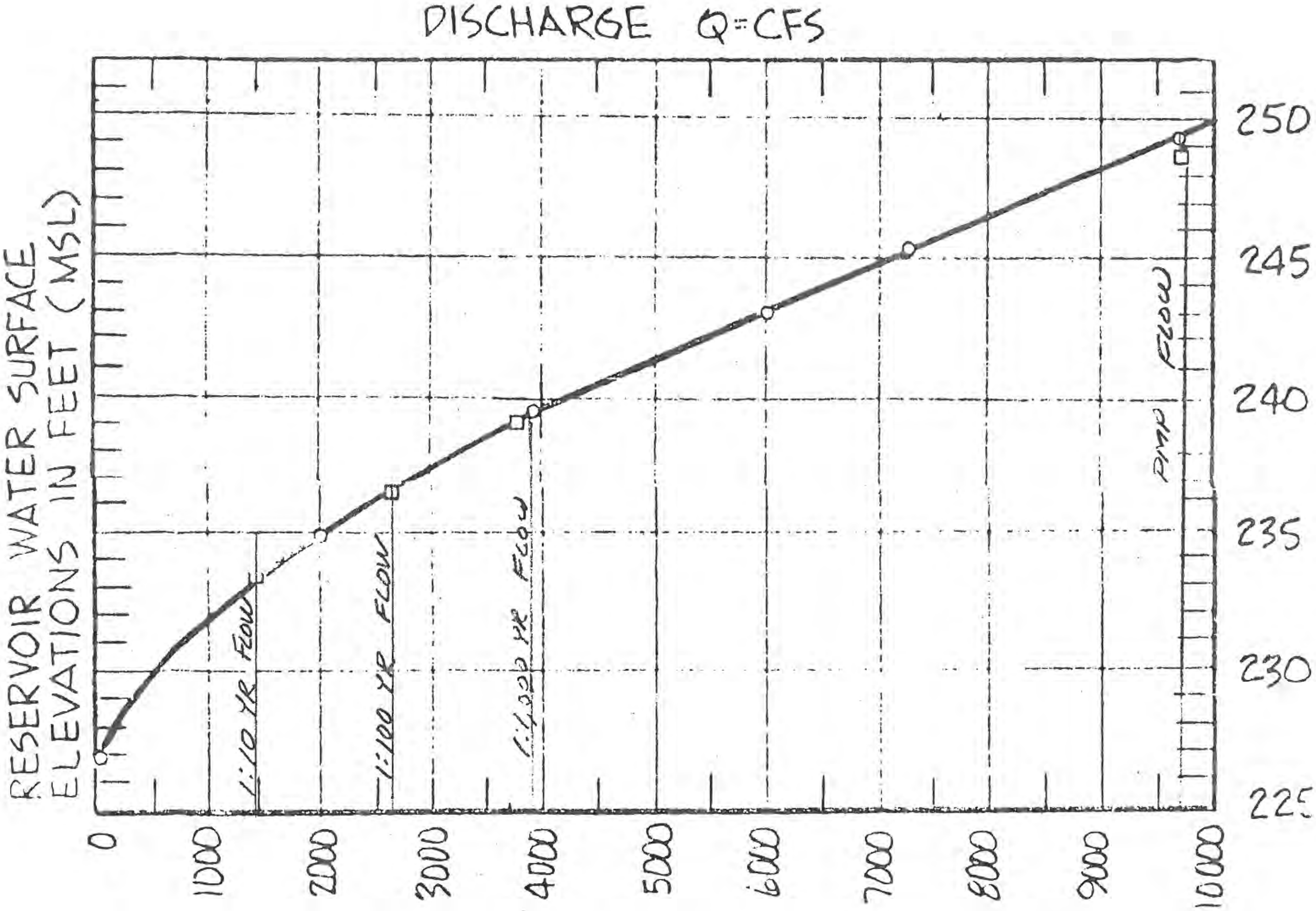
East Bay Municipal Utility District

Chabot Dam & Spillway Modification

EXHIBIT 6

Seismic Fault Map

AUGUST 1976



DISCHARGE RATING CURVE

SYMBOLS

○ RECOMENDED DESIGN

□ EXISTING CHABOT SPILLWAY (PROTOTYPE CHARACTERISTICS)

EXHIBIT 7

Chabot Spillway Discharge Rating Curve

RECIPIENTS OF DRAFT EIR

Alameda County Flood Control and
Water Conservation District
Attention Mr. Paul Lanferman, Director
Alameda County Public Works Building
399 Elmhurst Street
Hayward, CA 94544

Alameda County Parks Advisory Committee
399 Elmhurst Street
Hayward, CA 94544

Alameda County Planning Department
399 Elmhurst Street
Hayward, CA 94544

Alameda County
Public Works Department
399 Elmhurst Street
Hayward, CA 94544

Alameda County Taxpayers Association
1404 Franklin Street
Oakland, CA 94612

Alameda Historical Society
c/o Alameda Main Library
Santa Clara & Oak Streets
Alameda, CA 94501
Attn: Violet Soares, President

Alameda Victorian Preservation Society
P. O. Box 1677
Alameda, CA 94501
Attn: Mr. Nick Peroti, President

Association of Bay Area Governments
Hotel Claremont
Ashby and Domingo Avenues
Berkeley, CA 94705
Attn: Mr. Revan Tranter

Bay Area Air Pollution Control District
939 Ellis Street
San Francisco, CA 94109

State of California
Department of Fish and Game
Attention Eugene V. Toffoli, Regional Mgr.
Region 3
Yountville, CA 94599

California Native Plant Society
Suite D
2380 Ellsworth
Berkeley, CA 94704

State of California
Clearinghouse
1400 Tenth Street
Sacramento, CA 95814

Chief, Division of Safety of Dams
Department of Water Resources
P. O. Box 388
Sacramento, CA 95802

East Bay Regional Park District
11500 Skyline Boulevard
Oakland, CA 94618

Environmental Protection Agency
100 California
San Francisco, CA 94111

Mr. William H. Fraley, Director
Alameda County Planning Department
399 Elmhurst Street
Hayward, CA 94544

Thomas L. Jackson, Archaeologist
Treganza Anthropology Museum
San Francisco State University
1600 Holloway Avenue
San Francisco, CA 94132

Mr. D. Klevesahl
California Historical Society
2090 Jackson Street
San Francisco, CA 94109

Landmarks Preservation Advisory Board
City Hall
Oakland, CA 94612

League of Women Voters of California
126 Post Street
San Francisco, CA 94108

Mr. Norman J. Lind, Planning Director
City of Oakland
City Hall
Oakland, CA 94612

Mr. James E. McCarty
Director of Public Works
City of Oakland
City Hall
Oakland, CA 94612

Mosquito Abatement District
3024 East Seventh
Oakland, CA

Regional Water Quality Control Board
1111 Jackson Street, Room 306
Oakland, CA 94607
Attn: Executive Officer, Mr. Fred H. Dierker

City of San Leandro
Department of Public Works
San Leandro, CA 94577

Sierra Club
East Bay Chapter
5608 College Avenue
Oakland, CA 94618

U. S. Army Engineer District, San Francisco
Corps of Engineers
100 New Montgomery
San Francisco, CA

Castro Valley Chamber of Commerce
3601 Jamison Way
Castro Valley, CA 94546

Bay-O-Vista Homeowners Association
1680 Regent Street
San Leandro, CA 94577
Attn: Mr. William Corbett

* * * * *

COMMENTS RECEIVED ON THE DRAFT EIR

DURING THE REVIEW PERIOD OF

JANUARY 23, 1978 THROUGH MARCH 8, 1978

State of California
GOVERNOR'S OFFICE
OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET
SACRAMENTO 95814
(916) 445-0613

EDMUND G. BROWN JR.
GOVERNOR

March 14, 1978

D. K. McLoslkey
East Bay Municipal Utility Dist.
P. O. Box 24055
Oakland, CA 94623

SUBJECT: SCH# 78013090 - CHABOT DAM AND SPILLWAY MODIFICATION PROJECT

Dear Mr. McLoslkey:

This is to certify that State review of your environmental document is complete.

The results of the State review are attached. You should respond to the comments as required by the California Environmental Quality Act. You should address your responses to the commenting agency with a copy to the Clearinghouse.

Sincerely,

Deni Greene

Deni Greene
Director
State Clearinghouse

DG/ddt
Attachment
cc: Ken Fellows, DWR
Mary Schell, Library
E. C. Fullerton, Fish and Game
Charles C. Bishop, Conservation

State of California | The Resources Agency

Memorandum

To : Mr. Huey D. Johnson
Secretary for Resources
1416 Ninth Street
Sacramento, California 95814

Attn: L. Frank Goodson
Projects Coordinator

Date: February 21, 1978

From : **Department of Fish and Game**

Subject: SCH 78013090, Draft EIR, Chabot Dam and Spillway Modification Project, Alameda County

The Department of Fish and Game has reviewed the subject draft EIR and finds it deficient in its treatment of project impacts upon fish and wildlife resources and inadequate in its discussion of mitigation measures to offset detrimental impacts.

Proposed spillway construction requires an interim 15-foot reduction in reservoir water level. The draft EIR acknowledges the detrimental impact this drawdown could have on fishery resources, but does not adequately discuss mitigation measures. The timing of reservoir drawdown is of major importance. Proper drawdown scheduling could partially mitigate adverse impact on fishery resources. Drawdown during the spring would be most detrimental to the reservoir's warmwater gamefish populations. Such an event would severely diminish successful fish spawning. Therefore, we recommend EBMUD initiate and achieve the necessary drawdown during the winter season and subsequently maintain a stable, lowered reservoir level during the spring and summer construction period. Such a mitigative operational schedule should be detailed in the final EIR.

The interim water level drawdown will expose 97 acres of reservoir perimeter. In addition to the visual/aesthetic and biological impacts discussed in the report, drawdown will significantly interfere with angler use and fishing opportunity at this popular urban reservoir. Will the reservoir be open to angling use during the drawdown period? Will compensatory measures be taken to facilitate angler access and fishing opportunity at the lowered reservoir? Will the EBRPD catchable trout stocking program be continued during drawdown? These and related questions concerning angler access and use should be addressed in the final EIR.

San Leandro Creek downstream from Chabot Dam is a steelhead trout stream. The proposed project includes the alteration of at least 1,000 feet of stream channel below the dam. The report does not adequately describe the nature and magnitude of this alteration nor evaluate project impacts upon the fish and wildlife resources and habitats of this stream reach.

Channel modification is one of the most disastrous activities in terms of habitat degradation and loss. We believe it is incumbent upon the project sponsor to adequately define project impacts on fish and wildlife resources and formulate appropriate mitigation measures. If certain adverse impacts cannot be avoided, they should be specifically identified as immitigable. Preserving and, where possible, enhancing fish and wildlife habitats should be concomitant project objectives. Within extensively urbanized areas such as the project area, even marginal habitats acquire regionally significant fish and wildlife values. These values command special recognition and evaluation.

The loss of wetland habitat at the downstream toe of the dam without mitigation will result in a significant loss to wildlife. This wetland area provides valuable habitat for migrating and resident songbirds, raptors, herons and egrets and the mammal populations of the area. Mitigation measures should be proposed that would replace this loss. Creation of an equal acreage of wetland habitat would be necessary to fully mitigate this impact.

The draft EIR does not address the potential for project-generated soil erosion and concomitant siltation in downstream San Leandro Creek. We recommend the final EIR include an adequate erosion control program designed to prevent erosion and siltation during the winter following dam and spillway modifications. Measures must be formulated to protect San Leandro Creek from the adverse impacts of turbidity and siltation.

Department of Fish and Game personnel are available to discuss implementation of these recommendations. To arrange a meeting, please contact Mr. E. V. Toffoli, Regional Manager, Region 3, Department of Fish and Game, P. O. Box 47, Yountville, California 94599, telephone (707) 944-2443.

E C Fullerton
Director

State of California

The Resources Agency

Memorandum

To : Program Development Officer
Department of Conservation

Date : February 15, 1978

From : **Department of Conservation**
Division of Mines and Geology—San Francisco 94111

Subject: SCH# 78013090 Draft Environmental Impact Report, CHABOT DAM & SPILLWAY MODIFICATION

The geologic discussions in the subject E.I.R. is general in nature. There is need for a more detailed discussion of the nature of the rocks and terrain in the area above the right abutment, where the earth materials for the dam are to be obtained. Excavation there should be conducted so that the final slope angles and contours will prevent or minimize problems of landsliding and erosion.

These points should be discussed in the final E.I.R.

Charles C. Bishop
CHARLES C. BISHOP
RG 3156

CCB/df

cc: R.M. Stewart

APPROVED:

John T. Alfors RG774
Chief Deputy State Geologist
2-22-78

for Thomas E. Gay Jr.
RG 2634

EAST BAY REGIONAL PARK DISTRICT
11500 SKYLINE BOULEVARD/OAKLAND, CALIFORNIA 94619/TELEPHONE (415) 531-9300

March 3, 1978

Mr. W. F. Anton, Director of Engineering
East Bay Municipal Utility District
2130 Adeline Street
Oakland, CA 94623

Subject: Draft Environmental Impact Report for Chabot Dam and Spillway Modification Project

Dear Mr. Anton:

We appreciate the opportunity to review the above document and feel that the following concerns need further discussion:

1. Trail Closure:

   The construction area will require closure of the hiking/bicycling trail from San Leandro's Chabot Park to our marina area. During the summer this is an important access for young people and is much safer and more desirable than the alternate route of Lake Chabot Road. Provisions could be made to keep this trail open at least during the weekends.

2. Drawdown and Raising:

   The drawdown of the reservoir will have impacts on the fish breeding and recreational use. The EIR should discuss the timing of drawdown and raising of lake level and the manner of each in order to minimize the impacts of the changing lake level.

3. The Lake During Construction Period:

   The lake is proposed to be temporarily lowered 15 feet. At this lower level there will be problems of safe access for bank fishing, etc. The Chabot Marina will have to be closed or temporarily relocated, and whether the fishing docks would function or not is unclear. The handicapped dock would undoubtedly have to be closed. The length of time the lake would remain at this lower level is also unclear. The EIR should discuss measures to minimize these undesirable impacts.

4. Visual Impacts:

   The greatest concern is the long-range visual impacts of the project. We suggest that landscaping be done with vegetation similar to what now exists so that it will blend in with surrounding areas as soon as possible.

We also request that construction documents be forwarded to Mr. Don Harms, Assistant Chief of our Planning and Design Department when they are available.

We do look forward to working closely with you so that our operations and maintenance work can be coordinated with your proposed project.

Sincerely,

Peter Koos

Peter Koos
Principal Planner
Landscape Architect

PK:NH:lm

cc: Don Harms

ALAMEDA COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

399 ELMHURST STREET HAYWARD, CALIFORNIA 94544 881-6470 357-0844

PAUL E. LANFERMAN, ENGINEER-MANAGER

March 9, 1978

Zone No. 13
Line P

East Bay Municipal Utility District
2130 Adeline Street
Oakland, CA 94623

Attn: W. F. Anton

Gentlemen:

We have reviewed the draft Environmental Impact Report for the Chabot Dam and Spillway Modification Project. We regret the lateness of our response but hope that our comments will yet be of some value.

(1) Steep slopes and a large disturbed area give the project an extremely high potential for erosion and consequent sedimentation in San Leandro Creek, especially if the area will remain exposed through one or more rainy seasons. It was noted that large exposed areas would be reseeded but we would strongly recommend a much more intensive erosion and sediment control program which should include protective sediment basins which should be maintained until the entire construction site has stabilized.

(2) A small but viable steelhead trout run is known to exist in San Leandro Creek (the last such run in the East Bay). The area from the dam down to about I-580 apparently serves as a spawning ground and nursery area. Construction activities and resultant stream sedimentation could have a substantive adverse effect on this fishery. We recommend that you contact the California Department of Fish and Game for further information.

(3) We have a stream modification project pending on San Leandro Creek between the Nimitz Freeway and Preda Street. We would very much appreciate advance notice of any releases from Lake Chabot so that they do not jeopardize the construction project or workmen. Please contact our field office at 881-6294.

We appreciate the opportunity to review and comment on this report.

Very truly yours,

Paul E. Lanferman

PAUL E. LANFERMAN
ENGINEER-MANAGER

PEL:PEB:dmg

STATE OF CALIFORNIA—RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

DEPARTMENT OF WATER RESOURCES

P. O. BOX 388
SACRAMENTO
95802

(916) 445-1816

FEB 1 ? 1979

Mr. W. F. Anton
Director of Engineering
2130 Adeline Street
Oakland, CA 94623

Dear Mr. Anton:

Chabot Dam and Reservoir, No. 31-5

We have reviewed the draft Environmental Impact Report (EIR) for Chabot Dam and Spillway Modification Project and we have no comments.

Other units of the Department of Water Resources may have comments which would be sent to you through the State Clearinghouse.

Sincerely,

E. W. Stroppini, Acting Chief
Division of Safety of Dams

save water DWR

CALIFORNIA NATIVE PLANT SOCIETY
san francisco bay area chapter

2860 Delaware St.
Oakland, Cal. 94602

Feb. 24, 1978

Mr W. F. Anton
Engineering Div.
E.B. Municipal Utility Dist.
2130 Adeline St.
Oakland Calif. 94623

Re Chabot Dam-Spillway EIR - For the Record

Dear Mr. Anton:

I have just studied your EIR and made an on-site inspection of the proposed Chabot Dam and Spillway Modification Project, in company with Mr David Axelrod of our chapter. Mr Les Simmons took considerable time on the telephone afterward to answer our questions and explain some of the major features of the project.

The necessity of this project is pretty apparent, I believe, to most of us living in the East Bay who have observed the effects of floods -and nearby earthquakes-on hill structures. While I find the proposed huge-scale bank removal on the north side of the dam, and the resulting scar, rather horrendous, this requirement to make room for the new spillway was explained by Mr Simmons.

The beautiful stand of alders, willows and other trees along the creek below the present spillway and stilling basin should be protected as much as possible from a runoff of cement wastes or other debris during construction.

The passage of heavy trucks along the lakeshore drive from the marina presents a grave impact on park users, vegetation and wild life. Extreme care must be used in widening the existing road, as the abundant growth of trees and shrubs retains a very steep bank.

The Bay Chapter of CNPS would like to assist you in guidance, and perhaps in finding sources of native plants, when you reach the mitigating, replanting stage following construction, though I am aware that you do employ competent resource management specialists and consultants. Thank you for sending the EIR and your courtesy in consulting with us.

Sincerely yours,

Paul F. Covel, Conservation Chairman.

Copy to Mr James Roof, Pres., Bay Chapter.

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS
211 MAIN STREET
SAN FRANCISCO, CALIFORNIA 94105

SPNED-E

21 February 1978

Mr. K. D. McCloskey
Chairman Environmental Committee
East Bay Municipal Utility District
2130 Adeline Street
Oakland, California 94623

Dear Mr. McCloskey:

Reference is made to your notice of 19 January 1978, requesting review of the Draft Environmental Impact Report for the Chabot Dam and Spillway Modification Project.

Chabot Dam is upstream of the existing Corps project on San Leandro Creek. The Corps project, which is located between San Leandro Bay and the Southern Pacific Transportation Company railroad tracks downstream from State Highway 17, was designed and constructed to carry the 100-year flood. Based on your report, it appears that the 100-year flood peak discharge would be similar in the project reach with or without the spillway modification, and, therefore, indications are that the proposed project would have little impact on the existing Corps project.

Your report indicates that the crest of the dam would be raised to elevation 250 (feet above mean sea level datum). Exhibit 7 of your report indicates that the water surface would reach an elevation of about 249 during the spillway design flood (SDF). The approximate one foot of freeboard which is indicated is not considered adequate, particularly for a dam upstream of an urban area. Corps of Engineers policies normally allow for about five feet of freeboard. It is realized, however, that Spillway No. 3 is intended for use during an emergency situation, and that its use would increase the freeboard to close to five feet. If it is determined that Spillway No. 3 cannot be used, it is suggested that the crest of the dam be raised.

Thank you for the opportunity to review your report.

Sincerely yours,

H. E. PAPE, JR.
Chief, Engineering Division

PUBLIC WORKS AGENCY COUNTY OF ALAMEDA
399 Elmhurst Street • Hayward, CA 94544 • (415) 881-6470

February 2, 1978

East Bay Municipal Utility District
2130 Adeline Street
Oakland, CA 94623

Attention: W. F. Anton, Director of Engineering

Gentlemen:

The Alameda County Road Department has no comment to make on the Draft Environmental Impact Report for the Chabot Dam and Spillway Modification Project so long as the mitigation measures included within the report are implemented as a part of the project, particularly measure Nos. 7, 8 and 9.

Additionally, measure No. 10 should be expanded to include the installation of signs on Lake Chabot Road advising motorists of construction or haul vehicle activity at the location of the access road.

Very truly yours,

H. A. FLERTZHEIM, JR
DIRECTOR OF PUBLIC WORKS

By Jessie G. Cambra
JESSIE G. CAMBRA
CHIEF - ROAD DEPARTMENT

JGC:RS:jp

RESPONSES TO COMMENTS RECEIVED DURING THE REVIEW PERIOD

RESPONSE TO COMMENTS RECEIVED ON THE DRAFT EIR DURING THE REVIEW PERIOD

STATE OF CALIFORNIA, DEPARTMENT OF FISH AND GAME

In response to letter dated February 21, 1978, District staff met with Fish and Game management specialists Keith Anderson and Jack Booth at the work site on March 17, 1978. The following responses were discussed with them at that time:

1. The reservoir level would not be lowered in 1979 during construction of the lower portions of the spillway and parts of the buttress fill. Drawdown of reservoir level would begin about March 1, 1980 and would be at the rate of one foot per day. The 15 foot lowering would be achieved about March 15, 1980. The timing is, to some extent, dependent upon the weather. If the winter season is unusually wet and heavy rains continue beyond March 1, 1980, the timing of the drawdown may be delayed. Department of Fish and Game and EBRPD representatives have agreed that completion of drawdown prior to April 1 will minimize the adverse impact on the fishery resources. The drawn-down level would then be maintained through the spring and summer periods, with refilling by subsequent rains and releases from USL Reservoir as water is available.

2. The District permits the East Bay Regional Park District to utilize the Chabot Reservoir area for recreational purposes through a lease arrangement to the Park District. Chabot Reservoir water surface fluctuations are recognized in the lease agreement which specifically states that Chabot Reservoir may vary between elevation 229 and 211. The construction drawdown elevation is 212, within the allowable fluctuation range recognized in the agreement. However, as stated above, the District is scheduling the required drawdown period in early March of 1980, to minimize the impact on the recreational usage and the fishery resources. Experience with lowered operating levels in San Pablo Reservoir, Lafayette Reservoir, Contra Loma Reservoir and Del Valle Reservoir, to name a few in this area, has shown no adverse effects from these lowered levels on angler usage or fishing opportunity. The District understands that the Park District intends to continue its trout stocking program and its angler and other recreational programs during the entire construction period. Modifications to their existing facilities will be made by EBRPD to provide the necessary boating and angler access.

3. The length of the stream channel to be altered is approximately 350 feet (not 1000 feet), measured downstream from the end of the concrete apron of existing Spillway Number 1. This length of existing stream channel would be replaced by a 380-foot length of widened channel on a new alignment. The bottom width of this realigned channel would vary from 72 feet at the spillway basin to 50 feet at the point where it joins the original channel. The grade of this new channel would be sloped to drain from the new stilling basin to the original creek channel, and its bottom and sides would be riprapped with large rock for a distance of 100 feet downstream of the new stilling basin.

   Alder, sycamore, and willow slips would be planted along the remaining 280 feet of excavated channel bank as partial mitigation for the tree removal within the channelized areas. Oak trees will be planted along the creek banks in disturbed area. It is expected that some seepage from the dam, its abutments, and some local groundwater will continue to flow into the area downstream of the proposed new stilling basin. This will tend to reestablish the marshy vegetation in the area in a short period of time.

4. Contractor grading operations will be closely controlled. However, as the Department of Fish and Game points out, the exposed cuts and fresh excavation could cause some siltation downstream of the spillway area. The proposed siltation and erosion control measures would be as follows:

   (a) Downstream of the proposed construction site, there now exists an earth dike, with a 30-inch culvert through it, in the creek channel. A vertical riser will be added to the entry of this culvert to create a settling basin for any silt laden water flowing downstream from the construction site. A small portion of the settling basin adjacent to the earth dike will be cleared. It is believed that this measure would provide adequate control in the event such silt laden runoff actually occurs. The earth dike and collected silt will be removed during the summer following completion of construction. The banks of the creek in the area of the removed dike will be planted with native vegetation.

   (b) The cut slopes and surface of the fill placed against the downstream face of the dam will be hydromulched with mixed seed, and irrigated as necessary to provide grass slope protection in advance of heavy rains.

EAST BAY REGIONAL PARK DISTRICT

The following responses to the East Bay Regional Park District letter of March 3, 1978 were discussed at the work site with EBRPD representatives Ken Roby and Neil Havlik on March 17, 1978:

1. Trail Closure

   All possible means of keeping the section of trail across the dam open have been considered. During the construction period this is just not deemed safe. This relatively short section of trail must be closed during the construction, including weekends, to prevent potential accidents to onlookers due to the heavy construction activity and accessible formwork scaffolding, or possible vandalism to the contractor's equipment. During spring 1980, the District will review the possibility of opening a trail along the left abutment, subject to the status of work and the 1980 construction program.

2. Drawdown and Raising

   The fish spawning season is April to August. To avoid impact on fish breeding and to minimize impact on recreational use, the reservoir level will not be lowered in 1979 during construction of the lower portions of the spillway and parts of the buttress fill. Drawdown of reservoir level will begin about March 1, 1980 and will be at the rate of one foot per day. The 15 foot lowering would be achieved about March 15, 1980. The timing is, to some extent, dependent upon the weather. If the winter season is unseasonally wet and heavy rains continue beyond March 1, 1980, the timing of the drawdown may be affected. The drawn-down level would then be maintained through the spring and summer periods with refilling by subsequent rains and releases from USL Reservoir as water is available.

3. The Lake During Construction Period

   At the lower lake level, the shoreline will recede substantially. The amount depends upon the steepness of the bank. The dock facilities are not expected to be usable at the present locations during spring, summer, and fall of 1980 after the reservoir is drawn down. Since this reduced temporary water level is within the contractual limits in the lease with EBRPD, no specific measures by the District are included to move docks, relocate facilities, etc. Refilling of the reservoir will be from subsequent rainfall runoff and from releases from USL Reservoir as water is available. Under normal rainfall conditions, refilling could occur before May 1981 without making releases from USL Reservoir. By drawing down Chabot Reservoir during a specific relatively short period in late winter, dock relocation problems will be minimized. The District understands that EBRPD has developed a dock relocation plan to cope with the reservoir lowering.

4. Visual Impacts

The long range visual impact of the proposed project is treated on page 21 of the EIR. Mitigation Measure No. 6 on page 23 of the EIR speaks to revegetation. The following is an expanded description of the restoration efforts:

> The surface of the fill placed on the downstream face of the existing dam and all other cut and fill surfaces, will be hydromulched with a mixed grass seed (with a high proportion of poppy seed as recommended by the EBRPD representatives) and irrigated to promote the growth of a grass cover prior to the heavy winter rains. Planting holes will be excavated in the cut slope north of the new spillway. When the construction is completed, these will then be planted with five gallon can sized trees of the variety existing in the area. A drip irrigation system will be operated until rains ensure growth of these trees. In time, the visual impact caused by the proposed construction will be softened and eventually erased.

DEPARTMENT OF CONSERVATION, DIVISION OF MINES AND GEOLOGY

1. The Soils and Geology comments contained under the environmental setting section of the Draft EIR are excerpts from more complete reports compiled by the District's Consulting Geologist. In conformance with the doctrine of full disclosure of CEQA, it was felt that the paraphrasing of the more complete reports was in the best interest of the reviewing public. The intent was to disclose the fact that professional geological consultation had, indeed, been secured, and that engineering design of the structures involved would proceed on the basis of the consultant's opinions and recommendation. A list of these reports is shown at the end of this response. These reports are not attached, but are available for review at the District's office. The District has again met with the consultant and asked that he prepare a letter to the District in response to the Division of Mines comments. The consultant's letter report is contained herein and made a part of the Final EIR by incorporation in this response.

ALAMEDA COUNTY FLOOD CONTROL

1. In addition to reseeding, adequate drainage control measures, including lined ditches, drop inlets, culverts, and check dams if needed, will be included in the final design. The contractor will also be required to practice good erosion control during the construction period and make corrective measures as needed.

As mentioned in the Fish and Game response, a sediment basin will be created by modifications to an existing culverted road fill in the creek downstream from the construction site, and will be maintained through the first rainy season following completion of the project construction. With the erosion protection measures mentioned above, adequate site stabilization is expected to be obtained prior to the next rainy season.

2. The California Department of Fish and Game has been contacted during the review process of the Draft EIR, and contact will be continued during the final design period. The Department of Fish and Game has expressed satisfaction with our response to their comments on mitigation of adverse impacts on the existing fishery resource.

3. Such notification will be provided by the District.

DEPARTMENT OF WATER RESOURCES

Comments do not require a response.

CALIFORNIA NATIVE PLANT SOCIETY

Care will be exercised during construction to prevent excess runoff of wastes downstream of the spillway construction. As indicated in the response to the State Department of Fish and Game, an existing dike downstream of the construction would be used as a desilting basin.

Care will be exercised in using the existing access road from Lake Chabot Road to the construction site. To the extent possible, the abundant growth of trees and shrubs along the road would be retained.

The District appreciates the Society's offer to assist in replanting efforts upon completion of the project.

COUNTY OF ALAMEDA PUBLIC WORKS AGENCY

Mitigation Measures 7, 8, and 9 would be adhered to during construction of the proposed project.

In cooperation with the Public Works Agency, construction activity signs would be installed as appropriate, advising motorists on Lake Chabot Road to exercise caution.

DEPARTMENT OF THE ARMY CORPS OF ENGINEERS

The design of the dam and spillway modifications are in conformance with the criteria of State Division of Safety of Dams regarding spillway design flow and required freeboard, as stated in their July 18, 1975 letter to the District. In this letter, the Division stated that their present practice requires that the spillway for a new dam and reservoir with the physical size and downstream population and property, as at Chabot Dam, be designed to safely pass a probable maximum flood (PMF), and that they "require a minimum of 1.5 feet of residual freeboard from maximum reservoir flood stage to the dam crest for new dams. However, in evaluating spillways at existing dams or upgrading such spillways, passing the flood with zero freeboard is acceptable."

The District intends to maintain Spillway No. 3 as an emergency spillway. Although this spillway will be closed off with stoplogs under normal service conditions, they can be removed to increase the available freeboard when high flood discharges are required.

BURTON H. MARLIAVE
CONSULTING GEOLOGIST
67 Grandview Place
Walnut Creek, California 94595
Telephone 938-7258

March 22, 1978

Mr. D. G. Larkin, Chief Engineer
East Bay Municipal Utility District
2130 Adeline Street
Oakland, California 94623

Subject: Enlargement of Geologic Section of Chabot E.I.R.

Dear Sir:

The draft E.I.R. for the Chabot Dam and Spillway modification contains a general description of the regional and local geology in the vicinity of the Chabot Dam. It was suggested by the State Division of Mines and Geology that more detailed information on the bedrock to be encountered in the spillway cut on the right abutment as well as the stability of cut slopes should be included so the following addition is suggested.

The Leona Rhyolite which forms most of the right abutment and underlies the central portion of the main dam is the bedrock formation into which the spillway will be cut over most of its length. This will also be the source for the fill that will blanket the downstream slope and raise the crest of the dam 5 feet. The nature and extent of the rhyolite was determined in part by drilling and in part by geological field studies of the surface exposures. Twenty drill holes were sampled in the 1965 study of the stability of the dam by Shannon and Wilson and fifteen additional holes were drilled in 1974 during the dynamic stability analysis by Woodward Lundgren. In 1974 six holes were drilled in the area of the proposed spillway realignment and in 1977 two more were drilled at the crest of the existing spillway. In all cases these holes went through the dam fill and through the overburden into the bedrock so that a fairly accurate areal picture of the bedrock was determined.

The rhyolite is blue grey where fresh but when weathered near the surface it is usually a light cream color with many brown to orange and yellow oxidized seams. The rock forms bold hard outcrops on the surface and is massive to blocky with many tight fractures. Since this is a dike of rhyolite which has extruded to form a capping on the hills it may be narrower at depth than the exposure found on the surface. Near the lower end of the proposed spillway some cherty hard meta volcanic rock was encountered in drill holes 43 and 44. In the bucket area of the spillway a softer serpentinized rock is exposed.

Existing cut slopes at the dam up to 50 feet in height at 1:1 occur adjacent to the existing spillway and 1½:1 slopes above the old access road that crosses the proposed spillway alignment were found. These cuts have stood for over 50 years with only minor ravelling.

The proposed 1:1 cut slopes for the new spillway alignment would be primarily in the same stable rhyolite. While some flattening of the top 10 to 15 feet of the cut slope where it is weathered may be necessary this can best be determined during construction to minimize the removal of trees and native brush. A 15' wide berm has been provided adjacent to the spillway to collect minor sloughing and to permit access for maintenance. Should some of the dark meta volcanic rock found in drill holes near the toe of the spillway be encountered a cut slope of 1¼:1 might be necessary. In the softer serpentinized rock near the end of the bucket of the spillway 2:1 rip rapped slopes only 15 feet high have been adopted.

While surface flow of natural runoff is generally parallel to the proposed spillway alignment, where swales lead toward the cut slope, drainage gutters should be provided above the cut slope to divert runoff and reduce erosion.

Sincerely,

Burton H. Marliave
Registered Geologist No. 33
Certified Engineering Geologist No. 21
State of California

GEOLOGICAL CONSULTANT REPORTS PERTAINING TO CHABOT DAM AND SPILLWAY MODIFICATION PROJECT

<u>REVIEW OF STABILITY OF CHABOT DAM</u>

Shannon & Wilson, Inc.
Sept. 1965

<u>GEOLOGIC STUDY OF CHABOT DAM</u>

Burton H. Marliave, Consulting Geologist
April 10, 1965

<u>LANDSLIDE AND WAVE DAMAGE POTENTIAL IN CHABOT RESERVOIR</u>

Burton H. Marliave, Consulting Geologist
October 10, 1973

<u>EVALUATION OF THE SEISMIC STABILITY OF CHABOT DAM</u>

Woodward-Lundgren & Associates
May 13, 1974