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SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT FACILITIES IMPROVEMENTS PROJECT AND GEYSERS EFFLUENT PIPELINE PROJECT
Final EIR/EIS

SCH EIR/EIS No. 86-021101

August 25, 1994

Prepared for:
Lake County Sanitation District and
U.S. Bureau of Land Management

ESA

August 17, 1994

Dear Reviewer:

The attached document, combined with the Draft EIR/EIS, constitutes the Final EIR/EIS to the Southeast Regional Wastewater Treatment Plant Facilities Improvements Project and Geysers Effluent Pipeline Project. This report includes responses to written comments received on the Draft EIR/EIS and oral comments presented at the public hearings held on June 30 and July 14, 1994.

The public hearing for this Final EIR/EIS will be held in the Board of Supervisors Chambers in the County Courthouse, 255 N. Forbes Street in Lakeport at 2:00 p.m. on August 25, 1994.

Environmental Science Associates, Inc.
301 Brannan Street
Suite 200
San Francisco, California
94107-1811
(415) 896-5900
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Los Angeles
Sacramento

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Clear Lake Resource Area
2550 North State Street
Ukiah, California 95482-3023

(2800)
CA-33688
CA-050

Director
Office of Federal Activities (A-104)
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

AUG 17 1994

Dear Director:

In compliance with Section 102(2)(C) of the National Environmental Policy Act of 1969 and in accordance with 40 CFR 1506.9, we are enclosing five (5) copies of a final Environmental Impact Statement (EIS) for the "Southeast Regional Wastewater Treatment Plant Facilities Improvements Project And Geysers Effluent Pipeline Project". This is a joint EIS/EIR with the Lake County (California) Sanitation District. This Statement was prepared for the Bureau of Land Management.

Notice of this statement should be published in the August 25, 1994, issue of the Federal Register, and will be open for comment through September 26, 1994. Enclosed is a brief project description that may be used for the Federal Register notice.

If you have any questions, please contact Richard Estabrook at (707) 468-4052.

Sincerely,

Renee Snyder

Renee Snyder
Clear Lake Resource Area Manager

enclosures:
draft EIS/EIR (5 copies)
project summary

cc: Sean Hagerty, Bureau of Land Management (CA-922)
Jack Mills, Bureau of Land Management (CA-930)
Mark Dellinger, Lake County Special Districts

The project proposes to improve wastewater treatment and disposal capacity at the Southeast Regional Wastewater Treatment Plant servicing the areas around the city of Clearlake and Lower Lake and transport secondarily treated wastewater with Clear Lake makeup water in a 24-inch diameter, 26-mile long pipeline to The Geysers geothermal field in Lake and Sonoma Counties. From the treatment plant, the pipeline goes south through Lower Lake, over Childers Peak paralleling Big Canyon Creek Road, then past the Middletown Treatment Plant (and connected to it), and up Bear Canyon Road into The Geysers steamfield. Water would be distributed to Calpine's unit 13 and 16 steamfields in Lake County, Northern California Power Agency's steamfield in Lake and Sonoma County, and Unocal's unit 18 and 20 steamfields in Sonoma County.

The EIR/EIS is available for public review at the following locations:

Bureau of Land Management - 2550 N. State St., Ukiah
Lake County Sanitation District - 230A Main St., Lakeport
Lake County Planning Department - 255 N. Forbes St., Lakeport
Lakeport Public Library - 1425 N. High St., Lakeport
Redbud Public Library - 4700 Golf Ave., Lakeport
City of Clearlake Offices - 14360 Lakeshore Dr., Clearlake
Lower Lake Water District - 16175 Main St., Lower Lake
South Lake Water District - 21095 State Hwy. 175, Middletown
Sonoma County Public Library - 3rd & E Streets, Santa Rosa
Sonoma County Planning Dept. - 575 Administration Dr., Santa Rosa
Sonoma County Board of Supervisors Office - 575 Administration Dr., Santa Rosa
Yolo County Flood Control and Water Conservation District - 34274 State Hwy. 16, Woodland

Written comments on the EIS/EIR may be submitted to:

Bureau of Land Management
2550 N. State St.
Ukiah, CA 95482

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT FACILITIES IMPROVEMENTS PROJECT AND GEYSERS EFFLUENT PIPELINE PROJECT
Final EIR/EIS

SCH EIR/EIS No. 86-021101

August 25, 1994

Prepared for:
Lake County Sanitation District and
U.S. Bureau of Land Management

Environmental Science Associates, Inc.

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ESA

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT FACILITIES IMPROVEMENTS PROJECT AND GEYSERS EFFLUENT PIPELINE PROJECT FINAL EIR/EIS

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SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT FACILITIES IMPROVEMENTS PROJECT AND GEYSERS EFFLUENT PIPELINE PROJECT FINAL EIR/EIS

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INTRODUCTION

On May 26, 1994, the Lake County Sanitation District and the U.S. Bureau of Land Management released for public review a Draft Environmental Impact Report / Environmental Impact Statement (EIR/EIS) on the proposed Southeast Regional Wastewater Treatment Plant Facilities Improvements Project and Geysers Effluent Pipeline Project. A minimum 45-day review and comment period began on that date and notices were published in the Federal Register. The public review and comment period closed on July 26, 1994. Public hearings on the Draft EIR/EIS were held in Lakeport, CA, on June 30 and July 14, 1994.

The first part of this document contains copies of the written comments submitted on the Draft EIR/EIS. It also contains summary paraphrased comments of the public hearings. The second part of this document contains responses to the comments.

Each comment is numbered in the right margin (large numbers). Comment numbering may not coincide with the numbering in the original comment letters. Each response is identified by the associated comment number.

The text of the Draft EIR/EIS has not been reprinted. Therefore, changes to the text of the Draft EIR/EIS are identified in the reponse to comments. New or edited text is presented in italics.

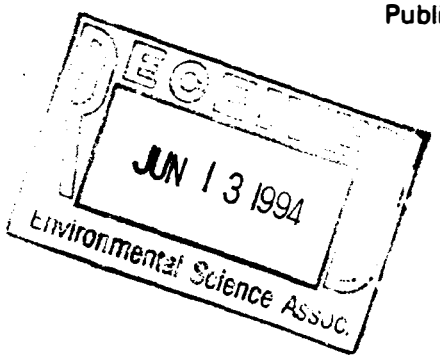
Pursuant to guidelines of the California Environmental Quality Act and the National Environmental Policy Act, this document combined with the Draft EIR/EIS will serve as the Final EIR/EIS. A separate Mitigation and Monitoring Plan is under preparation.

A period for public comment on the Final EIR/EIS will be held in the Board of Supervisors Chambers in the County Courthouse, 255 N. Forbes Street in Lakeport at 2:00 p.m. on August 25, 1994.

WRITTEN COMMENTS ON THE DRAFT EIR/EIS

COUNTY OF LAKE
PUBLIC WORKS DEPARTMENT
Courthouse - 255 N. Forbes Street
Lakeport, California 95453
Telephone (707) 263-2341
FAX (707) 263-7748

G. R. SHAUL
Public Works Director



June 9, 1994

Environmental Science Associates, Inc.
301 Brannan Street, Suite 200
San Francisco, CA 94107-1811

Subject: Geysers Effluent Pipeline Project

Gentlemen:

Staff has reviewed the draft EIR/EIS prepared for the subject project and offers the following comments:

1. The County-maintained roadways proposed for the alignment of the effluent pipeline will not support the type of construction loading anticipated. We are aware that the majority of these roads are suffering distress presently, however, with the anticipated normal traffic loading on these roads, they will likely function satisfactorily for many years with minimal maintenance. The proposed pipeline construction activities will definitely accelerate their failure. It has been our experience that, following construction, the argument with the contractor becomes the question of repairing a road that was already distressed prior to construction. From past experience, the County Road System is left in an accelerated maintenance intensive condition.

   It is staff's opinion that the County roads will be significantly damaged by the construction loading, and there must be a mitigation other than documenting pre-construction conditions and repair to equal or better.

2. The second issue is Table 5.2.11-1 "Estimated Impacts to Roadways Along Pipeline Route". Minor roads such as Second Street and Mill Street, which are closed for short periods of time, should not be a problem so long as access is made available to residents and the postal service. Roads such as Lake Street and Big Canyon Road, which will be closed for extended periods of time (35 days and 5 months, respectively) must have provisions for access by residents, school traffic, postal service, and emergency vehicles during construction activities. Permanent closure for the duration of construction will not be acceptable.

3. Finally, staff could not locate, in the draft, any discussion regarding the review and approval of construction drawings by Lake County Public Works staff. This may be premature, however, it should be considered.

If you have any questions or wish to discuss further, please contact Scott DeLeon, Staff Engineer, at (707) 263-2341

Very truly yours,

G. R. SHAUL
Public Works Director

SDL:csj

STATE OF CALIFORNIA - Environmental Protection Agency
PETE WILSON, *Govern*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
3443 Routier Road, Suite A
Sacramento, CA 95827-3098
PHONE: (916) 255-3000
FAX: (916) 255-3015

23 June 1994

Mr. Mark Dellinger
Lake County Special Districts
255 N. Forbes Street
Lakeport, CA 95453

COMMENTS ON EIR/EIS FOR THE GEYSERS WASTEWATER INJECTION PROJECT, LAKE COUNTY

Thank you for submitting the EIR/EIS for the Geysers Wastewater Injection Project which will serve as the effluent disposal system for the Southeast Regional Wastewater Treatment Plant in Lake County. We have reviewed the document and have the following comments:

1. **Page 1-12** The pumps extracting lake water would be shut down during periods of algae blooms in the lake. This is presumably to reduce the organic concentrations in the line and to eliminate solids from entering the injection wells and causing plugging. What level of solids would be expected to cause problems either in the pipelines or the injection wells.

2. **Page 1-16** Filtration is being added to the secondary treatment process for the Southeast WWTP effluent. Is the filtration necessary for protection of the pipeline, injection wells, or both? Is there a concern about mineralization plugging the injection well? If there are concerns about solids, what levels are acceptable?

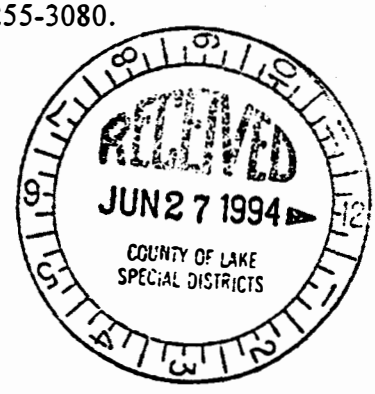
3. **Page 2-2 (paragraph 1)** The Regional Board issued the Cease and Desist Order in 1991 by authority of the Porter-Cologne Water Quality Control Act (§13300 et seq.). The permitting of the facility is also under the authority of the Porter-Cologne Water Quality Control Act.

4. **Page 2-110** Injection and Production Monitoring. Will the monitoring of the injection wells be sufficient to safeguard against plugging of the wells due to mineralization or excessive solids? Is there need for further prohibitions?

5. **Page 2-119** Application of sludge to the reclamation property will be governed by the waste discharge requirements in conjunction with the Federal regulations 40 CFR part 503.

If you have any questions regarding these comments, please call me at (916) 255-3080.

PAUL A. MARSHALL
Associate WRCE



COUNTY OF LAKE
PUBLIC WORKS DEPARTMENT
Courthouse - 255 N. Forbes Street
Lakeport, California 95453
Telephone (707) 263-2341
FAX (707) 263-7748

G. R. SHAUL
Public Works Director

June 27, 1994

Environmental Science Associates, Inc.
301 Brannan Street, Suite 200
San Francisco, CA 94107-1811

Subject: Geysers Effluent Pipeline Project

Gentlemen:

This department's Flood Control/Water Conservation staff have reviewed the draft EIR/EIS prepared for the subject project and offer the comments noted on the enclosed memorandum, dated June 24, 1994.

Be advised that comments from this department's Lakebed Management Division shall be forthcoming later this week.

If you have any questions or wish to discuss further, please contact Sue Arterburn at (707) 263-2341

Very truly yours,

GRSL

G. R. SHAUL
Public Works Director

GRS:csj

Enclosure

cc: Steve Brodnansky, Utilities Director
Kim Seidler, Planning Department Director
Sue Arterburn, Flood Control Director

COUNTY OF LAKE PUBLIC WORKS DEPARTMENT

MEMORANDUM

TO: G. R. Shaul, Director

FROM: Tom Smythe
Water Resources Engineer

SUBJECT: Southeast Regional Wastewater Treatment Plant Facilities Improvement Project and Geysers Effluent Pipeline Project, Draft EIR/EIS

DATE: June 24, 1994

I have reviewed the subject document and offer the following comments. The comments are listed by page number in Volume 1 of the subject document.

1 The treatment plant section of the EIR refers to adding effluent filtration to the treatment plant. I believe this was originally proposed when the selected alternative was disposal to Cache Creek. As disposal is now to the reservoir (where algae grows), then pumping to the Geysers area, effluent filtration appears to be unnecessary. I was unable to contact Mark Dellinger, Steve Brodnansky or Charlie Bunker regarding this question. I left a message to Charlie to call you Monday to discuss this issue.

2 Pages 1-10, 2-17, 2-31, : The text refers to the mean lake level as 1330 msl. Current lake operation is limited to be between 0 and 7.56' Rumsey (1318.26 and 1325.82 msl), or a mean of 3.78 R (1322 msl). Statistical review of the high and low levels since 1873 indicate the average high and low lake levels were 7.13 and 1.44 R, or a mean of 4.29 R (1322.5 msl). All references to the mean lake level of 1330 and depths of the make up water intake should be corrected accordingly.

3 Page 1-11: Reference is made to "purchasing" water from Yolo County Flood Control & WCD (YCFCWCD) which "owns" the upper part of the lake. The water belongs to the people of the State, however, YCFCWCD has water rights to "use" (not own) the water stored between 0 and 7.56 R. In light of the draft agreement between LACOSAN and YCFCWCD, should the word "purchased" be replaced with "obtained."

4 Page 1-12: It is suggested that the make up water be pumped all year except for the algal bloom period of August and September. There does not appear to be any reason for this as the intake is located approximately 27 feet below the lake surface minimizing the intake of algae, and the secondary treated effluent stored in the reservoir will be significantly higher in nutrients than the

lake water. It does not appear plausible that lake water will induce algal blooms within the reservoir.

4 A recommendation of the Clean Lakes Report is to operate Clear Lake Dam to release water in late summer when lake phosphorus levels are high to harvest some of the phosphorus available for blue-green algal growth. Although the quantity of make up water is small compared to releases of the dam, its operation should be consistent with proposed requests to YCFCWCD.

Therefore, we recommend references to not pumping during August/September be removed from the report.

5 Page 1-24, 5-7: Long term stability of stream banks and minimizing erosion are dependent on Mitigation Measure 5.2.1.1.E. Riparian vegetation removed from creek banks by construction operations should be replaced with native riparian vegetation similar to that removed.

6 Page 1-30: Mitigation for Impact 5.2.2.4 should include obtaining an encroachment permit from Lake County Lakebed Management. I have provided Lakebed with the EIR with the appropriate sections marked for their comment.

7 Page 1-30: The irrigation well to be abandoned in Impact 5.2.2.5 is located within the County jurisdiction, therefore, well abandonment is subject to a well permit as issued by Lake County Environmental Health.

8 Page 1-32: Because domestic water supply wells may be constructed after the pipeline project and due to the difficulty of "cleaning up" groundwater contamination, the monitoring program in Mitigation Measure 5.2.2.7.C should include all wells, or a selected sample thereof, located along the pipeline. This will ensure that pipeline leakage is identified and that all groundwater are protected from contamination from the pipeline.

9 Pages 1-58, 2-59, 2-61: Mitigation Measure 5.4.1.2.N requires sloping of road surfaces toward a hillside. This design practice concentrates flow into channels, significantly increasing the water's erosive power. Overall erosion can be minimized by outsloping the road, maintaining vegetation at the top and down the fill slope, and providing adequate cross drainage and energy dissipation at the natural drainage crossings. At large fills, such as creek crossings, drainage from teh road surface should be transferred across the fill slope in culverts or "half-pipe' flumes.

10 Page 2-33: Figure 2.3.2-A refers to the minimum water level of Clear Lake as 1326. This is actually the normal (average) high water level. The low water level could be more accurately represented as 0 R (1318 msl). During the 1976-77 drought (a 500 year event), a low level of 1315 msl was experienced.

11 Page 2-42: The pipeline crossing over the Clear Lake Outlet Channel is proposed to be attached to the Lake Street Bridge. The Lake Street Bridge is owned and maintained by the County of Lake, not the City of Clearlake. The bridge should be analyzed for carrying the additional weight of the pipeline (approximately 300 lb/LF). If externally mounted, the pipeline should not hang below the bottom of the bridge, as clearance for boats is limited.

12 Page 2-45: The location of the alternate pump station at Bear Canyon Access Road and Highway 175 is subject to local flooding. Flooding was observed in this vicinity on the south side of Highway 175, including some flooding of the highway, on January 20, 1993.

13 Page 2-48: Figure 2.3.3-C shows two alternate "draindown" connections to the Middletown WWTP. As draining two miles of 24" pipe would entail a volume of approximately 250,000 gallons, the connection to the storage pond is preferable to the primary treatment pond. A 250,000 gallon "slug" could reduce treatment efficiency.

14 Page 2-92: Consideration should be given to utilizing "ball-joint" DIP for the lake water intake piping. This type of construction may reduce the need for underwater assembly and anchoring of the pipe and reduce local turbidity caused by construction (Impact 5.2.2.4, p 5-23)

15 Page 4-63: Current algal control research is being conducted by the University of California, Davis, not the Clear Lake Algae Research Unit (CLARU). CLARU completed its investigations in the 1970's.

16 There is no additional information on water quality of Clear Lake in Section 4.4.4. Either the reference should be deleted or the information provided.

17 The report lists the Lower Arm's contributing drainage area is 192 square miles. Including the surface area of the Lower Arm (12.6 sq.mi.), the drainage area is approximately 81 square miles.

18 The Clear Lake Dam was constructed in 1914 by Yolo Water and Power. Yolo County Flood Control & WCD purchased the dam and obtained the water rights in 1967.

19 The Gopcevic Decree established Zero Rumsey relative to a concrete star in the Courthouse square in Lakeport. At that time, Zero was equal to 1318.65. Based on a resurvey by the USGS in 1982, the concrete star had subsided, making Zero equal to 1318.26 1929 NGVD.

20 Page 4-70, 9-7: In addition to the floodplains noted at the end of the second paragraph on page 4-70, the Flood Insurance Rate Maps (FIRM) designate floodplains for Burns Valley Creek (700' wide), Miller Creek (350' wide) (Burns Valley Overflow) and Copsey Creek (110' to 300'

wide). There are designated floodways on Burns Valley and Miller Creeks. The FIRM does not designate a floodplain on Big Canyon Creek, except at the confluence with Putah Creek. In
20 order to comply with EO 11988, the project should be coordinated with the local floodplain management agencies (the City of Clearlake and the Lake County Flood Control & Water Conservation District).

TRS:trs

COUNTY OF LAKE
PUBLIC WORKS DEPARTMENT
Courthouse - 255 N. Forbes Street
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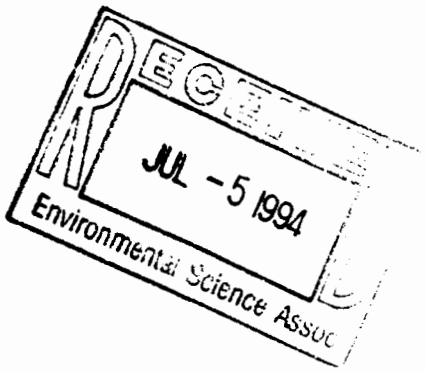
G. R. SHAUL
Public Works Director



June 30, 1994

Environmental Science Associates, Inc.
301 Brannan Street, Suite 200
San Francisco, CA 94107-1811

Subject: Geysers Effluent Pipeline Project

Gentlemen:

This Department's Lakebed Management staff have reviewed the Draft EIR/EIS prepared for the subject project and offer the comments noted on the enclosed memorandum, dated June 30, 1994.

If you have any questions or wish to discuss further, please contact Skip Simkins at (707) 263-2297.

Very truly yours,

G. R. SHAUL
Public Works Director

GRS:lmk.a

Enclosure

cc: Steve Brodnansky, Utilities Director
Kim Seidler, Planning Department Director
Sue Arterburn, Flood Control Director

COUNTY OF LAKE LAKE COUNTY FLOOD CONTROL

MEMORANDUM

TO: G. R. Shaul, Director of Public Works

FROM: Sue Arterburn, Flood Control Director

By: R. A. Simkins, Clear Lake Lands Coordinator
Lakebed Management

SUBJECT: Southwest Regional Wastewater Treatment Plant
Draft EIR

DATE: June 30, 1994

Lakebed Management Staff have reviewed the Southwest Regional Wastewater Treatment Plant Draft EIR and offer the following comments:

Page 1-19
1.4.2.1 Alternative Facility Designs, Lake Diversion Pumps and Pipeline on Pier.

1 Lake County Code, Chapter 23, limits the length of a pier to 100 feet lakeward of zero Rumsey (R) or to a depth of minus ten (10) feet R whichever is more limiting.

Page 2-67
Lake Diversion Pumps

2 Screen size and intake flows should be approved by the California Department of Fish and Game.

Page 2-92

3 Construction specifications should require contractor to comply with California Harbors and Navigation Code.

Disturbed sediment at the excavation site should be controlled by a siltation curtain or other means.

4 It should be noted that State Lands Commission has reserved to the State all mineral rights in the lake bed.

5 Blasting in the lake must be approved by California Department of Fish and Game.

Page 3-3
1 3.1.2.1 Alternative Facility Designs
(See previous comment under Page 1-19.)

Page 5-23
3 Impact 5.2.2.4.
See comment Page 2-92.

Page 9-5
Under Public works
6 Lakebed Management would issue a Lakebed Encroachment Permit for water intake structure.

Page 9-6
9.2 Consultation Requirements

7 Add a section for Clear Lake Shoreline Ordinance, Lake County Code Chapter 23. Section 23-4 requires an Administrative Encroachment Permit from Lakebed Management.

If you have any questions, please contact Skip Simkins at 263-2297.

RAS:lmk.a\lkbd\wstwtr

Friends of Cobb Mountain, Inc.

Box 47, Cobb, CA 95426
(707) 928-5376

1.4.3

5 July 1994

Mr. Mark Dellinger
Energy and Resource Manager
Special Districts
County of Lake
255 North Forbes Street
Lakeport, CA 95453

Dear Mark:

Thank you for sending me a copy of the DRAFT EIR/EIS for the SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT FACILITIES IMPROVEMENTS PROJECT AND GEYSERS EFFLUENT PIPELINE PROJECT.
It was duly received at the address in the United Kingdom to which you sent it. I am grateful for the opportunity to provide a review of the seismicity section on behalf of Friends of Cobb Mountain.

1 Regrettably, I find the treatment of siesmicity to be gravely deficient, for it utterly fails to treat our concerns in an adequate manner. You will yourself recongnize this in light of our past discussions with you, the results of which were summarized in written form. This summary is included, together with my letter of May 11, 1993, to Supervisor Mackey in Appendix A, items 12 to 14, Volume 2 of 2 of the DRAFT EIR/EIS. I would point out that your response to my letter to Supervisor Mackey, in which you assured us that our concerns would be taken fully into account in the DRAFT EIR/EIS, is not included in this Appendix, and that the appropriate existing documentation regarding your concurrence with our concerns and your intent to deal with them directly is therefore lacking.

2 In light of the above, I am sure that you can understand my present frustration, disappointment, anguish, and indeed anger -- not at you personally, for we have always known you to be even-handed and conscientious -- but with the system which routinely produces EIRs in such a way that issues that are insoluable or seriously inconvenient for the project become massaged to become non-problems.

The general treatment of the causes of the seismic events resulting from steam production and fluid injection in The Geysers Geothermal field given in section 5.3.2 on pages 5-115 through 5-135 is in basic agreement with other studies of seismicity at the Geysers, but I would refer the editors of the EIR/EIS to the historical listing of seismic events at The Geysers from the late 1940s to the present which is available from the U.C. Berkeley Seismographic Station, and which we ourselves obtained from them six months ago. The form in which we received this information is particularly valuable and revealing, as it includes relevant data with respect to each recorded event, and encompasses not only seismic events of magnitude 3.0 and above

in The Geysers geothermal field, but also all events during the same time period and in the same magnitude range within an area described by an approximately fifty mile radius from The Geysers. This data is also available, of course, from USGS in Menlo Park. In light of this information, the statement in the first paragraph on page 5-129 of the seismicity section of the EIR/EIS that "the frequency of earthquakes between M 3.0 and 4.2 is relatively small and essentially many of these events are attributable to natural regional earthquakes" is completely false. There has been a phenomenal increase in seismic events above M 3.0 at
3 the Geysers since the beginning of commercial geothermal operations, and especially since the mid-1970s, and the locations and depths of these events -- with very few exceptions -- show that they are directly attributable to steam extraction and fluid injection activities at The Geysers. This phenomenon and its causes are, as you know, generally reported and acknowledged in published papers on the subject. Minimizing and attempting to obscure the real situation, if that has been the intent of the statement quoted above, only serves to undermine the credibility of the EIR/EIS.

The most objectionable aspect of the treatment of induced seismicity in this section of the EIR/EIS is in its total failure to address the publicly known concerns of local residents in a meaningful way. When mentioned, these concerns are either reduced to "insignificant" by statistical argument or brought to proposed resolution by a suggested public information campaign to allow residents "to better prepare for any real or perceived effects of induced earthquakes and natural earthquakes" (page 5-135). Public information is important, but it cannot be used as a substitute for addressing the issues themselves. It is, in fact, insulting
4 to suggest to residents that if further earthquakes occur as a consequence of the proposed project they are the ones who must be prepared to cover the damages. The risk of major structural damage is dismissed with a "probably not". While acknowledging that "project-related induced seismicity potentially could contribute to minor local property damage, e.g., cosmetic cracks in plaster and stucco," we are told that "The impact is regarded as less than significant." (page 5-129). We are also told that "Seismic events under M 4.5 do not cause damage to structures unless, perhaps, they are already in a weakened condition" (page 5-129).

These statements provoke several serious questions: 1) What happens if major structural damage does occur? 2) Who is to be held responsible? 3) How is responsibility to be determined? 4) Who is to pay for the damage? 5) If it is to be assumed that homeowners are to pay, under what understanding of public liability law is this held? 6) Because cracks in plaster, stucco, and stone walls, stones displaced from chimneys, and perhaps broken dishes are deemed to be "less than significant," does this mean that their repair is to be regarded as routine home maintenance? 7) If this is the case, are homeowners expected to sustain the
5 expense of such repairs? If so, how can this be regarded as just? 8) Is an existing weakened condition of a structure sufficient cause for exonerating from responsibility the party (or the project) who causes damage to that structure? 9) Who is responsible for determining pre-project conditions of all structures within the larger Anderson Springs area? 10) How is that area itself to be defined? 11) Given the fact that residents of the Anderson Springs area, as well as elsewhere around the periphery of The Geysers, are presently weary of the frequent experience of induced earthquakes of M 3.0 and above, why is it that the need for mitigations is summarily dismissed by the report? Further questions might well be asked.

6 The statement "No mitigation is required" cannot be justified. Not only is the issue of responsibility and compensation for damage a legitimate one, but also for reasons of reducing

6 (cont.) psychological trauma for residents and frightened guests the sponsors of the presently proposed project should undertake the design and implementation of an injection program by which the locations and rates of injection will keep the resulting seismic events to a minimum in both occurrence and magnitude. This is an obviously needed mitigation which has already been publicly proposed and discussed.

I have not yet been able to communicate my reaction to the EIR/EIS to other members of the Board of Directors and of the Executive Committee of Friends of Cobb Mountain, but they will most certainly agree with my appraisal of the treatment of seismicity in this document. I believe that the least that can be done to repair the deficiency is to provide us with an opportunity to hold a round-table discussion with appropriate parties, at a time convenient to ourselves, for the drafting of a statement to be included within the Final EIR/EIS (not to be buried in an appendix) which will both recognize our specific concerns outlined in the 7 questions posed above, and will deal with them in a straightforward, explicit and effective fashion. This meeting will not be able to be held until after the 10th of August, following the return of James Matzinger and my wife and myself from Europe. If this is not done, we will be forced to regard the Final EIR as seriously flawed.

With best personal regards.

Yours sincerely,

Hamilton Hess

Hamilton Hess
Vice Chairman

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY PETE WILSON, Governor

DEPARTMENT OF TRANSPORTATION
DISTRICT 1, P.O. BOX 3700
EUREKA, CA 95502-3700
TDD PHONE 707/445-6463
(707) 445-6445

July 11, 1994

1-Lak-29/53/175
Lake Co. Sanitation District
DEIR/EIS for Wastewater Disposal project
SCH No: 93033052

Mr. Mark Dellinger
County of Lake
Planning Department
255 North Forbes Street
Lakeport, CA 95453

Dear Mr. Dellinger:

We have reviewed the Draft Environmental Impact Report/ Environmental Impact Statement (DEIR/EIS) for the proposed construction of a 26-mile pipeline which would carry treated wastewater from north of the City of Clearlake to South Lake County. We have commented previously to the County on the proposed Project Narrative in a letter dated April 25, 1991, and the Notice of Preparation of the DEIR/EIS in a letter dated April 7, 1993. We now offer the following comments:

1 We concur with the DEIR/EIS (page 1-82 and page 5-174 Mitigation 5.4.11.1.E) acknowledging that any work within the State highway right of way as a result of this project will require a Caltrans Encroachment Permit (Streets and Highways Code Sections 660-734).

2 There are two prehistoric cultural resources recorded within the proposed pipeline project route in Caltrans' right of way (CA-Lak-261 and CA-Lak-262 archaeological sites). The DEIR/EIS (page 4-153) states that "the true extent, significance and complexity of the (archaeological) sites are largely unknown." If these two sites are within the final pipeline route, the following will be required as conditions of the Caltrans Encroachment Permit:

1) a complete survey of cultural resources within the Caltrans right of way, inclusive of prehistoric and historic archaeology, historic architecture, and places of Native American cultural and/or religious significance (in accordance with California Public Resources Code 5097 and 5024, and California Environmental Quality Act, Appendix K);

2) documentation of consultation with all applicable Native American groups (per Public Resources Code 5024);

3) subsurface archaeological testing (per Public Resources Code 5024) to determine if the two recorded resources remain within the Caltrans right of way, and if either recorded
2 resource is eligible for inclusion on the California Register of Historical Resources; and

4) Mitigation measures if either of the recorded resources is within the Caltrans right of way (in accordance with CEQA Appendix K and Public Resources Code 5024).

Caltrans and County representatives met on December 16, 1993 and on June 27, 1994 to discuss the County's proposal for longitudinal encroachment of the pipeline within Caltrans' access controlled right of way. At the June 1994 meeting the County requested further consideration for placing the pipeline within the State highway right of way. We advised the County we would consider this request providing that alternatives analysis of pipeline placement inside and outside the Caltrans right of way is transmitted to our office. This alternative analysis should include at a minimum, the following:

3 1) For each alternative, a financial analysis comparing the cost of placing the pipeline inside and outside the Caltrans right of way. This analysis must include the specific costs (materials, labor, services, archaeological mitigation, etc.) for each alternative.

2) Cross-sections (elevations of the roadway, depth of pipeline placement, and a typical section) for each requested longitudinal encroachment location.

3) Reasons why alternatives to placement within the Caltrans right of way would not be reasonably available.

Should you have any questions please call Dave Carstensen at (707) 441-5813.

Sincerely,

E. L. WAHL
District Director

cc: Michael Chiriatti
State Clearinghouse
1400 Tenth Street
Sacramento, CA 95814

Board of Supervisors 7/11/94

Planning Board.

I have lived arround here long enough to remember the green area in our back yard, the plume of reinjected waste water that nourished the plum trees. That was our septic leach field. This is now gone, now that progress has arrived in the form of Special District bills which have gone up 30% this year alone.

Now I read about this grand plan to pump the very water that used to replenish the water table under my garden, take it and pump it up to Clearlake (which I thought was a bad idea) and thence up to the Geysers to spin the turbines of P.G.&E., Unocal and Nor Cal Power.

Not at my expense. I feel that removing the water from this basin, and pulling down the water level of Clearlake to do it, is rip off enough without asking the public to finance it.

Who represents the pulic interest in this? All I have to do is look at my water stressed plum trees to realize that any water, even waste water, is valuable in California.

1 Don't look to Special Districts. Another 30% rate increase is planned to fund this pumping. The new manager, Steven Brodnansky, came over from P.G.&E. during their most recent round of management cuts. Probably took a good early retirement. Swept right into temporary manager of Special Districts, stayed through the job posting and bidding. Well, good managers ARE hard to find.

We the citzens have bought this water, used it, and now must pay to dispose of it. Only the Board of Supervisors, and the Planning Dept. are in a position to see that we get the best possible "deal" for this water that the geothermal companies covet. They will only do so if the public holds their

feet to the fire. Is everyone in Lake Co. on drugs, or is it just the heat?

Bruce Arndt

box 509

Lower Lake, ca 95457

c. c.

PD, Times Star, Clearlake Observer.

STATE WATER RESOURCES CONTROL BOARD
DIVISION OF CLEAN WATER PROGRAMS
2014 T STREET, SUITE 130
P.O. BOX 944212
SACRAMENTO, CALIFORNIA 94244-2120
(916) 227-4481
(916) 227-4349 FAX

JUL 12 1994

Mr. Mark Dellinger
Lake County Sanitation District
255 N. Forbes Street
Lakeport, CA 95453

Dear Mr. Dellinger:

LAKE COUNTY SANITATION DISTRICT (LACOSAN); SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT IMPROVEMENTS AND GEYSERS EFFLUENT PIPELINE PROJECT; (SCH#86-021102); STATE REVOLVING FUND (SRF), PROJECT NO. C-06-4070-110

Thank you for the opportunity to review the Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the project referenced above. As you know, the State Water Resources Control Board, Division of Clean Water Programs (SWRCB/DCWP) is responsible for administering low interest loans for wastewater treatment plants and water reclamation projects. Since the LACOSAN will be seeking one of these loans, the SWRCB will be a responsible agency under CEQA, and will use all relevant environmental documents when making a decision on whether to issue the loan. The LACOSAN will need to provide us with copies of the Final EIR/EIS when it is completed. You should also include copies of comments and responses on all documents as soon as they become available. In addition, we would appreciate a summary of any verbal comments pertaining to the document and project approval received at the June 30 and July 14, 1994 public meetings. It is our understanding that the U.S. Bureau of Land Management (BLM) will be the lead federal agency for the project and will ensure that the appropriate federal agencies are afforded an opportunity to comment on the draft EIR/EIS. In addition, while CEQA itself does not require formal public hearings, at least one public hearing is required for an SRF loan project. Notices need to be distributed 30 days in advance. A copy of the notice and summary of the public review should be sent to the SWRCB with any loan application. Specific comments follow:

1 1. BLM will act as the lead federal agency for all phases of the proposed Southeast Regional Wastewater Treatment Plant project and the Energy Enhancement activities at the Geysers, with the exception of Section 106 Compliance. BLM has formally requested (letter of June 7, 1994) the DCWP assume the responsibility for Section 106 Compliance for the proposed project and the SWRCB has agreed. The State Historic Preservation Officer has been informed of this arrangement.

2 2. The final EIR/EIS should distinguish between those mitigation measures which will be adopted by LACOSAN as conditions of approval and those recommended by staff or the consultant. All significant and potentially

2 significant impacts identified should be addressed and appropriate mitigation measures proposed. The final EIR/EIS should identify what monitoring/reporting requirements will be used to ensure that the mitigation measures will be implemented effectively. We will need a final mitigation plan and monitoring program for the project and a document from the LACOSAN's governing body committing to implementation of the mitigation measures.

3 3. Page 1-46, item # 5.2.10.1. How and where will Serpentine deposits excavated during pipeline construction be disposed of?

4 4. Will the I/I reduction, addressed on page 3-40, be implemented as a part of the proposed project or independent of the proposed project?

5 5. The SWRCB's Cultural Resources Officer will work with the LACOSAN and your Archaeological Consultant to develop any additional studies which my be required in order to complete the Section 106 Compliance process. Any studies required to provide additional information for Section 106 Compliance will proceed independently from the rest of the EIR/EIS process and should not delay the completion of the final EIR/EIS.

6 6. As the DCWP's Cultural Resources Officer, I will contact Tribal Leaders from the various Native American groups in the Lake County area to determine if any historic gathering areas or Secret or Sacred Areas exist in the proposed project area.

If you require further assistance in this matter, please call me at (916) 227-4481.

Sincerely,

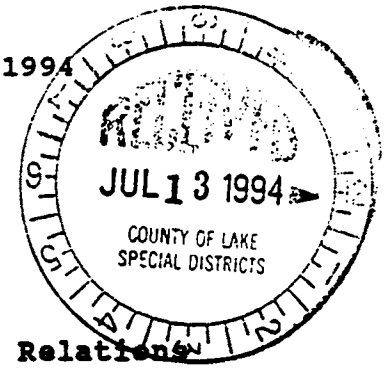
Joe L. Pope
Cultural Resources Officer

cc: State Clearinghouse
1400 Tenth Street
Sacramento, CA 95814

California Regional Water
Quality Control Board
North Coast Region 1
5550 Skylane Blvd. Suite A
Santa Rosa, CA 95401

State of California THE RESOURCES AGENCY OF CALIFORNIA

M E M O R A N D U M



To: Mr. Douglas P. Wheeler Date: July 7, 1994
Secretary for Resources

Mr. Mark Dellinger
Lake County Sanitation District
255 North Forbes Street
Lakeport, CA 95453

From: **Department of Conservation**
Office of Governmental and Environmental Relations

Subject: Draft Environmental Impact Report (DEIR) for the Southeast Regional Wastewater Treatment Plant Facilities Improvements Project and Geysers Effluent Pipeline Project, Lake County. **SCH #86021101**

The Department of Conservation's Division of Oil, Gas, and Geothermal Resources (DOGGR) has reviewed the DEIR for the proposed project and submits the following comments for your consideration.

1 1) In the section of the report titled "Acronyms and Abbreviations used in this EIR/EIS" the DOGGR is referred to as California Division of Oil, Gas, and Geothermal Resources (DOG&GR). The correct reference is California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR). This comment applies to all references to DOGGR throughout the document.

2 2) On page 1-30, section 5.2.2.5: The California Division of Mines and Geology does not regulate irrigation well closure.

3 3) On page 1-83, Table 1.7-1: In addition to fluid injection, a permit from the DOGGR is required for the drilling of new injection wells and the conversion of existing wells to injection on private or State lands. The permits issued are a Geothermal Drilling Permit and a Permit to Rework. The regulatory authority is the CA Code of Regulations Title 14, Division 2.

4 4) On page 1-83, Table 1.7-1, Fluid Injection: The Permit or Approval given by DOGGR is a Project Approval rather than a Notice of Intent or Responses to Written Orders.

5 5) On page 2-105, third paragraph: There are 40 wells approved as injection wells. An average of 29 wells are used to inject fluid each month.

6 6) On page 2-112, section 2.4.4.2, second paragraph: The DOGGR and BLM will require Calpine, Unocal, and NCPA to periodically demonstrate mechanical integrity of the wells.

7 7) Page 4-71, first paragraph: Groundwater resources are not regulated by DOGGR. The DOGGR is mandated to prevent damage to underground and surface waters suitable for irrigation or domestic purposes by reason of the drilling, operation, maintenance, and abandonment of geothermal resource wells.

8 8) Page 4-188: Comment on first paragraph, line two and three: Has there been sufficient wells drilled, of late, to demonstrate that "most drilling" currently uses "sumpless" drilling techniques?

9 9) Page 5-140, Last paragraph, next to last sentence: The following correction should be made. "Besides the biennial ~~annual inspection~~ tests, ~~injection wells are inspected during each mechanical integrity test, and again during the injection project review~~ a Division inspector will make periodic visits to the well site."

If you have any questions, please feel free to contact Kenneth Stelling or Ali Khan at the Division district office in Santa Rosa. The address is 50 D Street, Room 300, Santa Rosa, CA 95404; phone (707) 576-2385.

Jason Marshall
Environmental Analyst

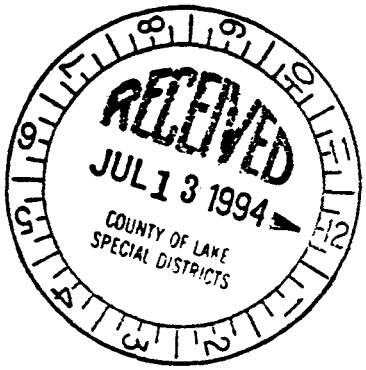
cc: Kenneth Stelling, Division of Oil, Gas, and Geothermal Resources, Santa Rosa

Michael Stettner, Division of Oil, Gas, and Geothermal Resources, Sacramento

SIERRA CLUB - REDWOODCHAPTER

P.O. Box 466. Santa Rosa, CA 95402
Phone: (707) 544-7651
Fax: (707) 544-9861

July 4, 1994



Mark Dellinger, EIR Representative
Lake County Sanitation District
255 North Forbes Street
Lakeport, CA 95453

Rich Estabrook, EIS Representative
U.S. Bureau of Land Management (BLM)
2550 North State Street
Ukiah, CA 95482

Re: Southeast Regional Wastewater Treatment Plant Facilities and Geysers Effluent Pipeline Project Draft EIR/EIS Release May 26, 1994.

Dear Sirs:

Thank you for the opportunity to comment on the above mentioned EIR/EIS. I am representing the Redwood Chapter of the Sierra Club and commenting on behalf of 7,000 members located in the counties of Lake, Mendocino, Solano, Sonoma and Napa.

This letter and our attached commentary are presented to you by July 14, 1994 in compliance with the request to provide comments on the proposed Geysers Effluent Project. (Project documents are Volumes One and Two and not the original EIR which was never deemed adequate for the original project analysis.) We may make additional comments either written or during public hearings before the Planning Commission, Board of Supervisors or other public entities. All comments and references contained herein are hereby incorporated into the official record of proceedings for this project and its successors.

We object to approval of the project in its present form for the following reasons:

1

1. There has been insubstantial evidence for conclusions derived in this technical document and that will directly affect the ability to carry out discretionary decision of compliance. A true description of depletion of The Geysers resource is lacking and technical analysis must be either included or summarized sufficiently for resolution. The current rate of resource use has depleted a non-renewable resource. The proposed action results are speculative, at best. We refer you for policy guidance to Governor Wilson's statement in addressing the current budget

1 crisis, "my goal of 'preventive' regulatory policies - policies that discourage unnecessary investment in infrastructure that is costly, unneeded and environmentally undesirable." We refer you to the NEPA Code of Federal Regulations, Title 40 - Protection of Environment Section 1502.22. Please refer to the Sierra Club Depletion and Geology Discourse attached.

2 2. There has been inadequate analysis of cumulative impact based on CEQA and NEPA requirements. Cumulative impacts from geothermal projects has been tested in court in the case of the Sierra Club, Cal-Trout and California Dept of Fish and Game vs Mono County on cumulative impacts under CEQA on EIR adequacy. The court was tried in 1988 and was withdrawn with a settlement in 1989 for funds for fish mitigation. There has been no analysis is this EIR/EIS of the impacts to the aquatic habitat from either the current proposed project or the potential projects that are pending. Please refer to the need for complete analysis of cumulative impacts for both NEPA and CEQA. (See Appendix A.)

3 3. The Sierra Club supports the principal component of this proposed project, reuse of wastewater. However, the approach proposed leaves much to be desired. There is the issue of introducing secondary treatment into water sources of the State of California. And there is a critical lack in defining a true financially viable and long term solution. Bacteria, viruses, chlorine and estrogen compounds may be required to be removed. Will secondary level of treatment, and not tertiary, be adequate for the wastewater?

4 4. The potential for spills of secondary effluent and runoff of toxic materials involving mercury mine tailings or asbestos/serpentine soils, or sedimentation through construction and pipe damages due to landslides or earthquakes is not adequately addressed or mitigated. The impact of additional toxins being introduced into public water resources or into areas like Big Sulphur Creek, designated by the EPA as exceeding recommended criteria of ammonia, aluminum, arsenic, boron, chromium, copper, iron, manganese, mercury, nickel and zinc are unlawful. The EIR lacks a good contour map and accompanying analysis of the run off flow

5 potential from the tanks and from the pipes in the case of failures, it should also include the location of the mercury mines and mining tailings sites.

6 5. There is the problematic removal of water from its' original watershed.

7 6. Some researchers blieve local seismicity may be related to fluid withdrawal, and possibly, to condensate injection because the microearthquakes can be correlated with two pressure sinks in the geothermal field associated with the regions of steam production. The injection plan can increase the seismicity and will not only effect local residents, but will, through the obvious movement of the earth soils, cause the faults and fractures by which the steam currently is utilized, to be sealed which will further damage the natural resource. What will be the critical level of microearthquakes at which the project will be halted?

8 7. A recent California Energy Commission (CEC) search could locate no records of riparian water diversions since they do not require a permit and riparian diversions must be identified in context with water quality impacts from this project.

9 8. Diatoms, siliceous compounds, from supplementary injection lake water can impact the geothermal resource field and a physical chemist needs to investigate.

10 9. What were the criteria for choosing the injection points? Otherwise the best and seemingly natural course is to inject water at the natural recharge points such as Cobb Mountain or the Colloyomi fault. A long range and comprehensive restoration of the geothermal resource has not been proposed and instead a profit margin increase is all this project will accomplish, if it can do that.

11 10. The Department of Oil and Gas needs to enforce a contractual agreement making the steam supplier liable that if steam is not produced then they incur the costs of reclamation. A bond of adequate amount to cover full and comprehensive restoration needs to be included as a stipulation for this project and any others.

12 11. There needs to be a clearer definition of legal responsibility. The Geothermal Resources Act of 1967 established the Geothermal Resources Board, however, by the end of the 1980's this board was dissolved. The Division of Oil and Gas under regulatory laws pertaining to wells and well closing, has limited oversight. There appears to be no central authority, only piecemeal authority weakly based within each county planning department. Limited regulatory authority is given to the State Water Resources Control Board, The Department of Fish and Game, Air Resources Board and the Dept of Forestry and Fire Protection. Under the Warren-Alquist State Energy Resources Conservation and Development Act of 1974, a state energy commission is to have responsibility to develop and coordinate a program of research and development for geothermal resources. The Federal Geothermal Steam Act of 1970 reserves to the Secretary of the Interior the right to require production of more than one component of the geothermal resources. Does this project fall within the scope of a state or federal agency for monitoring of mitigation steps? Is the drilling of wells whether production or injection wells, subject to state and/or local jurisdiction? Depending upon the jurisdiction will drilling permits be considered ministerial rather than discretionary, and thus being exempt from CEQA? In addition, Calpine and NCPA take possession of effluent at their pad sights (Unocal isn't directly determined) (pages 2-108/109), who has legal responsibility up to that point?

13 12. The final agreements between LACOSAN and the geothermal industry will include provisions for the participants to provide funds for system modifications if they become necessary (page 2-7) and in the event the modification is needed, the geothermal industry would provide a two-year advance notice that they could no longer take the water. Is this sufficient time when it potentially impacts so many peoples lives? Will there be a resolute Ordinance from both counties stipulating that the secondary effluent will not be discharged into water ways either ground water or riparian?

14 Attached are the following documents that will comprise our comments on the EIR/EIS; the Depletion and Geology Discourse, Comments List, Research Resource List, and Appendices A through R. The purpose of the Discourse is to supplement the lack of true

depiction of the current status of The Geysers resource and its' geology. Because the Discourse is derived from the Resource List sources and not directly from the EIR/EIS it need not be directly commented on by the EIR preparatory staff. However, the discourse is key in understanding the lack of information in this EIR/EIS for truly depicting the available technical research and conclusions. Conclusions which weigh heavily in defining the appropriateness of the proposed project. The Comments List represents our direct concerns with actions and comments in the EIR/EIS itself. The Appendix A to R is to be included in the comments in its entirety.

14

The use of an apparently unsubstantiated technical solution which threatens a unique resource and poses potential harm to species of special concern is seen as a risk Sierra Club members are unwilling to take.

We therefore request that the project be appropriately amended or the project be denied as proposed.

Sincerely,

Krista Rector
Executive Committee, Redwood Chapter

Sierra Club Comments

15 1. Mercury Mining tailings locations are not included in any of the maps nor are they discussed other than in context with OSHA compliance. There needs to be an expanded analysis of the potential of mine tailings being impacted by pipeline rupture or sedimentation impacts on waterways during construction. Mercury in particulate form is discussed in context of removal on page 5-146 with the amount held in effluent. Please explain how the effluent will be measured and monitored for mercury and other toxins prior to injection approval.

16 2. The real reason for decline in steam reservoir pressure is overdrawing of resource and more analysis is needed to appropriately determine feasibility and mitigation steps in the case of failure (see Discourse) Page 1-4, 2-105.

17 3. A true cost comparison with Cache Creek/Yolo County option for wastewater disposal is needed with the full cost of Geysers effluent injection page 1-5

18 4. 25 year history at The Geysers with condensate injection and drilling mud use includes failures which have not been adequately monitored for fish kills. Further explanation of the potential for aquatic impacts is needed. Page 1-6 Expand on Page 5-32 latter effect could result in fish kills. Potential impact on Rainbow trout page 5-59.

19 5. If this EIR/EIS is based on "preliminary design" only then it is not a true analysis under CEQA. Page 1-6

20 6. No data on the type of pipe selected in relation to the impacts of earthquake Page 1-9

21 7. No analysis of the steel tank on Childers Peak which is 60-70 feet in diameter and 24-32 feet high holding 620,000 gallons if damaged Holding berms? what is down hill? See page 5-31

22 Page 1-9 Impacts from 100,000 gallon tank on Y-Pad? Page 1-10

23 8. Lake Intake of water: will there be any analysis of water besides diatomes? How do diatomes made up of siliceous material react when heated and injected in compact mineral spaces? Page 1-10

24 9. No facilities planned for treating the make up water Page 1-12

25 10. What other reasons would there be for shutting off of lake water besides algae bloom, could there be toxic spills, etc. Page 1-12

26 11. The Y-pad would regulate flow of effluent to some of the distribution lines, are the rest from only the Childers Peak? Page 1-13

27 12. Pipeline pressure, what is the mitigation for pipe line pressure loss? Page 1-13

28 13. Mention of adjustments in make up water withdrawals, what is the total anticipated water removal over the anticipated 25 to 50 year life of this project? What is the cumulative effect on the lake? Page 1-13

29 14. What is the backup system for the distributed control system (DCS) page 1-13

30 15. How is SERWTP integrated with the emergency control system in case of failures? Page 1-14,

31 16. An alarm is mentioned but how is the leak to be located and how long would it take to find and repair the leak, what is the potential flow rate at all points in the system and what is in the path of each potential breaking point?

32 17. Unocal to widen a 2000 foot jeep trail Page 1-14 With expansion of the project what is the cumulative impact for additional native soils and plants destruction?

33 18. NCPA would add other sources of water for injection, would this be a separate permit process for instream flow takings? Page 1-15

34 19. Proposed filtration with a chemical coagulant aid of either polymer or alumimum sulfate (alum). If this is a residue what happens when it is superheated? Page 1-16 What happens when chlorine is heated?

35 20. What happens under abnormal conditions with the oxidation ditch process? Page 1-16

36 21. Clarify language of "open space" used on page 1-19 in reference to use of single pump station at Bear Canyon rather than the proposed five separated pump stations.

37 22. Reference is made to a surge tank on page 1-20, explain fully what can happen if there is a surge or pressure increase and it's effects on the integrity of the piping.

38 23. What happens at the injection wells when wastewater is cut off page 1-20

39 24. Diverted lake water would directly enter the pipeline as opposed to a reservoir, explain impacts if the lake water needs to be controlled due to contamination. page 1-20

40 25. Please explain the Alternate Route E definition of the pipe location, currently stated it would be entirely located within or in the shoulder of public roads. Does the pipe run above ground and what are the mitigation plans if it suffers from vehicle impacts page 1-21

41 26. Significant and unavoidable impacts page 1-22: Impact 5.2.3.11: could result in a

41 permanent cumulative loss of woodland and mixed chaparral that provide habitat for special status species of bird. How much loss in proportion to area, how much loss in proportion to population of which identified species? Please elaborate.

27. Cumulative impacts page 1-77 Cumulative in the case of this proposed project and all the others potentially to follow need to be fully and completely addressed (See Appendix A). Cumulative impacts are key in any analysis under CEQA or NEPA and must realisticly address the impacts of all potential projects. What may not have an impact under 10 small projects can and will have an impact when seen in the broad scope over a period of time. This EIR/EIS is seriously remiss in not addressing the true cumulative impacts of accepting wastewater in addition to the stated three cities, you need to include the other cities, starting with Santa Rosa.

42

43 28. Environmentally preferred alternative page 1-78, selection of route F, only a mention is made of the time delay in case of emergency, please elaborate.

44 29. 1-81 Responsible parties and cooperating agency. Please explain when an agency changes from being a responsible party, a mititgation monitoring party and becomes a cooperating party.

45 30. Explain why there was no cost analysis and impact analysis for using secondary treated effluent and not tertiary. Page 2-1, 2-4, 2-5, 2-7, 3-29.

46 31. Explain the legal definition of "final agreements" betweeen LACOSAN and "the geothermal industry" and how will there be specific provisions for funds for system modifications. Page 2-7

47 32. Explain the financial ramifications from the porposed two year advance notice or "walk-away" contract when "the geothermal industry" could no longer take the water. Page 2-7

48 33. Is Figure 2.1.4-a on page 2-19 to scale? Is the lower axis labeled correctly?

49 34. What is a comminutor on page 2-24?

50 35. Is the effluent only treated to secondary standards? Page 2-24? Are other plants effluent only secondary?

51 36. Page 2.58 Unocal pipeline injections sites, what will be the determination used for sites C and H and D&V 18-1.6?

52 37. Page 2-69 alarm signals are mentioned but response method is not outlined. Preliminary design report is available but when and how will final plan be

52 implemented? Who has oversite and responsiblity and bonding to cover spills? Please discuss in context with information on spills of injection fluid on page 5-141.

53 38. Table 2.3.5-4 construction disturbance table, no totals included.

54 39. Pipe pressure criteria and testing requirements are outlined, however, the method of wastewater removal is never completely explained, please describe how. page 2-90

55 40. Dust suppression using Clear Lake water must be bought from Yolo County how much and how many trips? page 2-95

56 41. page 2-97 67 percent pipe incline and deviation from existing or planned roads; how will repair crews service these areas for regular maintenance or for breaks in the pipe?

57 42. page 2-106 Please expand on your determination of "complexities and uncertainties" and what this means in terms of potential mitigation plans.

58 43. Explain the statement that the project would not increase production to installed capacity levels? Why wouldn't a plant expand or it's well fields expand is the resource became plentiful? What is meant by this statement, is there a cap on the growth? Page2-106

59 44. Page 2-107 zero to 60 percent return values, 30% in 4th year; injection seems "assured"; natural reservoir phenomena account for a significant but unknown effect on IDS recovery; and suspension of injection had no observable effect on IDS mass flow rates: all this points to a hit and miss program. How many injection wells, whether eventually capped or used would there be drilled in order to find a successful series of wells?

60 45. page 2-109 "may be mixed" by Unocal with condensate and diverted stream flow, which stream, which permit? What are the possiblities of spills occurring during the "mixing" process?

61 46. page 2-111 "enthalpy"? Please define it and the monitoring of it. It seems to be the crux of the ability of the industry to monitor its effectiveness and allows them to make a judgement on the cost effectiveness of purchaseing water, especially if there is no quaranteed outcome.

62 47. Page 2-111 locations and rates of injection would vary over time in response to reservoir pressure condisitions and steam production, where and what amount of wells are to be developed and what are the mitigations for extended and expanded development?

63 48. page 2-112 citizine's concerns not allayed, especially when induced seismicitiy is termed

63 "unsignificant", however, of greater concern is the fact that you may be destroying a resource through seismic induced collapsing of the faults and fractures. Please address this issue, what technical analysis has been done?

64 49. Spill control plan see summary section 5.3.3, "have existing spill control plans related to their injection programs". Past history at The Geysers shows a complete lack in monitoring of fish kills (See Appendix O). There also is a laxity in applying appropriate fines which means spills aren't a "problem" to the operators. Please address how this project will increase the probable and potential spill numbers and what the impact would be to waterways and aquatic habitat.

65 50. Project abandonment and reuse: what "certain" facilities are abandoned, how are they abandoned and how is the land reclaimed to its' natural state. Expand on the program alteration proposed if there is to be "reuse" for "another purpose".

66 51. Funding not yet committed is mentioned on page 2-126. What alternatives are being proposed to supplement these sources? How does funding affect the "go" or "no go" option of this project?

67 52. Page 3-30 well abandonment under Dept of Conservation, please review the mitigation if or when the State Lands Commission and the Department of Conservation is absorbed into a new entity as proposed by the current Governor.

68 53. Page 3-31 Please relate and explain the information on regulation and the table on page 1-81. There doesn't appear to be a direct correlation between responsibilites. For instance, the CRWQCB must sample injected effluent and report on volumes. Any lost circulation at depths less than 300 fee must be reported. Reported to who? What happens after the reporting?

69 54. Page 3-36 Anderson Springs injection area; this is a confusing section of the EIR. Are there more than one proposal, for example "Alternative G"? Or are you referring back to the original proposed EIR that was never accepted or confirmed? How does this relate to the current project.

70 55. Page 3-36 Calpine presentation to Bd of Sups 5-28-91. This information should have been issued as an Appendix to the current EIR. Please publish this information with the responses to this EIR/EIS.

71 56. Linkage with other Wastewater sources page 3-39 Again, this emphasizes the need for a complete cumulative impact statement which is missing in the oversight of this EIR/EIS. Please fully address the cumulative impacts of all possible future projects.

72 57. Explain the proposed "synergistic" alternative to coordinate with a remediation program for the Sulfur Bank Hazardous Waste Site Superfund site. Where is this site?

72 What does it contain? How would it be incorporated and what are its' mitigations?

58. page 3-40 The cursory comments on reduction of flows and conservation is indicative
73 of a lack in true mitigation for resource impacts. Reduction in use, reduction in surface flows into treatment plants and resource in geothermal/electrical production is key in terms of long term impacts and should be treated fully as needed.

59. Ranking of Project alternatives page 3-44. The assessment of long term impacts by the
74 use of the Project Alternatives is highly suspect. For just one example, there is a no impact on Water Resources. Please explain the criteria for assigned of values.

60. Page 3-48 The original cost estimate of The Geysers recharge/effluent injection project
75 was $17 mil versus $39 million. The $39 million doesn't include private industry construction and piping costs. How can this project be a lower cost alternative instead of the most expensive project possible?

61. Page 4-8 There is little discussion of slope stability when in fact the geology of The
76 Geysers is notorious for slides. Slides are what have caused the ground water resources in the area. Slides are what makes The Geysers road the most expensive in Sonoma County. Please expand this section and fully address the slide action potiential for pipeline damage.

62. Page 4-31 surficial deposits, page 4-45, 4-47,4-52, 4-53, plese address the issue of "severe
77 erosion hazard" and its potential sedimentation impacts on the area fish and aquatic life.

63. Page 4-62 to 68, Pages 4-72 to4-74. Please address the issue of the 66 crossings over 11
78 tributarys and the potential for spills. What is the fish count in these areas and what type of fish will be affected?

64. Page 4-68 water quality, page 4-70. Please address the issue that riparian withdrawals
79 are not known for this area. Please propose a mitigation step to identify all riparian water use.

80 65. Furthermore please address the issue of impacting an already depleted waterway such as Big Sulphur Creek which has a EPA rating. Page 4-78.

66. Page 4-77 An Aquatic resources monitoring program data base is mentioned but there
81 appears to be no proposed mitigation of fish impacts based on outcomes of continued data gathering. Please expand on how aquatic habitat impacts would be monitored and mitigated.

82 67. Effluent Chemical compounds page 4-92, compare how this will increase the toxin loads in area stream ways when spills occur.

83 68. Page 4-98 vegatation patterns due to the serpentine or chemical nature of soil means that revegetation will be difficult at best. How will inspections and revegetation programs be monitored?

84 69. Injection operations would not disturb biological resources Page 4-131. Please expand on this one sentence. Are you saying that because of the excessively noisy activity, there will be no life forms around the injection wells?

85 70. Population growth 4-177 This project will have profound effect on population growth, but as always, the answer will be overriding considerations even though such things as traffic and the resultant air pollution will protect area resources.

86 71. Page 4-183 asbestos is discussed in terms of air pollution, however, as of 1994, asbestos water pollution will now need to be monitored. Please address the impacts of asbestos on water quality for all life forms. Page 5-85 asbestos, mercury page 5-89.

87 72. Mercury on page 4-184, rock but no location of tailings is shown. Please expand on possible impacts should pipeline ruptures and spills occur.

88 73. Page 4-203 six wells only produces a minimum of return at the 40-60% ratio? How many wells are needed to supply the steam to meet the depleted rate of steam for the maximum plant capacity?

89 74. Unit 18 and 20, page 204 highest returns are seen at the borders? Why and what are your conclusions for additional injection wells?

90 75. Page 4-206 Unocal four wells, changes are to be made but based on what criteria?

91 76. Non-condensible gases, page 4-207, 4-209 with additional steam doe you anticipate increases in hydrogen sulfide and radon releases?

92 77. Seismicity, see volume 2 or pages up to 5-4. Seismicity is a significant impact when it is effectively shutting down the fissures and fractures which result in decreased recharge rates.

93 78. Slope failures page 5-10 and page 12 5.2.1.4 old landslide between stations 57.3 and 57.4 change route or does there need to be a truly comprehensive analysis of the geology and soils before a route is selected?

94 79. Please explain the impacts of "fill" being placed in a tributary of Big Sulphur Creek and the impact on fish. Page 5-9.

95 80. effects of diatoms and biological growth from injection, data to evaluate not available page 5-114. Please clarify how you reached your conclusion on significance.

96 81. Seismicity monitoring on page 5-135 is mentioned as possible. What type of increase in seismicity would warrant a monitoring and mitigation plan?

97 82. Viral release from effluent into the atmosphere is discussed on page 5-147. Mention is made of evaluation but no mention is made of what to do. Please expand on mitigation steps.

98 83. Royalties page 5-149 are discussed, however, there is no discussion of bonding appropriate amounts for mitigation impacts. Please include true monetary mitigation plans for resource impacts and recovery to original state in the case of project failure.

99 84. Removal of priority pollutants of wastewater and the difference is primary versus secondary versus tertiary. Please cost justify the use of secondary effluent and not tertiary effluent for injection in The Geysers. page 5-157

100 85. Chlorine has been designated as insignificant, however, in recent scientific publications, not only chlorine but estrogen complex compounds have been shown to be elements in wastewater that profoundly impacts the animals and mankind. Please address the issue of significance now that chlorine is potentially a pollutant tagged for removal from America's waterways. page 5-171

DEPLETION AND GEOLOGY DISCOURSE

The Sierra Club position is directly related to the following:

> NEPA and Code of Federal Regulations, Title 40 - Protection of Environment:
> Section 1502.22 Incomplete or unavailable information:
> When the agency is evaluating reasonably foreseeable significant adverse effects on the human environment and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking...a statement of the relevance of the incomplete or unavailable information to evaluating significant adverse impacts...a statement of the relevance of the incomplete or unavailable information...a summary of existing credible scientific evidence which is relevant...

Please note that the Appendices M, N, O, P and Q are published or draft articles on the Geysers which will provide relevant background for understanding the complexity of The Geysers. Appendices B through K will supplement the graphics in the EIR/EIS and again provide a more comprehensive review of the proposed project.

The following are summations and comments taken from technical writings specific to The Geysers and their comments can be researched further by obtaining information articles listed in the attached Research Resources List (Appendix R). It is critical to be aware of the issues involved in the proposed project and we feel that the specialists who wrote these technical reports eloquently addressed the potential problems and the need for a true understanding of the proposed project.

Reference Item 1.

> In the mid-1980's the field unexpectedly began to decline more rapidly than predicted. The California Energy Commission (CEC) created a Technical Advisory Committee (TAC) composed of CEC, Div Oil/Gas, State Lands Commission, utility and steam suppliers. The TAC is overseen by the Siting and Regulatory Procedures Committee (SRPC). Citing the TACs lack of progress, the SRPC held a hearing in 1991. The TAC were asked at the hearing the causes of the decline and offer solutions. (The hearing text in full should be a part of this document) Following the hearing, the SRPC issued an Order which directed steam suppliers to prepare a coordinated resource plan for The Geysers. The participation is voluntary. If in the absence of meaningful and comprehensive solutions from the industry, the SRPC will pursue other options at its disposal, including available regulatory and/or legislative remedies. A presentation to the SRPC by the voluntary member Consortium emphasized five elements for increasing the efficiency of operations in four distinct regions of the field. During the prehearing workshop the Consortium announced that an agreement was signed on September 17, 1991 between Lake County and the TAC Consortium.

Note: this document and its' conclusions need to be incorporated in the present proposed EIR/EIS project and any subsequent projects.

Reference Item 2.

The decrease in new development has resulted from a combination of increasing development cost and resource risk, decreasing availability of favorable steam and/or power sales agreements, and problems with the performance of the developed steamfield...beginning in the late 1980's, projects began to be affected b rapid declines in well productivity resulting from declining reservoir pressures...accelerated more than anticipated following the large increase in installed plant capacity during 1980-86. Further strategies for improving field performance are understudy with the urging and backing of state regulatory agencies.

Reference Item 3.

Capacity addition in The Geysers was relatively gradual until the end of 1982, in the following seven years, the installed capacity more than doubled (943 to 2056 MW)...wells we selected for decline curve analysis show a distinct change in decline trend beginning in 1985 as the reservoir responded to this capacity increase...the most sever pressure declines had occurred n the areas which had been developed first (Units 1-6 and 7-8) ...two small areas of similar pressure depletion in Units 13 and 18 in the southeast portion of the field.

Reference Item 4:

In the court case County of Sonoma vs State Board of Equalization:
Radioactive decay of minerals occurring deep within the earth's crust is the ultimate source of the heat in the geothermal resource system at the Geysers. Weaknesses in the earth's crust in the vicinity of The Geysers, caused by the juncture of the earth's Pacific and North American plates have allowed the magma to make its way over millions of years from deep within the crust to an unusually shallow depth. As it intruded, the magma heated the rock and caused metamorphism in the rock, changing its mineralogy. The heated rock in turn heated the water within the rock formation and set up a hydrothermal convection system. The hydrothermal fluid contained minerals from the intruding magma and also minerals dissolved from the surrounding rock. The heated water as it circulated deposited into fractures in the rock the minerals which it contained. Over long periods of time these mineral deposits caused a seal to develop which became tighter with time, until a virtually impermeable barrier was formed around the geothermal fluid. There is some natural recharge by ground water from outside the system, which is not a significant amount.

Reference Item 5.

The steam in the reservoir is approximately 475 degrees Fahrenheit and has a pressure of approximately 500 pounds per square inch. Pressures within the steam reservoir exist independent of hydrostatic pressures, indicating that the steam reservoir is substantially cut off from the ground water overlying the system. Below the steam reservoir is an area of boiling brine with high concentration of dissolved minerals, silica, boron and arsenic in particular. This boiling brine feeds new steam into the

system. The deposits of minerals in hydrothermal systems often creates, over long periods of time, veins of minerals in the fissures radiating outward from the heat source. The hydrothermal system at the Geysers has deposited veins of mercury which has been mined commercially.

Reference Item 6.

Water influx or recharge is an important factor that may affect the performance of a geothermal reservoir. This factor could be particularly important in a steam reservoir because the low density of steam in relation to the density of liquid water can result in a small mass of steam in the reservoir for low water saturations. Some researchers have concluded that the steam reservoir could not be subject to significant recharge based on pressure data. A recharge could be possible if water entered from a low pressure source as reservoir pressure declines, but such a source can exist only with a free surface level far below the ground surface. Such a free surface is not known to exist in The Geysers Geothermal field.

Some people feel that the geothermal field life could be limited to the amount of fluid initially in the reservoir or if it is possible to achieve deep injection than the reserve of a geothermal reservoir is the heat contained in it rather than the fluid content as long as it is available and economical to inject.

Reference Item 7

Further complicating the picture in recent years is the fact that injection and natural recharge are assumed to compensate for an increasingly smaller fraction of the total mass produced...

Reference Item 8

After the steam passes through the turbine, the steam is condensed and the hot condensate is passed through cooling towers where approximately 80 percent evaporates into the air leaving only 20 percent for reinjection. The Geysers geothermal system is being depleted by the extraction of steam and with or without reinjection the steam will eventually be exhausted.

Reference Item 9

As far back as 1970, researchers have shown that the reservoir was underpressured with respect to hydrostatic pressure and the temperature varied very little. The reservoir has been shown to be underpressured with respect to hydrostatic pressure and that the temperature varied very little with depth below 1,000 feet. The conclusion was that the steam reservoir could not be subject to significant water influx from water-bearing formations communicating with surface waters. It was calculated that the initial mass of steam was 241 billion pounds in the Big Geysers area.

Reference Item 10

Mostly The Geysers steam reservoir consists of massive, dense graywacke with low-to-

no permeability. Graywacke has a permeability of less than 1 millidarcy and a porosity of less than 10 percent. Because of the very low permeability, steam flows for wells are only obtained when open fractures are encountered during drilling. The majority of the wells have intersected vertical fractures on the average of 1 to 7 times. Only rarely does a drilling break of a few feet occurs, indicating a large fracture or cavernous opening in the rock.

Reference Item 11.

problems...these include excessive pressure drawdown and associated decline in well flow rates, corrosion due to high chloride concentration in the produced steam and high concentration of noncondensible gases in some parts of the field...starting in 1987, problems with the amount and quality of the steam produced at The Geysers became evident...in some parts of the filed the steam began corroding valves and pipes caused by the presence of HCL and in other areas, the noncondensible gas content in the steam was high to the extent of affecting turbine performance....

Reference Item 12.

The subsurface data from Geysers wells are largely proprietary,therefore, no field-wide synthesis has been achieved. Despite the abundance of scientific work at The Geysers, there exists no consensus on many important aspects of the geology and other important characteristics of the geothermal reservoir. This is due in part to the complex nature of the Franciscan assemblage which is deformed...the heat sources is associated with the young Clear Lake Volcanics and is believed to consistent of a large magma body located beneath Mt. Hannah as shallow as 13,000 to 16,000 feet...at depths of 4,000 to 8,000 fee or more wells in the steam reservoir have penetrated an intrusive body that is believe(d) to be contemporaneous with the Clear Lake Volcanics...shale, serpentinite and melange are found above and adjacent to the steam reservoir and these rocks are impermeable and bound the reservoir...pronounced faulting occurs along a strong northwest-southeast trend and a weaker northeast-southwest trend...the importance of faults within the reservoir is less clear...the whole of the reservoir appears to be in hydrologic communication, but faults within the filed may subdivide the reservoir into structural blocks, between which the flow of fluid is impeded somewhat...substantial evidence indicates that the reservoir fluid consists of water and steam in equilibrium with the steam phase controlling pressure distribution. Nearly all production wells produce saturated or superheated steam, but at the southeast end of the field wet wells (producing water and steam) have been drilled, suggesting that the southeast boundary of the reservoir may be a zone of transition from steam-dominated to water-dominated conditions.

Reference Item 13.

..first steam entries...suggest that there are three upflow zones in the Southern Geysers, one in the southeast area and two others in the central area...At The Geysers, the Franciscan Assemblage is a sequence of tabular, stratigraphically continues slabs bounded by thrust faults. These were intruded by shallow, silicic

magmas...simultaneously, related magmas of the Clear Lake volcanic field were erupted adjacent to and to the northeast of The Geysers; Cobb Mountain being the most significant volcanic edifice... a probable magma body associated with the area of nearby Mt. Hannah and beneath The Geysers itself...we believe that The Geysers reservoir is "mining" heat from buried still hot, young igneous rock and possibly magma and moving it to the near surface. This process occurs when the reservoir extends downward into hot rocks, enhancing upward heat transfer by convection....

Reference Item 14.

In Geothermal Kinetics Inc v Union Oil Co:

...the court decision stated that the liquid in the geothermal system was a separate, depletable deposit, cut off from the normal ground water system. thus the water and steam components of geothermal resources are part of a distinct water system.

Reference Item 15.

Within the reservoir, hydrothermal fluids occupy and flow through open fracture networks. These productive fractures occur primarily in the highly-impermeable main graywacke. Well data indicate that within the main graywacke, the productive fractures frequently occur in clusters,separated by large intervals of unproductive rock. The unproductive rock may either contain open fractures not connected to the reservoir or fractures sealed by hydrothermal mineralization. Steam flow occurs in near vertical, open fractures.

Reference Item 16.

An essentially closed hydrothermal system with an areally extensive two-phased zone of ascending steam and descending condensate. The zone is bounded from below by a hot water (brine) table heated by the magma source through conduction, and from above by a zone of steam condensation. In the upper condensation zone, condensed steam loses some heat to overlying rocks before flowing back to the lower, hot water table. A proposed model of The Geysers explains the structural-fluid flow whereby steam boils off from a hot brine table to the northeast and flows up structure to the southwest through fracture networks in favorably-fracture graywacke thrust slabs. These slabs cover an extensive area and would be the host rock. Other slabs overlaying this may be acting locally as a reservoir cap. In areas where permeable, unsaturated rock is present at high levels, the steam gives up heat to the overlying rock, condenses and drains into unsaturated rock. In the northeasterly-trending anomalies such as Squaw Creek, Hot Springs Creek and Castle Rock Springs, some ascending steam may branch off at a lower structural level and flow through large, upward-spreading dissolution channels coincident with antithetic or extensional faults and fractures. Alternatively, steam may spread laterally through the same structures after reaching a higher structural level.

Reference Item 17.

Observation of Cobb Mountain area revealed that there was no surface

runoff...concluded that 95 percent of the 80 inches of annual precipitation on Cobb Mountain infiltrates into the volcanics...the combined flows from the springs along the flanks of Cobb Mountain are important because they supply the flow for Alder, Gunning, Anderson and Kelsey Creeks, Putah Creek and serve the communities of Cobb and Collayomi valleys for domestic water supplies.

Reference Item 18.

The source of fluid for the reservoir has not been clearly defined...the limited recharge to the reservoir occurs mostly through the porous rock on the flanks of Cobb Mountain.

Reference Item 19.

Hypothetical natural recharge for the southeast is Cobb Mt. but it has not been studied....The chemical patterns indicate lateral steam flow and condensation support the existence of a deep liquid-saturated layer in which condensate flows back to central boiling zones. With low liquid saturation this inward flow would be very slow, (possibly blocked by vapor-filled fractures) and probably could not maintain convection.

Reference Item 20.

Most rain falling on Franciscan rocks runs off and little infiltrates. In contract the dacite and rhyodacite of Cobb mountain are highly permeable, weather slowly and maintain open fractures. Little runoff is observed from Cobb Mountain and it has been estimated that 95% of the 200 cm average annual precipitation infiltrates into the volcanics...in the south, recharge is likely to have occurred from rainwater infiltrating the fractured Cobb Mountain volcanics and entering the reservoir from the side....therefore it is likely that recharge from Cobb enters the deep liquid zone rather than being directly connected to the steam reservoir.

Reference Item 21.

It seems reasonable to assume further that the source of recharge in the south is Cobb Mountain which has the required high infiltration and is nearly equidistant from each of the major upflow zones.

Reference Item 22.

In 1969, the tax court in Reich v Commissioner of IRS held that the natural steam at The Geysers qualified for a depletion allowance. The producers were also entitled to write off as expenses the intangible costs of drilling and developing The Geysers field. The court held that the geothermal steam in question is not ordinary ground steam that is fed by constant water seepage, which would make it inexhaustible and rather the judges reasoned, it is locked in closed spaces like natural gas and is not replenished by seepage. it was therefore held to be depletable and subject to the same tax treatment as natural gas with respect to depletion allowance. Under current tax laws, there is nothing to require that the resultant tax savings be reinvested in exploration and

development to ensure a continuing supply of the resource being depleted. At the time it was thought that future court challenges to the depletion allowance for geothermal resources were certain, but I know of none.

Reference Item 23.

Water infiltration to reservoir: Cool water drainage may also occur through several volcanic pipes in Cobb Mountain and through its very permeable volcanic rocks. Another possibly Quarternary fault to the northwest (Sec 36, T.12N., R.9W.) may also act as a drainage channel for descending cool water. Quarternary normal faults usually mark the outer boundaries of the productive steam areas and may help to limit lateral steam migration by acting as drainage channels to cool, meteoric waters and at deeper structural levels, to steam condensate.

Reference Item 24.

Geysers Unit 16 EIR, area of recharge is Collayomi Fault zone and Mt. Konocti.

Reference Item 25.

Within the reservoir, geothermal fluid at a typical temperature of 240 degrees Celcius may circulate through near-vertical faults and extensive networks for subhorizontal fractures in the graywacke. The brittle nature of the graywacke unit may allow for the existence of open fractures but relatively few steam-bearing, open fractures occur in the overlying rock.

Reference Item 26.

Groundwater flowing through rock may raise or lower rock temperatures. In the area of The Geysers, landslides, alluvium, Clear Lake Volcanic rocks, fractured chert and greenstone are susceptible to infiltration by groundwater. Graywacke at The Geysers appears to be free of flowing groundwater below a depth of 30 meters.

Reference Item 27.

Can the steam be derived entirely from ground water? The origin of the steam lies at a very considerable depth....it is difficult to conceive that a body of ground water of any magnitude can penetrate even a few hundred feet. Where cracks or seams exist, water will doubtless penetrate if the steam pressure it encounters is not prohibitive, but the water must be copious if it is to penetrate far in such seams without being again vaporized...where steam cannot find its way up, surely water cannot find its way down.

Reference Item 28.

Although studies carried out by several operators in The Geysers show that enhanced injection can improve field performance, implementation of augmented injection must proceed carefully and in stages, in order to avoid possible adverse impacts on field performance. Wells affected by breakthrough of water from nearby injection wells can "water out" (develop water-dominated rather than steam -dominated zones) This decreases well productivity and may make the well non-productive, causing loss of

steam supply.

Reference Item 29.

Another impediment to additional drilling at The Geysers is the lack of suitable sites for drilling pads. Because of its rugged and landslide prone topography, The Geysers area contains a limited number of suitable sites for drilling pads...NCPA have practically no potential sites left for building new drill pads.

Reference Item 30.

According to a heat flow mapping analysis, the areas of Power Plants 13 and 20 are in one of two of the highest heat flow areas in The Geysers. The lowest heat flow area has been identified as the area under Cobb Mountain which supports the hypothesis that Cobb Mountain may be the area of meteoric water downflow. (Meteoric as in related to the earth's atmosphere.)

Reference Item 31.

Castle Rock Springs A-CRS-5 well and Union U-71-8 well are located next to Power Plant # 13 and Power Plant # 20. The Castle Rock Springs well holds the record as of 1986 as the second highest heat flow rate and the Union well is the highest with a rate of 1938 mW/m2.

GDC 10 Well in Sec 29 T.11N., R.8W tested at 177,811 kg/hr (392,000 lb/hr), the highest flow rate in the field to date. The well may have penetrated one of the major steam conduits. (Just as in drilling a well, water is injected to "kill" it, perhaps injections at this point will serve to "kill" this area. This well is located in the immediate vicinity of PG& E plant # 20.)

Reference Item 32.

Pressure sinks have formed around the producing well areas, while other areas of the field remain at near-original pressures. Infill wells developed between surrounding producing wells have an interference effect.

Reference Item 33.

Since steam wells producing water are considered "noncommercial", no known history exists of long-term water production at The Geysers. Even so, persistent production of water would not be expected. In fact, well histories indicate that water encountered in the reservoir rocks by steam wells usually stops flowing into the well within a day or two of production...the southeast Geysers...and the low gas contents of steam in this area suggest that this part of the filed was the site of massive recharge to the system.

Reference Item 34.

The Geysers has undergone sever pressure decline in recent years...two different quantities of reinjection...but care must be taken in designing an injection scheme that avoids local quenching of the reservoir and/or premature breakthrough of the

injectate...given the lack of regular well spacing and the number of wells present it may not be possible to identify the optimum strategy...in the absence of fluid replacement, the reservoir is depleted in less than 15 years..

Reference Item 35.

Injecting 60% of the produced mass results in premature breakthrough of injectate resulting in a water out...it appears that reinjection 60% of the produced mass results in appreciable quenching, independent of the pattern used.

Reference Item 36.

Attenuation is the property of a material to dissipate the energy of a wave and is defined in the frequency domain as.....the data was collected by the Unocal NEC-Thermal U-N-T partnership....the low Q in the lower part of the reservoir suggests that the saturation is in the 30-70% range while saturation at the top of the reservoir could go up or down and still agree with the lab results.....the Q decreases with depth within the reservoir which we infer to indicate partial saturation (30-70%) at depth with drier conditions near the top of the reservoir...

Reference Item 37.

Data from injection experiments in the southeast Geysers show strong interference both negative and positive with neighboring wells...steam shortfalls have curtailed power generation and have emphasized the need to view injection not just as a means for condensate disposable but as a reservoir management tool for replenishing dwindling fluid reserves...recent injection experiments performed by NCPA in the Southeast Geysers have shown dramatic patterns of interference with production. during 1990 water was injected from one day to several weeks at rates of 200-600 gpm. Nearby production well responded to injection with rapid strong rate declines...

Reference Item 38.

....one of 34 injection wells used at The Geysers....also caused interference with Calpine well located approximately 984 feet due north. Initial effects were beneficial, increasing production rates, but later water breakthrough was observed.

Reference Item 39.

...so far all of our simulations have only been performed for one single injection cycle, interference effects and constraints from repetition of many cycles have not yet been explored...however, water breakthrough would have occurred if the production well had been placed at lower elevation, or if injection had been continued for longer periods of time...based on the foregoing, it is to be expected that each injection well has a limitation on the rate at which water can be injected without causing significant reservoir pressure decline and consequently negative interference with neighboring producers. Acceptable limits for injection rates may be difficult to predict...injection should not be concentrated into a few wells that would take up large rates

Reference Item 40.

Unit 13 - 2 injection wells...demonstrates that the recovery of injection derived steam is influenced by the geologic structure of the bottom of the reservoir and the relative location of the injection wells. The migration of the injectate from the first injection well, located up structure from the second, quenched the area around the second injection before it started operation.

Reference Item 41.

Constant pressure boundaries declining with time were used on the south and west sides of the model to mimic the effect of offset production due to Unit 16, Units 18 and Unit 20....the recovery of injection derived steam in the Unit 13 study area has had mixed results...the structure of the bottom of the reservoir can exert a great deal of influence on the direction the injectate travels.

Reference Item 42.

...about 20 to 25% of the mass extracted from the reservoir is currently being reinjected..however some Geysers operators have had mixed results. Even though the rate of reservoir pressure decline was reduced by water reinjection some wells started to produce a steam-water mixture...evidently all injection operations will have to be carefully designed to be able to recover most of the heat stored in the reservoir rocks and reduce possible negative effects on producing wells.

Reference Item 43.

...the fault it exits, instead of being an unimpeded passage to the depths is probably a zone or band of rock shattered by an irregular system of seams long enough and narrow enough to interpose a high resistance to the passage of gases....steam only increased when open fractures were encountered... figures prove that wells that emit the greatest quantities of steam do not necessarily possess the highest pressure...the increase of pressure everywhere with depth shows clearly that at the source, the pressure must be much higher than it is in any of the wells. Within the realm of laboratory experience, two gas reservoirs connected by even the finest capillaries cannot remain for any length of time at very different pressures, but where gases are forced to traverse fine tortuous seams for perhaps thousands of feet, the conditions obviously transcend any with which we are familiar...

Reference Item 44.

Union Oil Company will do well drilling and disposal of waste condensate for PG&E plants in Sections 4,5,6,7,8,9, T11N R8W and Section 36 T12N R9W. This area is within the Cache Creek drainage basin of which Clear Lake is a part and Cache Creek is a tributary to the Sacramento River...the disposal sites will be conditioned to meet the criteria contained in the Calf Administrative Code, Title 23, Chapter 3, Subchapter 15 for classification as a Class II-1 disposal site suitable to receive selected Group 1 and 2 wastes and Group 3 wastes...due to the topography, geology and weather conditions in the area, drill sites and waste sumps may be subject to failure resulting from erosion

and slippage which could result in discharge of waste to the waters of the state.

Reference Item 45.

Load following or the amount of electricity generated and therefore the amount of steam produced follows electricity demand. Less steam is withdrawn from the reservoir and less electricity is generated. This is a new option for the producers and in fact, load-following is excluded by PG&E (at the 1991 CEC hearing) because of difficulties in the practice when power plants and fields are operated by separate entities. NCPA however, is in a good position to use this option because they own and operate both the wellfield and the power plant.

Reference Item 46.

In the southern reservoir the initial presence of liquid water in matrix pres and small fractures provided a plentiful supply of low-gas steam to dilute the gas contained in the original vapor. The loss of this liquid in the late 1980's caused rapid declines in reservoir pressures and steam flow along with increases in gas concentrations. ...the high overall liquid saturation of this reservoir resulted in low gas steam as long as liquid was available, but liquid has declined recently and gas concentrations are rising (super-heated steam with less liquid holds greater concentrations of gas because it stays hotter and holds more in suspension)

Reference Item 47.

It is postulated that the northwest Geysers area evolved more slowly toward vapor-dominated conditions than other parts of the geothermal field because of its poor connection with the surface...the central and southeastern portion is a shallower, leaky and mature steam reservoir.

Reference Item 48.

In comparison to freshwater fish from other regions, those in the Geysers area show very high levels of the toxic elements mercury, lead, zinc and copper....The soil sedimentation and past mining activities increase metal burdens and leach trace elements into streams, and further that the venting of steam wells and mineral laden steam with atmospheric fallout from cooling towers into natural resources also contribute to the total or cumulative burden... the effect of lead on aquatic life is radically effected by water hardness which is not taken into context in the setting of EPA standards for domestic water supplies or for freshwater fish... the concern is that the threshold of tolerance for fish for toxins will be exceeded before that threshold can be determined.

Reference Item 49.

Union Oil Company has initiated a program to inspect all of their early wells after their well GDC 65-28 blew out in 1975...two other wells are sited in this same slide area and the nearest one, Little Geysers" 2 was plugged and abandoned with great difficulty...90 other wells are located on landslides....each wet winter season charges the

slopes and slides with high moisture and causes renewed slide activity. Each winter sees reactivation of old slides at The Geysers, and quite frequently the initiation of new ones. It is difficult if not impossible to predict ahead of time which slide will be the next to move.

Reference Item 50.

Graywacke,argillite, greenstone, chert and serpentinite are the dominate rock types found in the Franciscan bedrock in The Geysers...the nonreservoir rocks have low temperature, porosity and permeability and they overly the reservoir rocks which have high temperature, high fracture permeability and are saturated with water and steam. The transition between the nonreservoir and reservoir rocks is marked by a zone of nearly impermeable rock. This zone has been postulated by many to cap the reservoir and serve as a barrier to reservoir recharge. The low permeability may be a result of mineral deposition in the fractures

Reference Item 51.

...pure silica, the mineral quartz, is not very soluble in water. Even in a geothermal system only a small amount is actually dissolved. Yet enough must be brought to the surface to seal in the geysers, so the rock must be very rich in silica. The kind of volcanic rock that can provide enough silica is called rhyolite. As long as water stays at high temperature and pressure, the silica stays in solution, but when it flows through the more open pluming some silica is deposited along the way.

Appendix A to R

Item 1.
NEPA and Code of Federal Regulations, Title 40- Protection of Environment:

Section 1508.7 Cumulative Impact
"Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency or persons undertake such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Section 1508.27 Significantly

Relates to considerations of both context and intensity. Context is relational to the affected locale. Intensity is the level of severity. Significant impact is predicated on the projects effect on:
1. unique characteristics of the geographic area
2. the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
3. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in proinciple about a future consideration.
4. Whether the action is related ot other actions with individually insignificant but cumulately significant impacts.
5. The degree to which the action may adversely affect or may cause loss or destruction of significant scientific, cultural or historical resources.
6. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical.
7. Whether the action threatens a violation of Federal, State, local law or requirements imposed for the protection of the environment.

Item 2.
Clean Water Act :
defines a pollutant as sewage, industrial, municipal and agricultural waste discharged into water.

Item 3.
Federal Water Pollution Control Act Title 33 - Navigable waters Section 1298 (a)

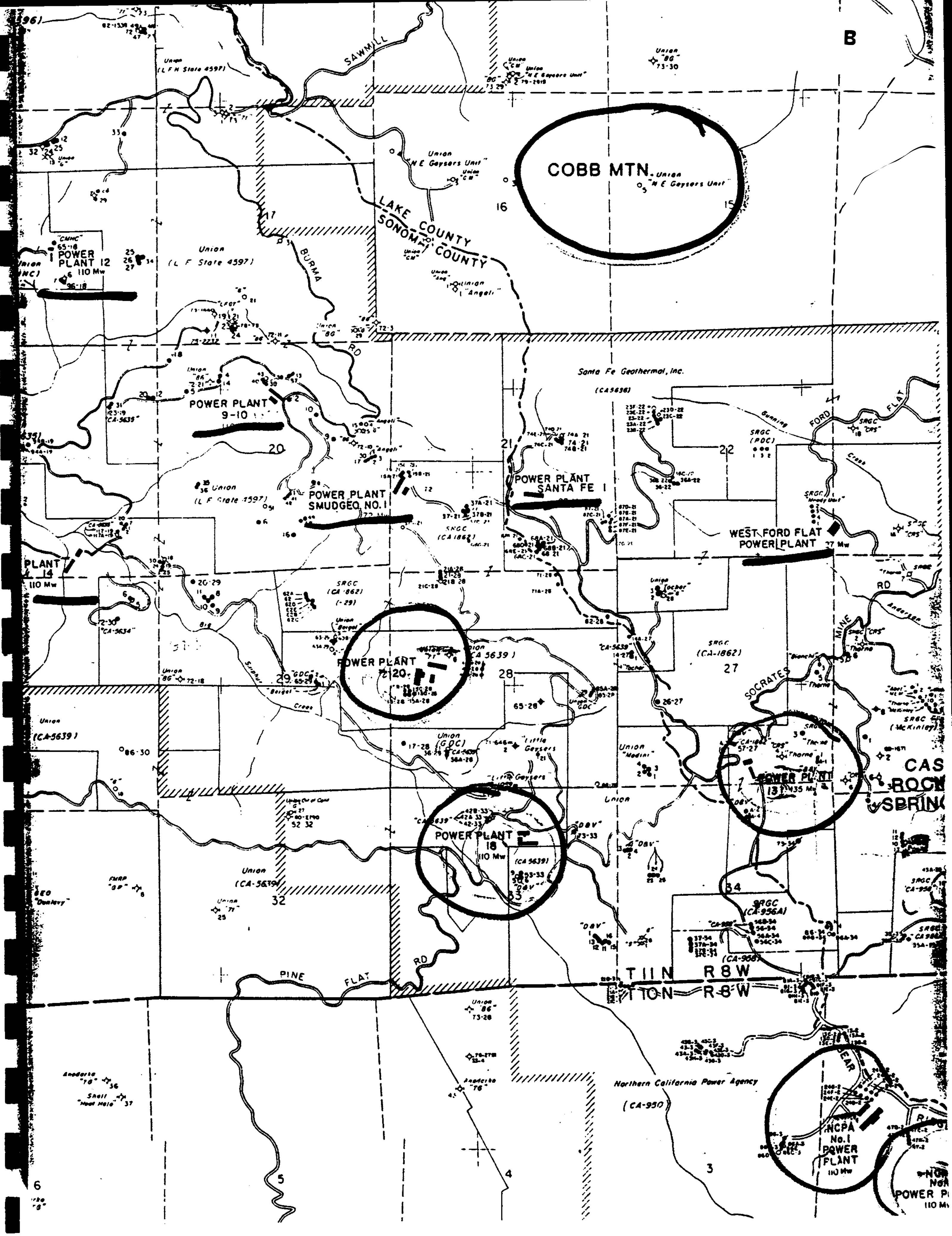
...Policy of Congress that a project for waste treatment and management undertaken with Federal financial assistance...shall be that system which constitutes the most econmical and cost-effective combination of devices and systems used in the storage, treatment, recycling and reclamation....or necessary to recycle or reuse water at the most economical cost over the estimated life of the works including intercepting sewers, outfall sewers, sewage collection systems, pumping power, other equipment and their appurtenances, extension, improvements, remodeling, additionas and alterations thereof; elements essential to provide a reliable reclyd supply such as a standby treatment unit and clear well facilities and any workings, including site acquistion of the land that will be an integral part of the treatment process (including land use for the storage of treated wastewater in land treatment systems prior to land applications)...construction costs, operation, maintenance and replacement costs.

1298 (c)(a) The Administrator shall require value engineering review in connection with any treatment works...prior to approval of any grant for the erection, building, acquisition,1 alteration, remodeling, improvement or extension of such treatment works...is projected to be in excess of $10,000,000..."value engineering review" means a specialized cost control technique which uses a systematic and creative approach to identify and to focus on unnecessarily high cost in a project in order to arrive at a cost saving without sacrificing the reliability or efficiency of the project.

Item 4.
Council on Environmental Quality Title 40- Protection of Environment Code of Federal Regulations 1502.22 (b)(3)
...When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement, and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking (b) If the information relevent to reasonably foreseable significant adverse impacts cannot be obtained...(3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment.

Section 1508.7 Cumulative impact is the impact on the environment which results from the incremental impact of the action when addded to past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or persons undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time.

Section 1508.27 defines Significantly (b) (3) Unique characteristics of the geographic area such as proximitiy to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas (5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks. (6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in priniciple about a future consideration. (7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or breaking it down into small component parts. (8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources. (9) The degree to which the actino may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.


B
COBB MTN.
Union "N E Geysers Unit"
LAKE COUNTY
SONOMA COUNTY
SAWMILL
BURMA
RD
Union (L F H State 4597)
Union (L F State 4597)
POWER PLANT 12
110 Mw
POWER PLANT 9-10
POWER PLANT SMUDGEO NO. 1
POWER PLANT SANTA FE 1
Santa Fe Geothermal, Inc.
(CA5636)
WEST FORD FLAT POWER PLANT
27 Mw
FORD FLAT
Gunning
Creek
SRGC (PDC)
PLANT 14
110 Mw
SRGC (CA 1862)
POWER PLANT 20
Union (CA 5639)
Big Sulphur Creek
Union "Little Geysers"
Union (CA-5639)
POWER PLANT 18
110 Mw
(CA 5639)
SRGC (CA-1862)
SOCRATES
MINE RD
Anderson
POWER PLANT 13
135 Mw
CAS ROCK SPRING
Union "Medini"
SRGC (CA-956A)
(CA-958)
PINE FLAT RD
T11N R8W
T10N R8W
Northern California Power Agency
(CA-950)
NCPA No. 1 POWER PLANT
110 Mw
POWER P
110 Mw
Anadarko "TG"
Shell "Heat Hole"
FMRP "GP"
GEO "Dunlevy"
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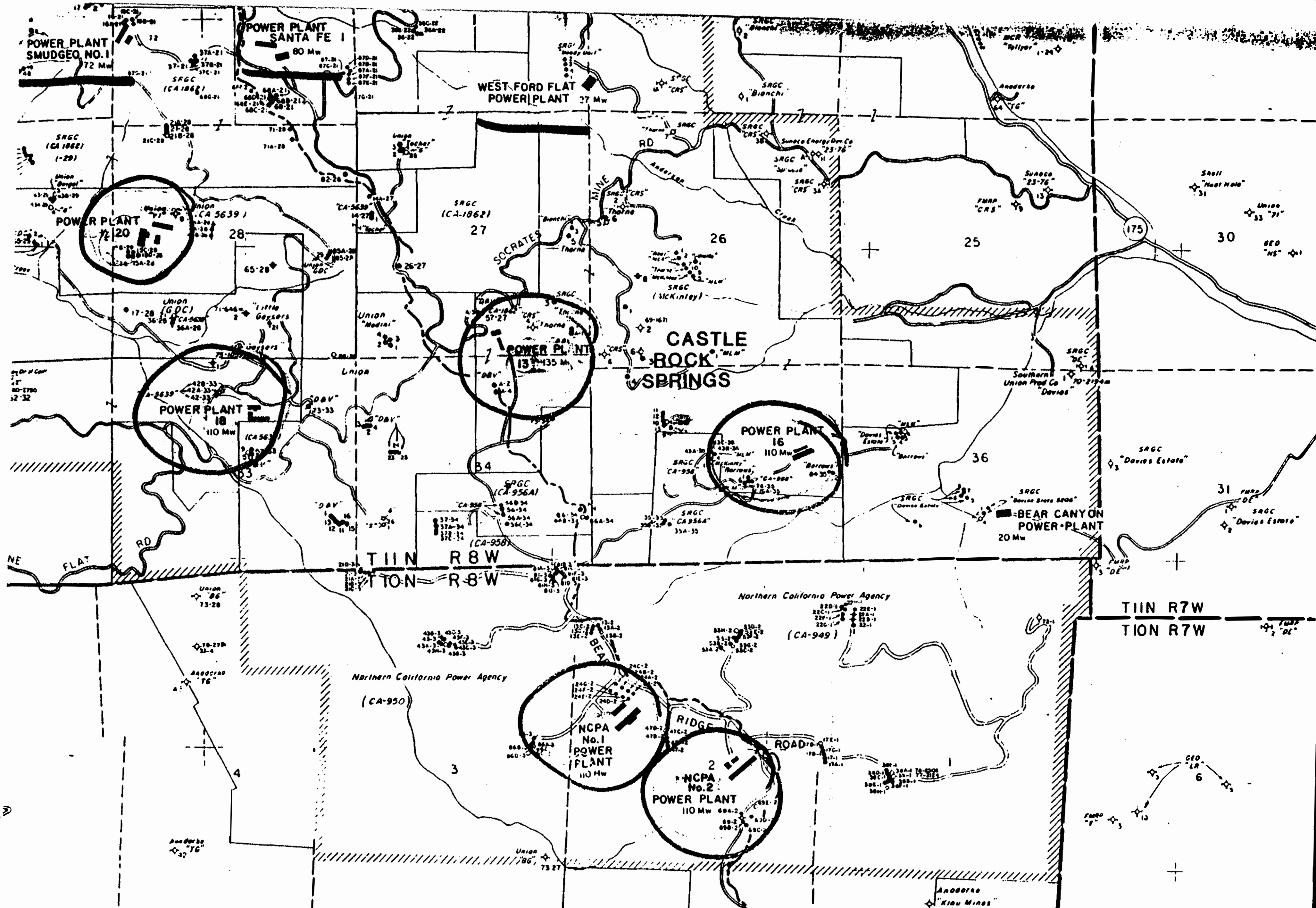

POWER PLANT SMUDGEO NO.1
72 Mw
POWER PLANT SANTA FE 1
80 Mw
WEST FORD FLAT POWER PLANT
27 Mw
POWER PLANT 20
POWER PLANT 18
110 Mw
POWER PLANT 13
135 Mw
CASTLE ROCK SPRINGS
POWER PLANT 16
110 Mw
BEAR CANYON POWER PLANT
20 Mw
NCPA No.1 POWER PLANT
110 Mw
NCPA No.2 POWER PLANT
110 Mw
T11N R8W
T10N R8W
T11N R7W
T10N R7W
SRGC
(CA 1862)
(CA-1862)
(CA 5639)
(CA-956A)
(CA-958)
SRGC CA 956A
(CA-950)
(CA-949)
Northern California Power Agency
SOCRATES
MINE
RD
Anderson Creek
BEAR RIDGE ROAD
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Union
Sunoco Energy Dev Co
Southern Union Prod Co "Davies"
Anadarko "Kiau Mines"

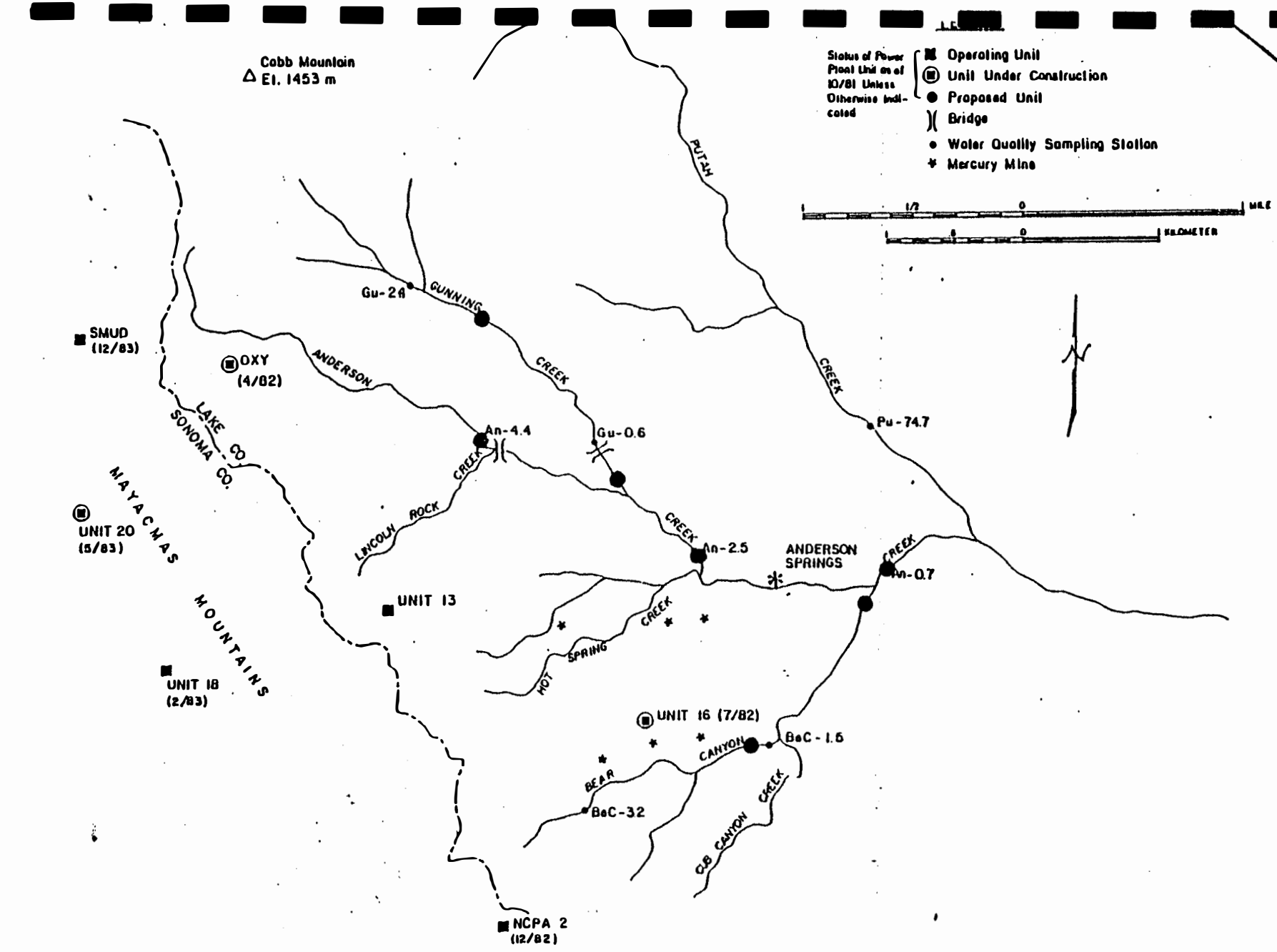


Figure 2. Sample station locations (large solid circles) on Anderson, Gunning and Bear Canyon creeks, superimposed on KGRA-ARM map (McMillan, 1985).

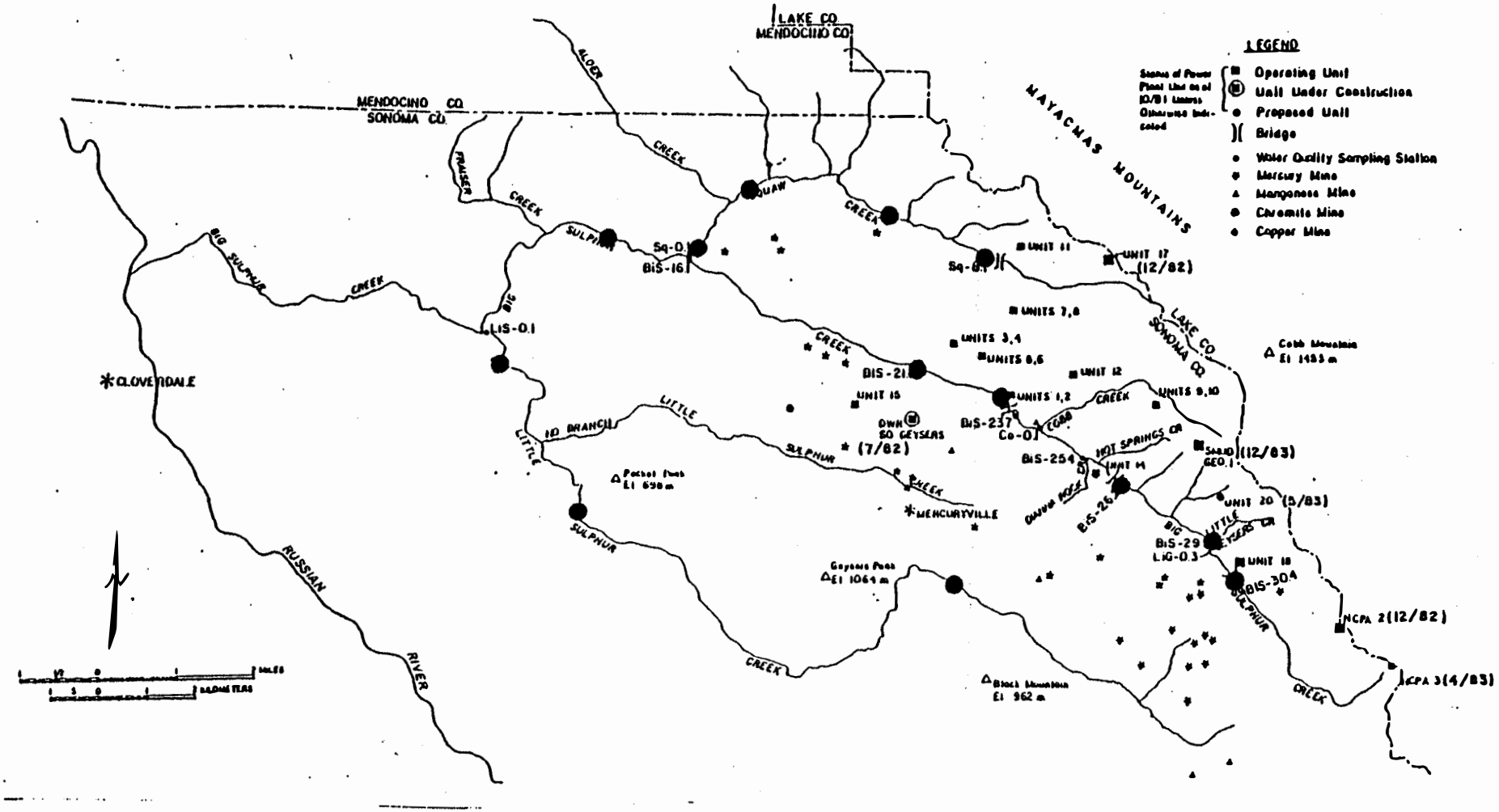
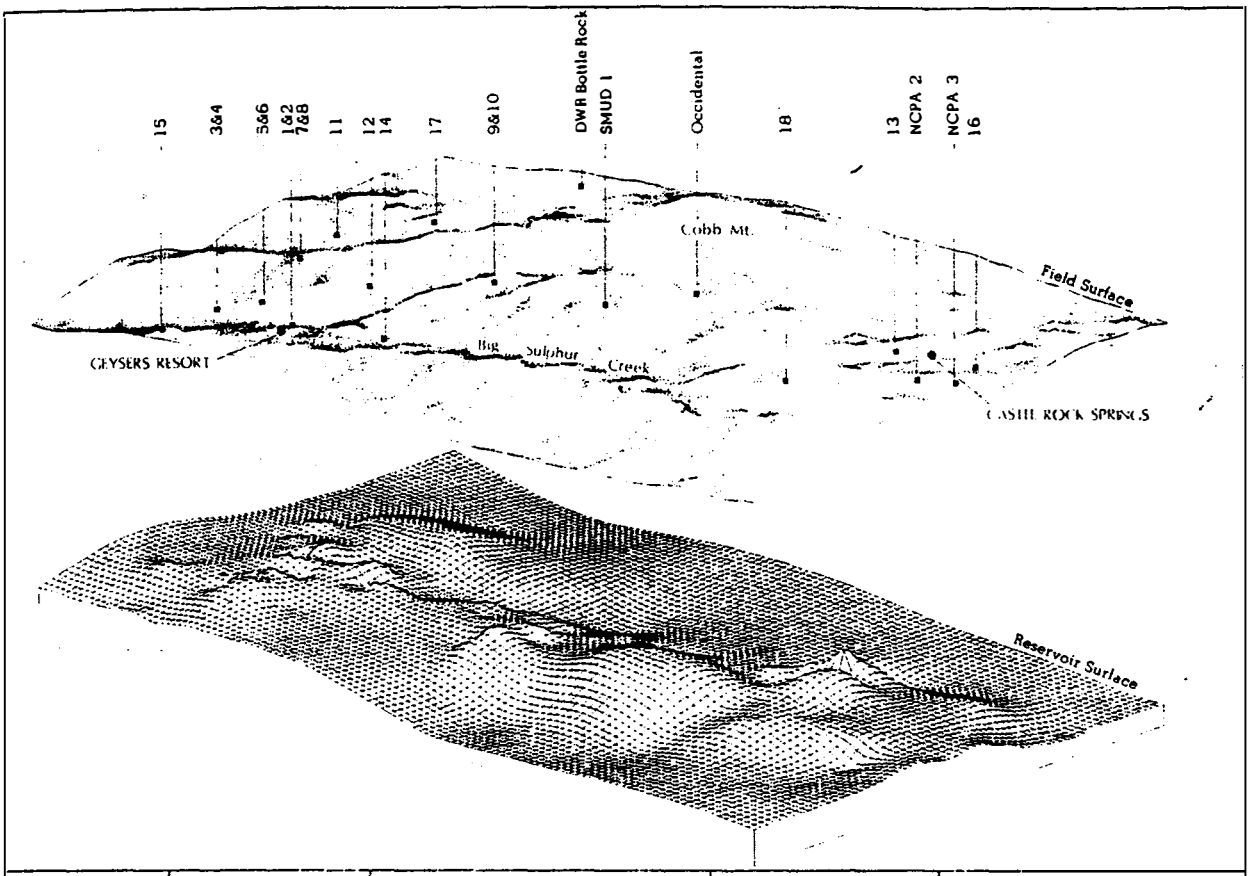


Figure 1. Sample station locations (large solid circles) on Big Sulphur, Little Sulphur and Squaw Creeks, superimposed on KGRA-ARM map (McMillan, 1985).

Table 1. Power plants, under operation and projected for completion, The Geysers Geothermal field. Field surface depicted above the reservoir surface, represented by a computerized grid: Views are to the north from 20° above the horizon. Vertical separation between the surfaces is greatly exaggerated. Computer plotting courtesy of the U.S. Geological Survey.



Unit No.	Date on Line	Operator	Generating Capacity (MWe)	Cumulative Field Generating Capacity (MWe)
(a)PG&E 1	September '60	Magma-Thermal Power Co.(b)	12	12
PG&E 2	March '63	Magma-Thermal Power Co.(b)	14	26
PG&E 3	April '67	Union Oil Co. of CA	27	53
PG&E 4	November '68	Union Oil Co. of CA	27	80
PG&E 5 & 6	December '71	Union Oil Co. of CA	55/55	190
PG&E 7 & 8	Aug. / Nov. '72	Union Oil Co. of CA	55/55	300
PG&E 9 & 10	Aug. / Nov. '72	Union Oil Co. of CA	55/55	410
PG&E 11	May '75	Union Oil Co. of CA	110	520
PG&E 12	March '79	Union Oil Co. of CA	110	630
PG&E 15	June '79	Thermogenics, Inc.	55	685
PG&E 13	May '80	Aminoil USA, Inc.	135	820
PG&E 14	September '80	Union Oil Co. of CA	110	930
(c) NCPA 2	Proj. March '82	Shell Oil Co.	110	1040
PG&E 17	Proj. August '82	Union Oil Co. of CA	110	1150
PG&E 18	Proj. October '82	Union Oil Co. of CA	110	1260
PG&E 16	Proj. November '83	Aminoil USA, Inc.	110	1370
(d) SMUD 1	Proj. December '83	Aminoil USA, Inc.	65	1435
(e) DWR Bottle Rock	Proj. April '84	MCR Geothermal Corp.	55	1490
(f) Occidental	Proj. ? '84	Occidental	80	1570
NCPA 3	Proj. ? '85	Shell Oil Co.	55	1625

(a) Pacific Gas and Electric Company.
(b) Union Oil Co. of Calif. entered into a joint ownership with Magma-Thermal Power Company in 1967.
(c) Northern California Power Agency.
(d) Sacramento Municipal Utility District.
(e) State of California, Department of Water Resources.
(f) Occidental Petroleum Company.

Geysers Aerial Photo

The image of The Geysers Geothermal field was sensed May 17, 1984, by an U-2 aircraft operated out of Ames Laboratory (NASA contractor), using the Daedalus Thematic Mapper Simulator. The system records solar reflectance in 12 spectral channels or bands ranging from Ultraviolet through visible, and near Infrared to Thermal Infrared (heat, bands 11 and 12). As banks 11 and 12 cover the same wavelength and differ only in amplification, the lower-gain band 11 was eliminated. The field was sensed from 65,000 feet altitude at about 9:00 a.m.

We analyzed the resulting Ames data in the Digital Image Analysis Laboratory of the Kodak Remote Sensing Company (formerly of General Electric Space Division) in Landover, Maryland, using the Interactive Multispectral Analyzer (IMAGE-100) developed by General Electric Co. We produced 157 spectrally different enhancements by combining the 11 bands in different ways.

This enhancement combines bands 10, 9, and 8, assigned to blue, green, and red, respectively. (The original photo is in color.) Band 10 covers 2.08 - 2.35 microns wavelength in the near Infrared and favors ultramafic rocks such as serpentinite, and less so some mafic rocks such as basalt or diabase. Band 9 covers the spectrum from 1.55 - 1.75 microns and modestly favors hydrothermally altered rocks. Band 8 covers 0.91 - 1.05 microns and does not portray any common rock or vegetation. However, it favors hydrated evaporite salts and highlights fairly faithfully the area of the steam field.

Caption and photo are courtesy of John W. Gabelman & Associates, Inc., 23 Portland Court, Danville, CA 94526. Phone (415) 837-5989.

Big Sulfur - follows forest line

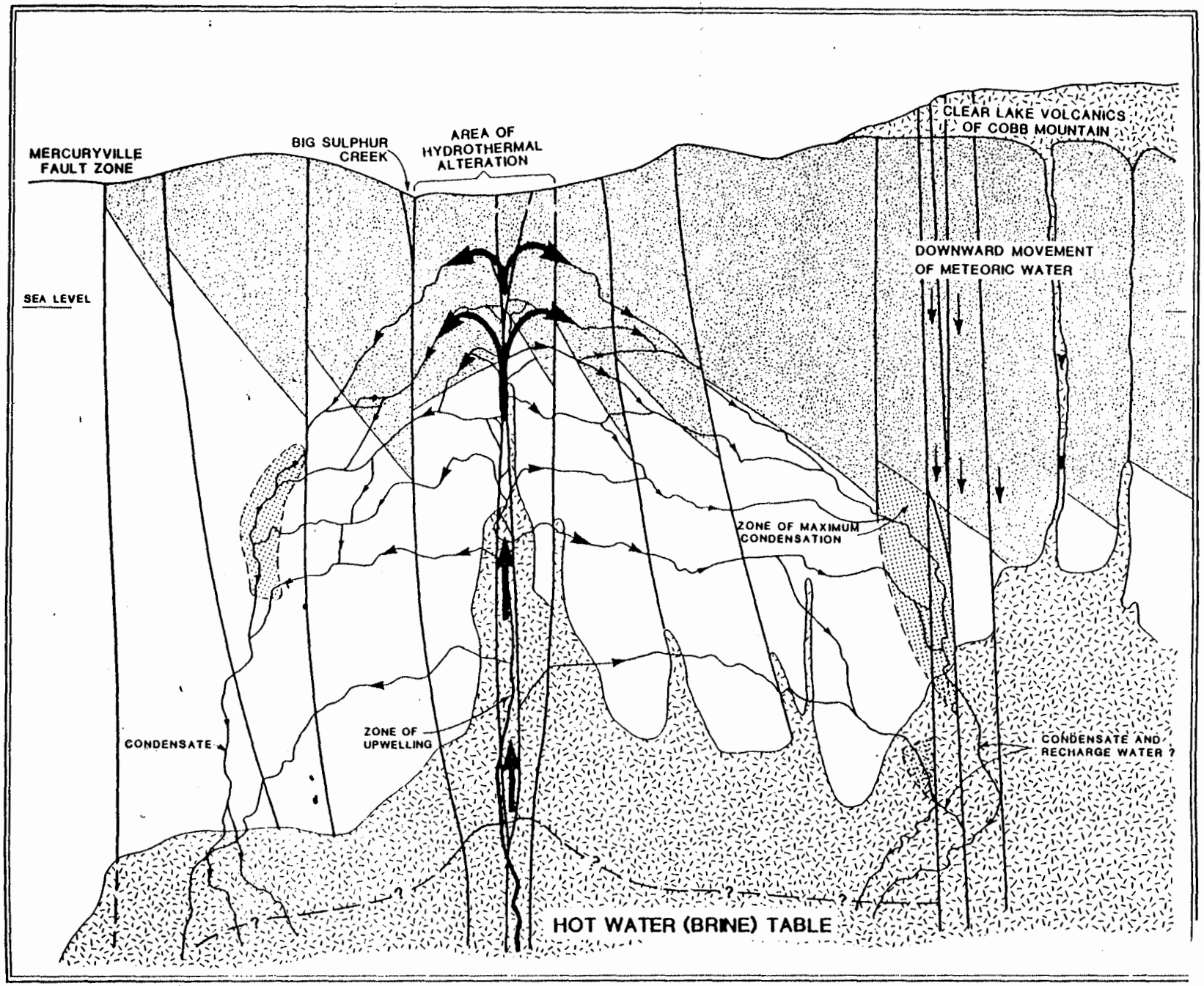


Figure 6. Schematicized cross section of The Geysers Geothermal field, showing the inferred relationship of geologic structure to hydrothermal fluid flow. California Division of Oil and Gas. Richard P. Thomas, 1981.

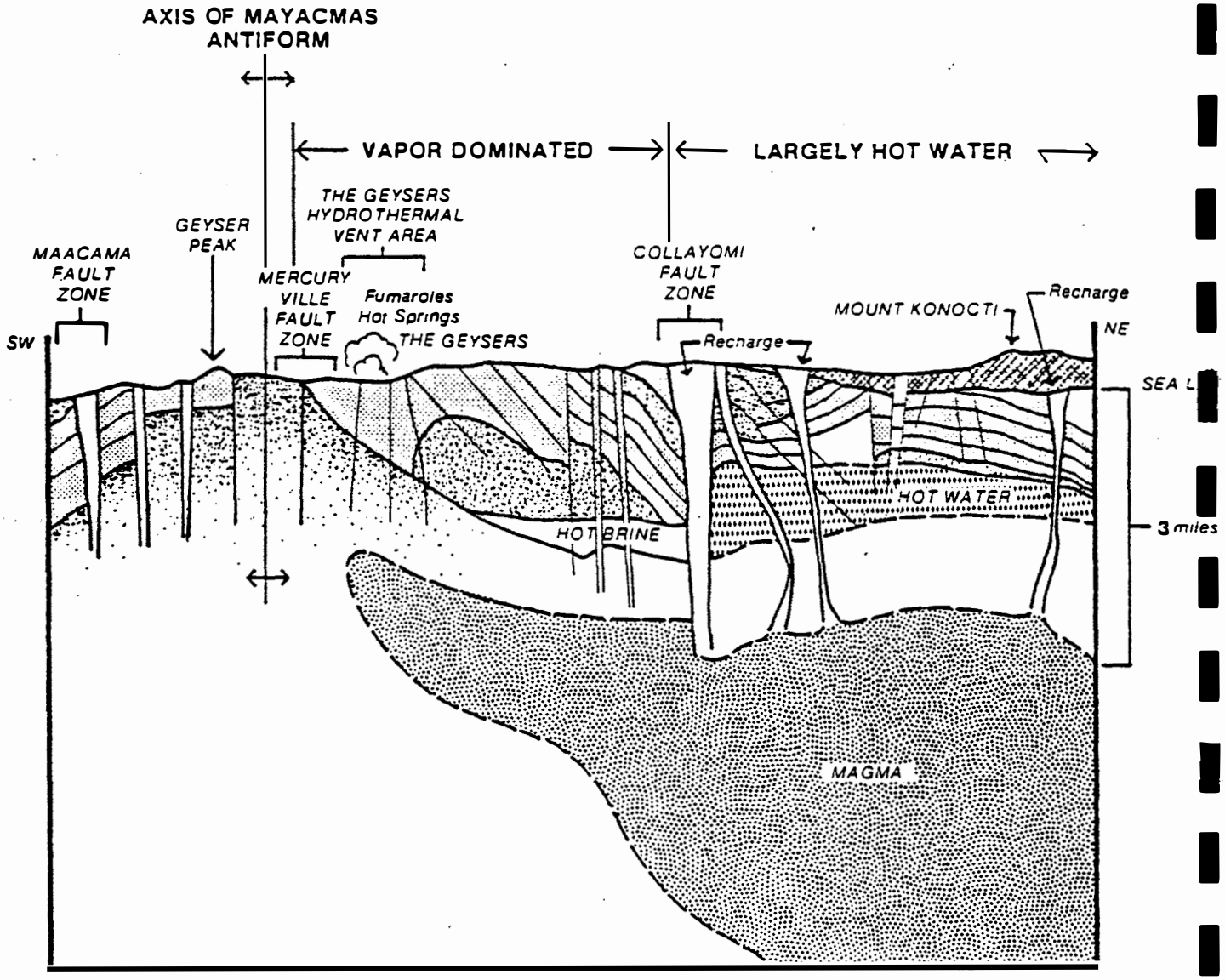


Figure 13 CROSS SECTION THROUGH THE GEYSERS — CLEAR LAKE REGION

- Impermeable cap rocks (Serpetinite, greenstone, melange, metagraywacke)
- Fracture networks in graywacke reservoir rocks
- Clear Lake Volcanics and associated vents providing recharge to geothermal system
- Partially crystallized magma body inferred to be at depth with center below 3 miles (4 KM)
- Water vapor in steam reservoir above boiling water table
- Hot water

Structural model for the Geysers geothermal system. Cross-section through The Geysers-Clear Lake region, from the Maacama fault zone on the southwest, to Mount Knocti on the northeast, depicting structural elements of The Geysers-Clear Lake geothermal system.

Source: "Field-trip Guidebook Castle Steam Field, Great Valley Sequence." April 29, 1978, 53rd Annual Meeting, Pacific Sections AAPG, SEPM, SEG. Modified by the California Energy Commission, February, 1979.

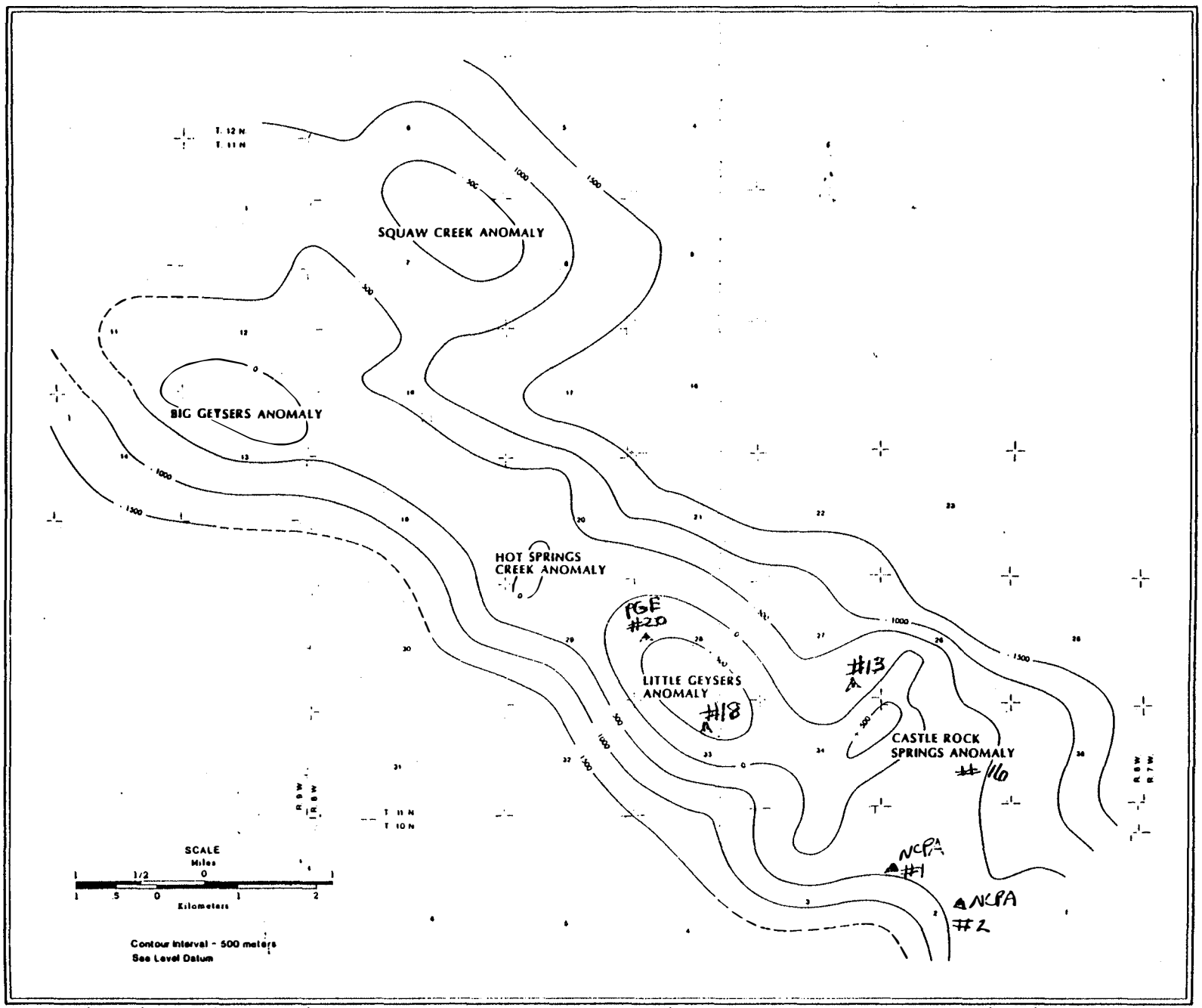


Figure 4. Idealized map of first reported steam entries at The Geysers Geothermal field. First steam entry major anomalies are indicated. Contours are in meters. California Division of Oil and Gas. Richard P. Thomas, 1981.

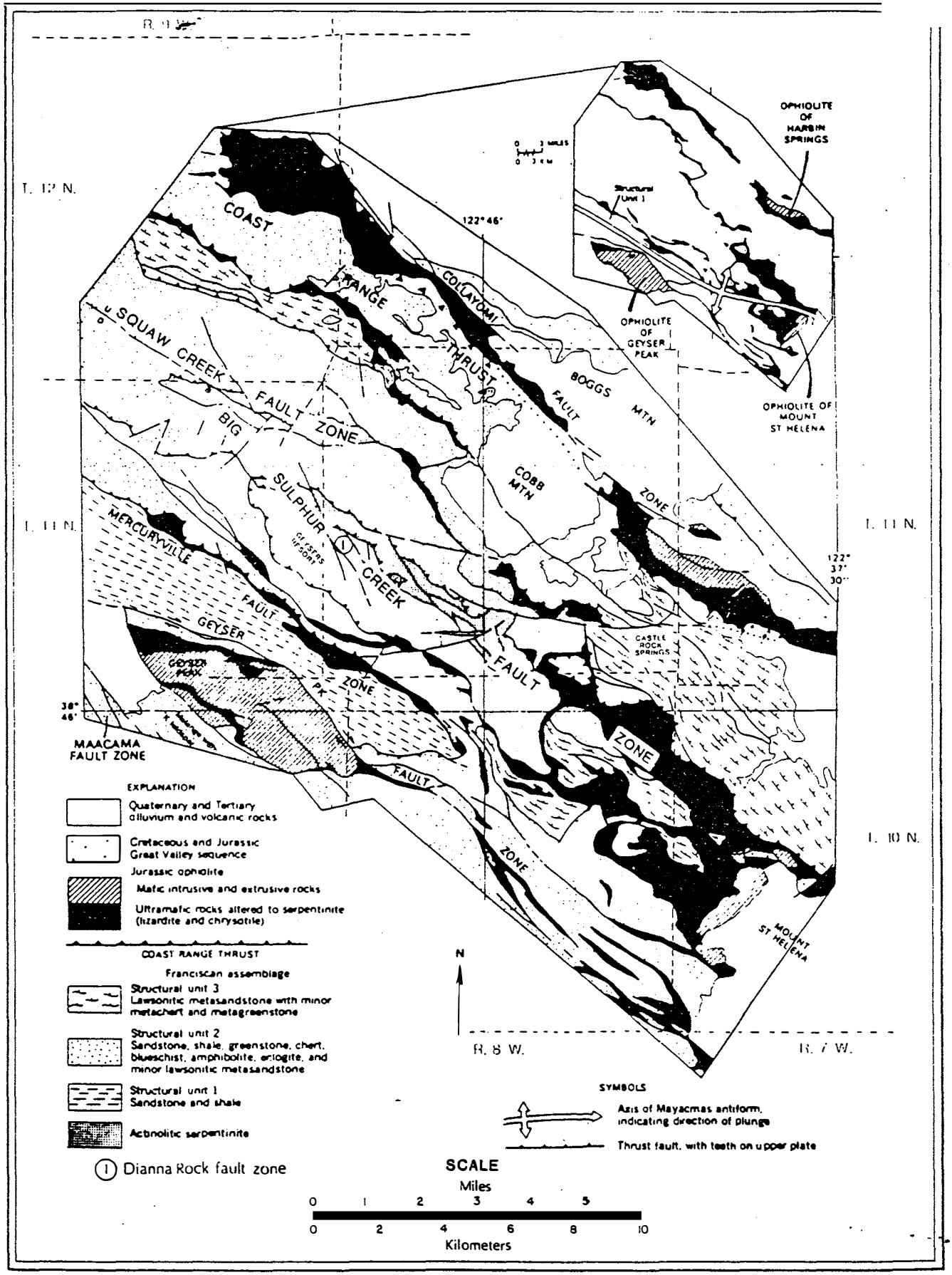


Figure 2. Generalized geologic map of The Geysers Geothermal field and vicinity showing structural units and major fault zones (after McLaughlin, 1977).

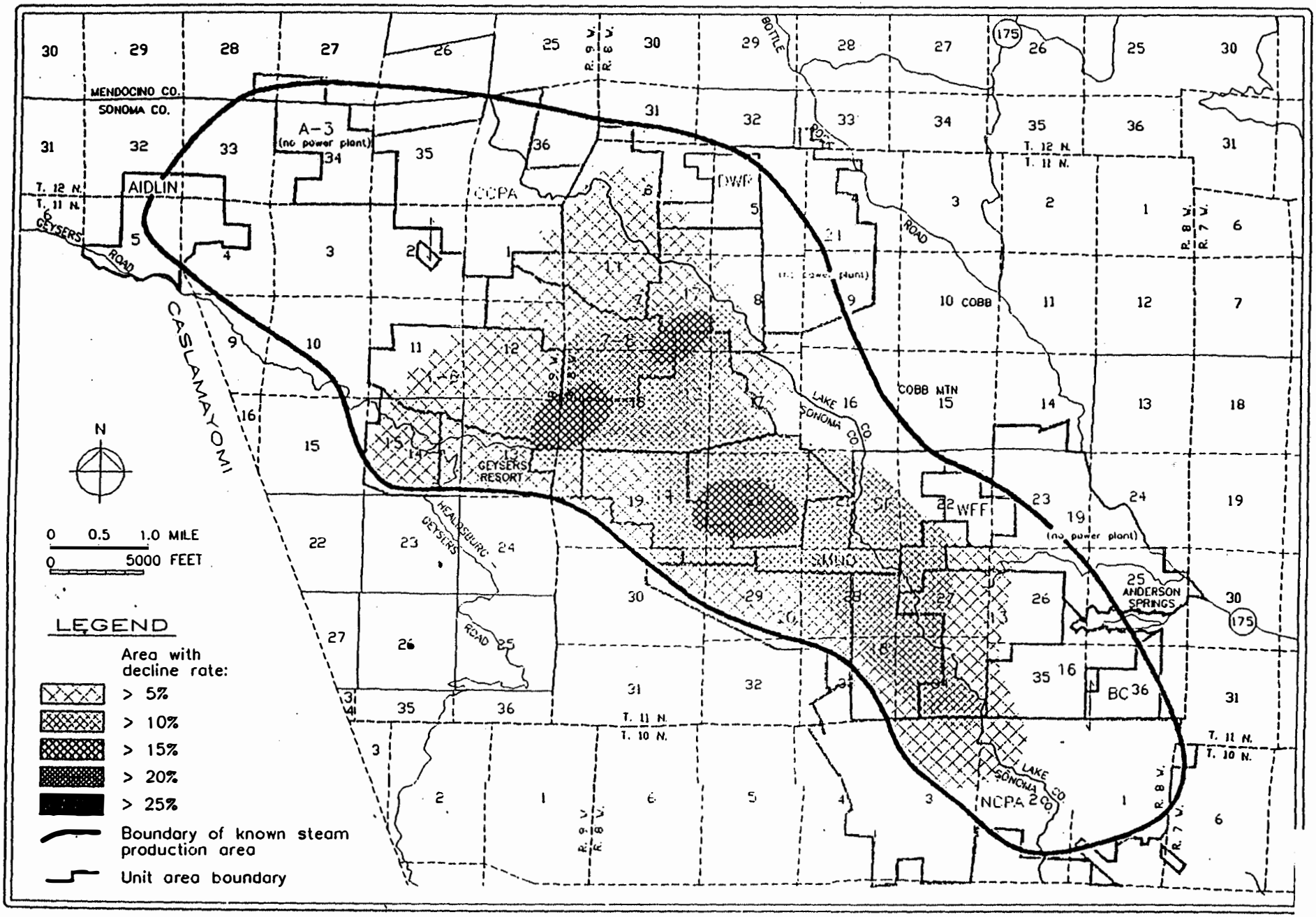


Figure 4.11 Generalized exponential decline rates (c. 1985)

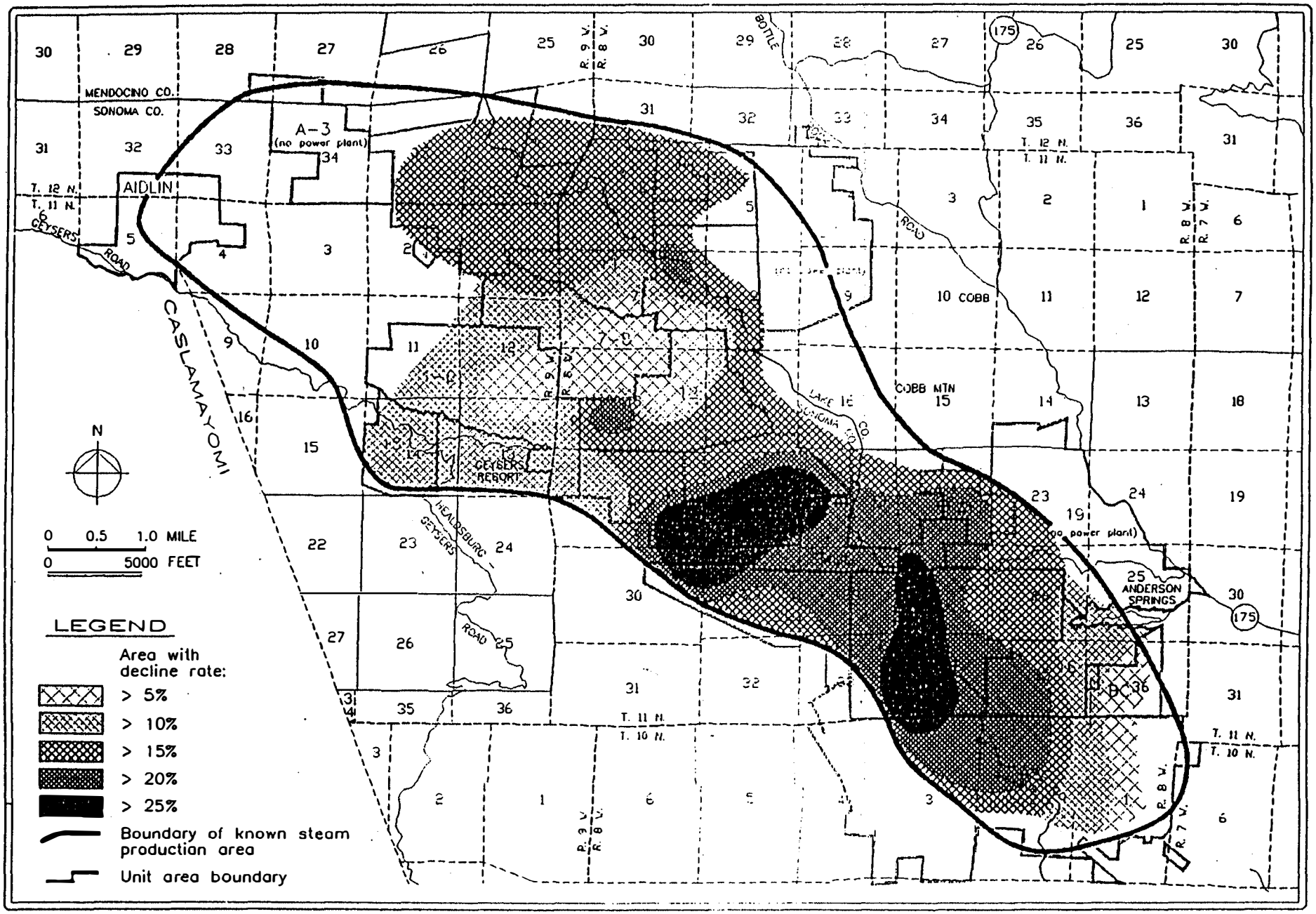


Figure 4.12 Generalized exponential decline rates (c. 1990)

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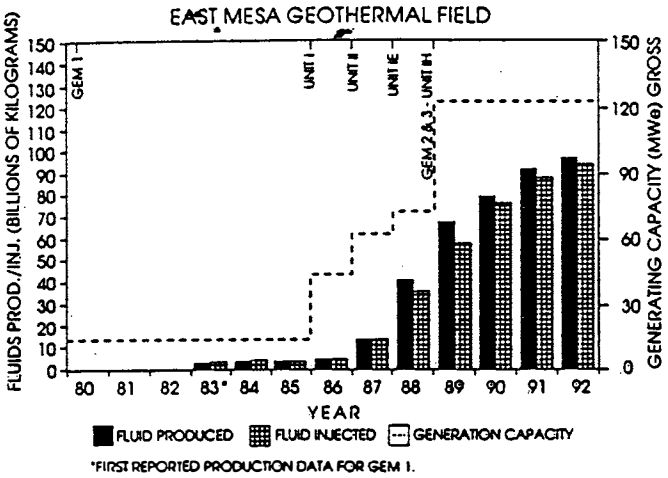
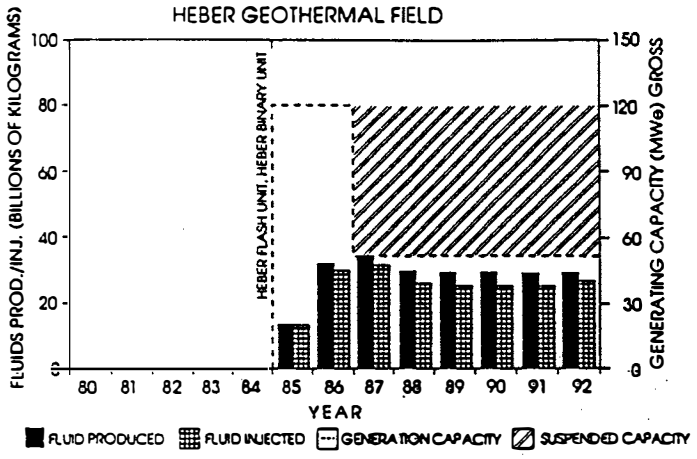
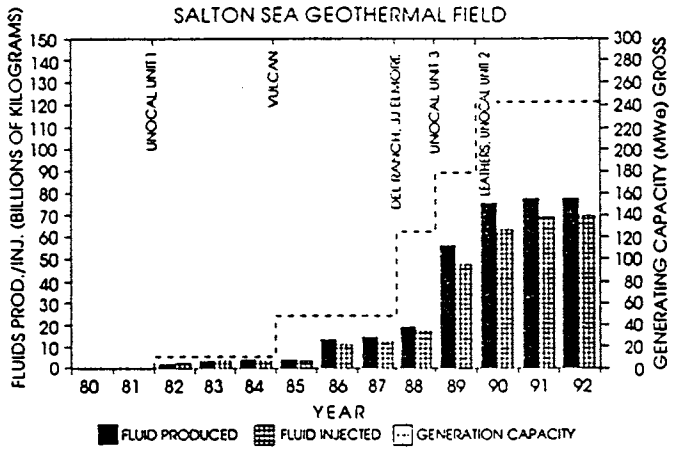
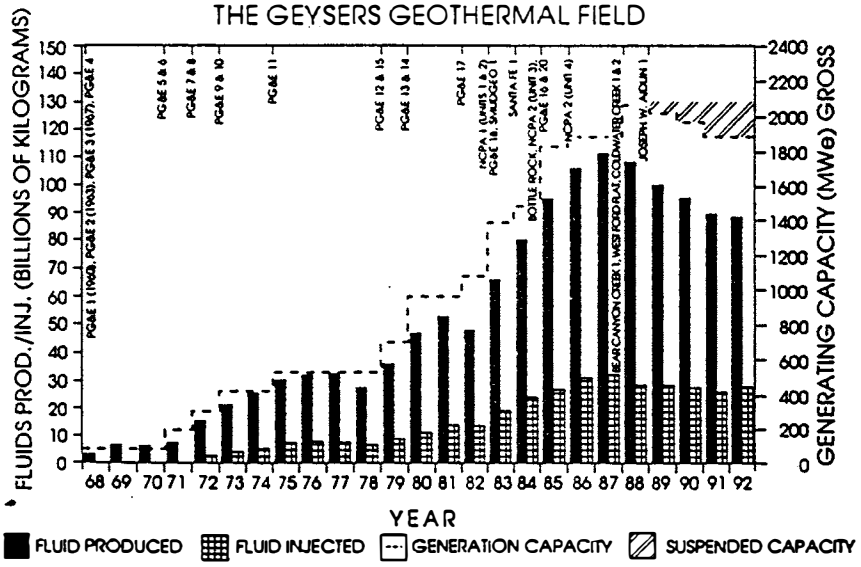


*FIRST REPORTED PRODUCTION DATA FOR GEM 1.





DISTRICT NO. G3



Adopted December 12, 1980
Amended June 24, 1992

STATE WATER RESOURCES CONTROL BOARD
DIVISION OF WATER RIGHTS

OUTLINE FOR ENVIRONMENTAL IMPACT REPORTS INVOLVING WATER DEVELOPMENT

I. Description of Project

A. General

Describe the relationships of the project to the surrounding area. Provide a clear background for determining the effects of the project on the area. Describe the whole action; individual components of an interrelated, overall project should not be separated and considered as individual projects. All phases of the project which may have an effect upon the environment, such as land acquisition, site preparation, construction and operation, should be described.

B. Detailed Description

1. The Location and Project Boundaries. The project site and regional area should be delineated on maps. The hydrologic basin should be described as well as other nearby water sources which are related or could be affected by the project.

2. The Objective, Need and Justification for the Project. Describe the objective of the project. Do not use the preferred, structural alternative as the objective. Rather, describe the project objective in general terms of what goal the project is to accomplish. For example, the objective of a project might be to establish water supply for a community from 1990 to 2010. The selected alternative could be to enlarge a reservoir to 50,000 acre-feet and enact water conservation ordinances throughout the community. Describing the objectives of the projects allows better development and analysis of alternatives.

   a. State the need for the project and provide detailed justification of the amounts of water requested. Give all the assumptions used in calculating and predicting water consumption or use, and in predicting the amounts and timing of water demand buildup. Describe trends and water usage patterns utilized or not utilized in the analysis.

   b. Indicate whether the proposed quantities of water include a full commitment to water conservation, and if not, include a discussion of how water conservation would affect the quantities of water involved in the project.

c. Demonstrate that the requested quantity of water corresponds to the intended use. Carefully describe the service area, acreage to be irrigated, population to be served, or amount of power to be generated and show that the amount of water requested is not in excess of what is required.

d. Show that the demand or need for the benefits to be derived from the use of the water currently exist or will exist during the project life and that the schedule for implementation of the project is consistent with the need.

e. For power generation projects, indicate what demand forecasts are used (utility, energy commission, etc.). Discuss the assumptions concerning the timing of energy demand. Provide a net energy analysis; include deductions of construction energy requirements, transmission losses, operation and maintenance energy requirements, energy produced by older projects that would be inundated by the proposed project, and energy required for water or wastewater treatment. Identify and describe the energy service area, compare the project energy output to the total service area and statewide demand to show perspective. Show that the proposed energy supply matches the service area utility's load curve.

f. Show that the proposed agricultural use of water is consistent with the availability of suitable irrigable land with adequate soil and drainage.

g. Discuss market trends for crops grown in the service area and whether these market trends will support agriculture's ability to pay for their appropriate share of the project cost.

3. The Technical Design and Operation of the Project. Describe the entire project. All project facilities, such as future water supply and development plans, water and electrical distribution systems and corridors, water treatment facilities, wastewater treatment and disposal projects should be described. The operation of the project should be discussed in detail. This should include seasons and amounts of water diversion, amount of water to be left in the source for instream uses, and dry-year contingency plans. An operation study should be included for large reservoir projects.

4. Conservation Measures. Describe in detail measures which will be implemented to reduce energy and water consumption. Describe any reuse of water. Efficient use of the resources must be demonstrated.

   a. The amount of saving or reuse should be described.

b. Discuss the efficiency of the water and energy consuming equipment or processes to be used during construction and operation of the project.

c. Discuss economics of conservation measures taken or not taken. Compare the costs of the new increment of water or power supply resulting from the project to conservation alternatives for equivalent increments (rather than using a melded cost which averages in older, existing, cheaper facilities).

d. If water is to be sold, the pricing structure should be discussed. The impact of the pricing structure on the quantity of water used and the implications to conservation should be explained. Indicate possible conservation measures which could increase the efficiency of water use.

5. The Regulatory Framework. All permit requirements of governmental agencies should be described, including construction, operation and reclamation authorities.

6. Economics. Describe the economics and financing of the entire project.

a. Discuss the project schedule, including all permit approvals, draft and final environmental documents, final design, construction and filling of reservoir. Estimate when the project will be operational and the expected project life. Indicate what inflation, bond, and discount rates were used in the economic analysis and comment on why the figures were chosen and if they are consistent with probable future rates.

b. Identify the groups that will accrue benefits and the groups that will lose benefits from the project; use; and quantify the benefits. Discuss subsidies in the project. Are power sales subsidizing water and power buyers? Will any tax or non-project revenue be used to pay for project features, distribution system or mitigation? Will any subsidies have a discouraging effect on conservation measures?

c. List all costs of the project. These include costs of project planning and construction, land acquisition, relocation, water distribution and power transmission (and energy requirements thereof), water treatment and wastewater treatment and disposal (and energy requirements thereof), mitigation for primary and secondary impacts, costs for providing governmental services (police, fire, school, recreation, social services, transportation, etc.) to construction workers and future recipients of any new water supply and compensation costs of any old power or other

projects removed from service by the project. Discuss possible unexpected costs due to delays in approvals, previously unidentified mitigation measures such as archeological site preservation, strikes, adverse weather, unexpected construction conditions and any design changes and comment on the availability of contingency funds.

d. Discuss tax revenues foregone because of the project. Identify taxes foregone such as property taxes on government purchased facilities and land, State and Federal taxes foregone if the project is publicly owned rather than privately owned, and taxes or fees on production such as timber taxes or grazing fees which will be lost because of the project.

e. Describe project benefits. Discuss the benefits realistically (e.g., consider the period required for filling a large reservoir before benefits would accrue). Do not inflate benefits (e.g., consider water required for streamflow maintenance at its own unit value, not at a higher value that might be assigned to other project water).

Describe other values involved in the project and discuss their economic impact to the project. These include proximity of the project to population centers, accessibility to the project area, scarcity of the resources involved in the project, bequeathing (leaving for future generation) resources affected by the project, and open space values.

II. The Environmental Setting

A. General

The social, economic and environmental setting of the area is important for the decisionmaker and the public and should be described. The environmental setting is the starting point from which forecasts of the environmental impact of the proposed action must be made. The same categories used to describe the environmental setting should be used to describe the environmental impacts after implementing the project. While the focus should be on the immediate area, parts of the surrounding area should also be included, where appropriate, to avoid overlooking any important interbasin or regional impacts.

B. Detailed Description

The environmental description should include the following items. In many instances certain of these items will not be relevant to the project or the decisions to be made, and they can be covered by a very brief description.

1. Climate

Describe the climate for the general area including temperature, precipitation, humidity, and wind direction and velocity. Describe any topographic features which influence the weather.

2. Topography

Describe the topography of the area delineating the major and minor drainage basins along with their characteristics such as areas, slope, elevation, natural and artificial drainage nets, erosion and deposition.

3. Geology

Describe the geology of the area. Geologic structures or formations that have a direct influence on either groundwater or surface water should be mentioned. Areas which are susceptible to earthquakes, landslides or subsidence should be located on a map and described. Seismic effect on the project should be discussed.

4. Soils

Identify area soil types and their permeability, erosion potential, expansion and compaction characteristics. If agricultural use is involved, describe the area and whether it has suitable irrigable soil and adequate drainage.

5. Hydrology (Water)

a. General

Describe surface water and groundwater resources in the area.

b. Water Quality

Describe the existing surface and groundwater quality using physical, chemical and biological parameters.

c. Water Quantity

Describe the existing surface and groundwater quantities and relate to water uses in Section e below. Discuss stream flow rates by season giving normal rates and maximum and minimum rates during very wet and very dry years. If groundwater is involved, give pertinent facts on aquifer storage, safe yield (if known), depth to water, recharge rate and overdraft, if any. Recharge areas should be identified. Structures influencing stream flow should be located on an area map.

d. Water Quality and Quantity Problems

Identify existing and potential water quality and quantity problems. Address specifically any point and non-point sources of pollution arising from industry, municipalities, agriculture, mines or saltwater intrusion.

e. Water Uses

Describe existing and probable future surface and groundwater uses. Recreation use, use by wildlife and instream use by fish and riparian plants should be described. Describe any possible reuse or reclamation of water. Fully describe the water service area. Indicate any factors peculiar to the service area which affect water usage. Compare proposed water usage in the service area to water usage statewide, to show perspective. Discuss trends, such as the increasing ratio of multi-family to single-family housing.

f. Water Quality Management

Describe or reference all areawide or basin water quality management plans, court ordered allotments or interstate compacts involving water quality/quantity in the project area.

Identify any State Water Resources Control Board or Regional Water Quality Control Board permits or orders concerning water quality.

g. Flood Hazards

Indicate the 25, 50 and 100-year flood levels for the area. Identify any flood-plain plan or proposed project.

6. Biology

a. Describe type and intensity of natural and man-made vegetative coverage.

b. Indicate those plant and animal species in the area which have been designated rare or endangered by State or Federal agencies.

c. Quantitatively describe wildlife and fishery resources in the area.

d. Describe wildlife habitat (or portion thereof) which might be affected by the project.

7. Identification of Significant, Environmental Sensitive Areas

Identify and show on a map, if possible, any of the following which may be significantly impacted by the proposed action, and which are not described elsewhere in this chapter:

a. Marshland, wetlands, and estuaries.

b. Flood plains or flood-retention areas.

c. Groundwater recharge areas.

d. Steeply sloping lands.

e. Forests and woodlands.

f. Prime agricultural lands.

g. Habitats of rare and endangered species.

h. Public outdoor recreation areas, including but not limited to specified boatable sections of the affected waterway.

i. Sensitive geologic areas.

j. Archeological and historical sites.

8. Land Uses

The following items should be discussed if undeveloped areas may be affected.

a. If available, include a map showing existing land uses such as residential, transportation, utilities, institutional, open space and outdoor recreation, agricultural, forest land, water, archeological, historic and other points of interest.

b. Describe current land use planning by all levels of government.

c. Describe the administrative and regulatory land use controls now in effect.

d. Describe development trends for the industrial, agricultural, commercial, residential sectors--especially those near bodies of water. Describe any aspects of these trends which might threaten water quality or bring about other environmental problems.

9. Air Quality

If pertinent, discuss the major factors directly affecting air quality. Include the current and anticipated future air quality in the project area.

10. Population Projections and Economic Forecasts

Describe the current and projected population levels and current and projected future economic development. The reasons for using a particular projection or forecast should be briefly stated.

11. Energy

If power generation or a large power consumption is involved in the proposed project, describe existing energy supplies and energy use patterns in the region and locality. Describe any energy conservation program which has been implemented and the amount of energy savings realized.

12. Other Programs in the Area

Describe any significant local, State or Federal project in the area which will interact with the proposed water development. Discuss the interaction.

13. Aesthetics

Describe the area's general aesthetic quality. Where appropriate, discuss noise levels and man-made objects.

III. Environmental Impacts

A. General

Impacts should be discussed in relation to those items included in the project description and environmental setting sections. Environmental effects from construction activities, as well as the project operation, must be discussed. This section should discuss direct and indirect (primary and secondary) impacts of normal and worst case situations (project failures, accidents, droughts, etc.), and estimate the anticipated duration of the impacts.

B. Detailed Description

The State Water Resources Control Board is concerned primarily with the effects of a project on the quantity and quality of surface and ground water. The following list of potential environmental impacts to be considered has been prepared with this in mind. However, other areas identified in the environmental setting section may be directly or indirectly affected by, or affect, water resources. In exercising its Board public interest authority, the Board is required to consider all project impacts.

Potential impacts include:

1. Impacts to surface and groundwater quantity (total quantities and seasonal variations)

   a. Effects on other users.

   b. Effects on water usage patterns in the area.

   c. Effects on instream uses (fish, wildlife, riparian vegetation, recreation, aesthetics). The discussion of project impacts to instream uses of water should include:

      (1) The identification of existing and potential instream uses of water in the project impacted stream, including but not limited to, the use of water for fish, wildlife, riparian vegetation, recreation, aesthetics, water quality, etc.

      (2) The project impact to these instream uses of water and a description of the methodology and assumptions used to evaluate the impacts.

      (3) A discussion of the level of flow required to: (1) maintain, (2) restore, and (3) enhance instream uses. A discussion of the feasibility of achieving each of these levels of instream uses in connection with the proposed project, and a description of the methodology and assumptions used in making these determinations.

   d. Effects on groundwater (water supply, saltwater intrusion, land subsidence, phreatophytes) overdraft.

   e. Water losses (water loss by evaporation, seepage, etc.).

   f. Water quantity - quality relationships.

2. Impacts to surface and groundwater quality (degree of change, seasonal variations, and effects).

   a. Physical changes such as siltation, drainage, temperature, turbidity.

   b. Chemical changes (volumes, constituents, concentrations) such as biostimulants, toxic chemicals (acute and chronic), dissolved inorganic and organic matters, dissolved oxygen and other dissolved gasses, oxygen-demanding substances.

   c. Impacts to beneficial uses due to water quality changes.

   d. Potential impacts from accidents such as failure of project or project component, accidental release of chemicals or other substances.

3. Impacts to Water Resources Management

Conflicts with State, regional or local water agencies' plans or policies.

4. Impacts to Biological Resources

Quantitatively describe effects on aquatic and terrestrial biota (vegetation, invertebrates, fish, wildlife, habitat, rare and endangered species).

5. Impacts to Significant, Environmentally Sensitive Areas

a. marshland, wetlands, and estuaries.

b. flood plains or flood-retention areas.

c. groundwater recharge areas.

d. steeply sloping lands.

e. forests and woodlands.

f. prime agricultural lands.

g. habitats of rare and endangered species.

h. public outdoor recreation areas including, but not limited to, specific boatable sections of the affected waterway; any impacts on safety of boating in these sections should also be discussed.

i. sensitive geologic areas.

j. archeological and historical sites.

6. Impacts to Land Use

a. Effects to current land use.

b. Effects to land use trends.

7. Impacts to Energy Resources

a. Effects on local and regional energy supplies and on requirements for additional capacity.

b. Effects on peak and base period electrical demand.

8. Cumulative Impacts

Discuss project impacts in relation to other existing and proposed projects in the region, basin or State. Cumulative impacts on instream uses of water resulting from all diversions of water on the stream should be addressed. The cumulative impact assessment should include:

a. Description of resources in the area which are most susceptible to cumulative effects, including but not limited to, fisheries, deer, timber, recreational resources, archeological resources and public services.

b. Identification of existing water development projects and quantification to the extent possible of past effects on the environment, particularly on the resources listed above.

c. Identification of other types of development in the area which have had adverse effects on those resources listed above, and quantification to the extent possible of those effects.

d. Description of all of the known proposed water development projects in the area with sufficient detail to allow assessment of potential environmental effects.

e. Assessment (including quantification to the extent possible) of individual and cumulative effects of the proposed water development projects on susceptible resources during construction and operation. This should include, but not be limited to construction schedules, normal seasonal flows and variations, and other specific impacts relative to the project's preliminary feasibility testing, construction and final operation.

f. Identification of individual and cumulative safety problems for river users associated with construction and operation of the project.

g. Identification of possible programs available to mitigate cumulative impacts and any limitations within the area to widescale application of these programs.

h. Conclusion drawn from analysis of areawide cumulative effects, concentratng on potential ability to find effective mitigation for those impacts and the levels of the resources listed above which can be maintained if these mitigation measures are implemented. Include descriptions of any mitigation measures to be implemented and the potential for success of these mitigation measures.

IV. Mitigation

A. General

This section should discuss methods to eliminate or minimize adverse impacts, the levels to which impacts would be reduced, and the basis for selecting levels as acceptable. Where alternative mitigation measures are available, each should be discussed and the basis for selection of a specific alternative should be given. The environmental document should identify those mitigation measures to be implemented and conditions needed to ensure that the mitigation measures will be implemented. It should clearly distinguish between those measures which the project proponent will implement and other measures which are discussed but will not be implemented. Contingency plans in the event of accidents, project malfunctions or drought years should be included.

B. Detailed Description

Water and energy conservation and water reuse (reclamation) must always be considered as mitigation measures. Conservation and reuse may eliminate or reduce the need for the project or reduce the quantity of water needed or the size of the project, and may mitigate adverse impacts. Conservation and water reuse, by delaying the buildup of demand, can delay the need for a project, and therefore, delay adverse impacts associated with a project. For further information concerning water reuse, the Board's Office of Water Recycling should be contacted.

Specific water and energy conservation mitigation measures can include:

a. Measures to reduce wasteful, inefficient or unnecessary water or energy consumption during construction and operation of the project.

b. Proper siting, orientation and design to minimize water or energy waste and maximize all beneficial uses of water or energy production.

c. The potential for reducing maximum water diversion demand or peak power demand.

d. Measures which reduce the overall water or energy demand and, therefore, reduce or delay the need for the project.

V. Alternatives

A. General

All reasonable alternatives to the proposed project, or to the location of the project, which could feasibly attain the basic

objectives of the project should be discussed. The reasons why they were rejected in favor of the ultimate choice must be made clear. The "no project" alternative must be evaluated, along with its impact. The discussion of alternatives shall include alternatives which are capable of substantially reducing or eliminating any significant impacts, even if these alternatives impeded attainment of project objectives and are more costly. Environmental effects of alternatives should be described sufficiently so that they can be compared with the environmental effects of the selected project.

Alternative water and energy conservation measures and plans, water reuse methods or plans, or energy cogeneration methods should be described. Explain the reasons the selected conservation measures or plans were chosen. The alternatives should be compared in terms of their overall water and/or energy consumption, in terms of the amount of water and energy saving by reducing wasteful, inefficient, and unnecessary water or energy consumption, and in terms of offering opportunities to incorporate water or energy conservation measures.

Other alternatives can include different water sources, different designs, locations, and operating plans.

B. Detailed Descriptions

1. For water supply projects, discuss the following alternatives:

   a. Funded municipal and industrial conservation.

   b. Funded agricultural conservation.

   c. Water reclamation and reuse.

   d. Water transfers.

   e. Desalinization.

   f. Growing less water-intensive crops.

   g. Growing more salt-tolerant crops.

   h. Legislated conservation efforts (e.g., ordinances prohibiting gutter flooding, legislation requiring leak detection, ground water management, etc.).

   i. Pricing policies (e.g., abolition of declining block rates, institution of increasing block rates with life line provisions etc.).

   j. Conjunctive use of groundwater (on a "safe-yield basis") and surface water.

   k. Improvement of distribution systems (e.g., lining of ditches, plugging leaks, interconnecting distribution systems, etc.).

l. Water exchanges (substituting lesser quality water for better quality water for agricultural uses, thereby freeing up a "new" supply of good quality water for municipal consumption).

m. Acceptance of less "firm" water supplies which would allow for higher expected dry year deficiencies or more frequent deficiencies.

n. Brush control to increase runoff.

o. Weather modification to increase precipitation.

p. Snowpack management to delay runoff.

2. For power generation projects, include discussion of the following alternatives to reduce demand or increase available energy supply:

a. Funded energy conservation (e.g., interest free loan programs for installing insulation).

b. Better peak load management (e.g., air conditioner load management, pricing, etc.).

c. Passive solar energy.

d. Photovoltaic energy.

e. Bio-mass conversion.

f. Garbage burning.

g. Geothermal.

h. Wind energy.

i. Pricing (e.g., time of use rates for residential and industrial users, replacing declining block rates with increasing block rates accompanied by life-line rates, revising incentive programs which encourage particular kinds of energy use).

j. Potential for increased coordination of electrical system interties.

k. New building standards for conservation.

l. Replacing inefficient electrical users (e.g., pumps, motors, televisions, etc.).

m. Retrofitting existing dams and canals with power generating equipment.

n. Refitting existing hydroelectric projects with more efficient power generating equipment.

o. Cogeneration.

VI. The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance of Long-Term Productivity

A. General

Describe the cumulative and long-term effects of the proposed project which adversely impact water resources and the environment. Special attention should be given to impacts which narrow the range of beneficial uses of water. In addition, the reasons why the proposed project is believed by the sponsor to be justified now, rather than reserving an option for a future project, should be explained.

VII. Any Significant Environmental Changes Which Would be Caused by the Proposed Action

A. General

Identify uses of nonrenewable resources during the initial and continued phases of the project which are irreversible. Primary impacts (such as energy consumption) and, particularly, secondary impacts (such as a reservoir which provides access to previously inaccessible areas and increased visitation to the surrounding areas) generally preclude an alternate future use and commit future generations to similar uses. Also irreversible commitments of resources should be evaluated to assure that such current consumption is justified.

VIII. The Growth-Inducing Impact of the Proposed Action

A. General

Describe the ways in which the proposed project could foster economic or population growth, either directly or indirectly in the surrounding environment. Included in this are projects which would remove major obstacles to population growth. A major expansion of water supply might, for example, allow for more construction in the service area. Increases in the population may further tax existing community service facilities so consideration must be given to this impact. Also, discuss the characteristics of the project which may encourage and facilitate other activities that could significantly affect the environment, either individually or cumulatively. The establishment of an agricultural water supply, for example, may cause conversion of undisturbed lands to irrigated croplands. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.

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The Healdsburg

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Our 128th Year Number 96 © Enterprise & Scimitar, Healdsburg, CA Wednesday, September 15, 1993

Geysers on the decline

City sets asides large reserves to cope with loss of steam fields

by RUSTEN HOGNESS
Tribune Intern

Failing steam fields at The Geysers — which by 2010 may generate just one-fifth of the electricity they do now — have forced Healdsburg to set aside large cash reserves to prevent sharp electric rate hikes after the year 2000.

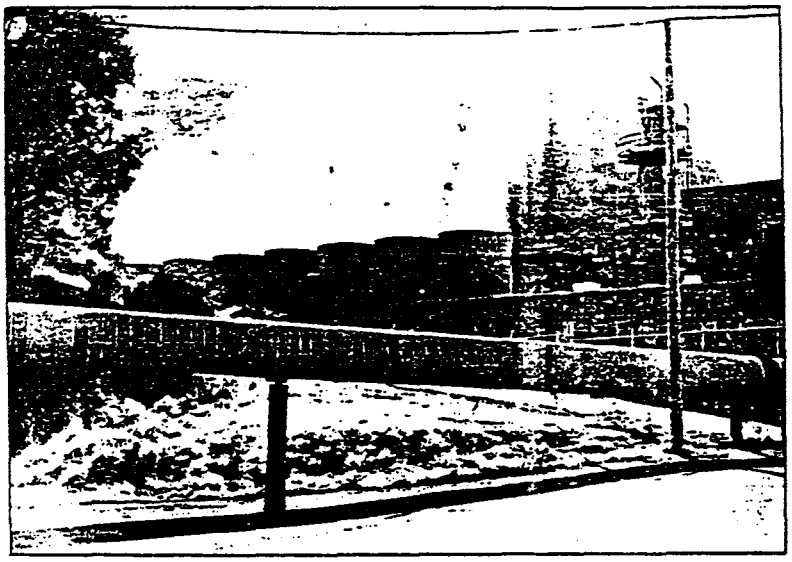
The City Council voted last Tuesday evening to set up two reserve funds to soften the blow of the coming decline in geothermal electricity. Healdsburg, as a member of the Northern California Power Agency (NCPA), owns a $60 million share of the steam wells and two geothermal power plants in the southern part of The Geysers.

The first fund — the Rate Stabilization Reserve — will keep electricity rates from spiraling steeply upward as steam is exhausted from The Geysers. Each year between now and the end of the decade, the city will set aside an average of a half million dollars of profits from its electrical utility business. The reserve will grow to more than $3.5 million.

"But by the year 2000, the decline in power from The Geysers will catch up with us," said Electric Utility Director Bill Durfee in an interview.

Then, for two or three years, the city will be able to charge just about what its power costs. But after 2003, the city's electric utility will start to run in the red.

That's when the reserves will soften to blow to ratepayers.



RUSTEN HOGNESS

POWER DECLINE - The Geysers steam fields could be generating just one-fifth of the electricity they do now, by the year 2010. In that event, the city is setting aside cash reserves to circumvent sharp electricity rate hikes.

"Without the reserve, the city would be looking at double-digit increases in rates," said Duarte. "We're trying to prevent that disruption."

The other fund — the Accelerated Steam Decline Reserve — is like an insurance policy. The city will add $175,000 a year to this fund, to be used to meet unforeseen problems in the steam fields.

The steam resource at The Geysers could decline more rapidly than experts now expect. Efforts to mitigate the decline by injecting more water back into the ground could fail. And the whole region is geologically unstable.

"There are faults all through there," said Duarte. "An earthquake could shut everything down. Lots of things could happen. We don't want to be caught unprepared."

Geologists didn't completely understand The Geysers at the time NCPA decided to buy into the geothermal action over a decade ago, according to Rob Lamkin, NCPA's Assistant Director of Operations and Engineering. They still don't know just how long the field can be made to produce usable steam.

"We're working on several ways to increase the life of the reservoir and produce power more efficiently," said Lamkin.

"We won't know for some time yet if overall the investment will prove to have been a profitable one. There are too many unknowns."

The city's reserve fund for unforeseen problems at the Geysers could grow to more than $3 million if contributions continue as scheduled to the year 2010, when Healdsburg finishes paying off its investment in geothermal power.

The City still has 17 years of payments to make on its $60

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Community shaken, angry over gang attack

Gang activity rare so far in Healdsburg

by JOELLE BURNETTE
Tribune Staff Writer

People in small-town Healdsburg are shocked, many are concerned.

But anger seems to prevail in the aftermath of the gang related knife attack at the high school that recently sliced through the comfort zone of a small community.

"It's a shock to them that this can happen" in Healdsburg, said Mayor Carla Howell of the reactions she has heard.

Enid Myers has a son at the high school. She and her family recently moved from the Los Angeles area to Healdsburg and said she thought they got away from the gang violence.

"We thought we left that behind," she said.

She explained how people are used to hearing the guns blazing in Southern California, "but here, it's disconcerting."

Howell said since the incident at Healdsburg High School September 2, she has received about six calls from concerned citizens and several more have stopped her on the street about it as well.

These people's and many others' concerns stem from the incident after the third day of school when police said an 18-year-old man and a 16-year-old boy threatened several students and a police officer with a knife and a cut-off stick. The two were allegedly members of a certified Santa Rosa gang [illegible] were trying to gain status [illegible] in the gang.

Howell credited the police department and school personnel for handling the incident quickly so that no one was [illegible]

"People don't need to [illegible] really insecure," Howell said. "It was a random act and [illegible] don't need to feel they are under siege."

Actually, she said more people are angry than afraid. "We know the problem exists but they don't want it to happen here."

People want the gangs to get the message that "they're not welcome in our community," said Howell.

Prior to the incident, she explained there had been action taken at the schools and police department to prepare and train personnel to respond quickly to potential gang related incidents such as this.

"We're watching (gang related activity) really carefully," she said.

Feedback from the community, she said, indicates that "their biggest concern is that we not back down and we protect our own turf."

She said there is going to be fear of the potential for future gang violence in Healdsburg "but we also have to stand our ground."

People recognize that th

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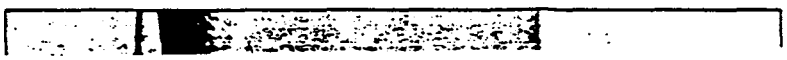
Efforts under way to prolong steam field

Reinjecting water



Drive to restore cuts to crossing guards

GEYSERS

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million investment.

"It's like a mortgage," said Duarte.

Like smart homeowners, the city took advantage of lower interest rates and re-financed its payments a couple of months ago, saving nearly $2 million in payments.

But it's a little like having a mortgage on a home perched on an steep, eroding hi side. No one else will buy the home for anything like enough to pay off the mortgage. So, you go on living in your house and try to slow the inevitable erosion. You adjust to walking on your ever more tilted floors.

Today, Healdsburg's share of the power available from the NCPA plants at The Geysers is about 5 megawatts — enough to light 50,000 100-watt bulbs. That's almost one-third of the city's peak power needs.

Experts estimate that by the year 2010, power produced by the geothermal plants may be only one-fifth of what it is now. That would leave the city's share at just one megawatt. Healdsburg will have to sign contracts with other electricity suppliers to make up the difference.

"We won't know for some time yet if overall the investment will prove to have been a profitable one. There are too many unknowns."

— Rob Lamkin, NCPA

But even if steam production at The Geysers stopped completely today, Healdsburg would have to keep making its remaining $32 million in "mortgage" payments.

Geologic History of The Geysers

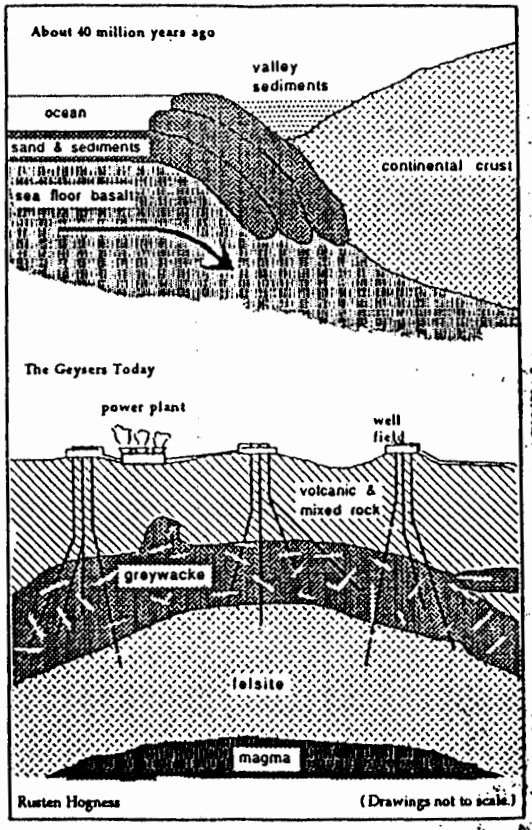
Over 30 million years ago — before the San Andreas Fault zippered up the coast and put a stop to it — the sea floor off the California coast was slowly diving below the edge of the continent. As it scraped down, parts of the sandy and mud of the seafloor were scuffed off and built up at the edge of the continent. Eventua y, this was buried and transformed into a "dirty sandstone" known as greywacke (GRAY-wacky).

Rainwater seeped into the greywacke, and hot, liquid rock called magma surged up beneath it. The top of the molten rock ha dened into a light-colored, granite-like stone called felsite that remained hot because of the magma below.

The heat turned some of the water in the greywacke to steam, which rose through tiny fractures in the rock, then condensed and seeped back down. This circulation deposited minerals that partially sealed the reservoir. Rainwater ceased to flow in as freely, and steam pressure built up in the greywacke. Occasional fractures in the stone overlying the greywacke allowed most of the water trapped in the reservoir to boil off.

Only the tiniest fractures in the rock still hold water. Steam fills the larger fractures. Steam wells tap these fractures and bleed off the steam.

Because the rocks below remain hot, re-injecting water into the reservoir may partially replace the removed steam. But injecting too much water could quench the rocks and stop the flow of steam.



GANGS

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(Please turn to page 7)

Efforts under way to prolong steam field

Reinjecting water is effective, up to a certain point

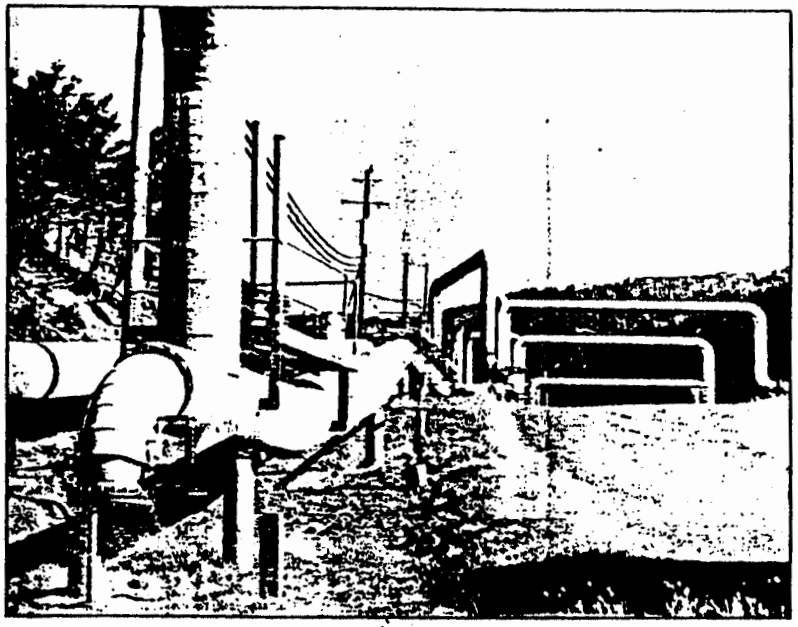
by RUSTEN HOGNESS
Tribune Intern

On the surface of the rugged hills northeast of Healdsburg known as The Geysers, everything seems fine. But miles underground, deep beneath the sparsely wooded hills and canyons, trouble is brewing in the rapidly dwindling steam reserves.

And now the trouble is beginning to surface. PG&E is making plans to shut down more of its power plants at The Geysers. All of the geothermal electricity producers are sharing in a scramble to slow the decline of steam pressure by injecting more water back into the ground. And all are searching for new technologies to make the most of what steam remains.

On the dry hillsides, the power plants look like seven-story planter boxes topped by rows of huge steaming soup bowls. The unobtrusive steam wells are clustered on thick concrete pads set into the bedrock. No new drilling is going on now, though drilling rigs occasionally redrill old wells to clean them out and keep the steam coming.

The wells are clustered because they must start on stable ground, but they reach throughout the reservoir. After boring down several hundred feet,



RUSTEN HOGNESS

TROUBLE UNDERGROUND - Trouble has been brewing underground at the rapidly dwindling steam reserves at the Geysers.

drillers angle the well shafts out like the legs of a spider standing on tiptoe. Some wells even split into two shafts as drillers search a mile and a half or more deep for enough steam pockets to make a productive well.

Giant white inchworms of pipe crawl across the hillsides, linking the steam field wells and the power plants. The pipes — up to 40 inches across, covered by two to four inches of fiberglass insulation and an aluminum skin — follow contours of the land, but snake over roadways and sometimes hump up or to the side for no apparent reason. These digressions allow the expansion and contraction that might otherwise strain and tear the pipe joints as steam floods into them or is with-

(Please turn to page 3)

Drive to restore cuts to crossing guards

by JOELLE BURNETTE
Tribune Staff Writer

With school children left marooned on street corners as motorists zoom by, one local mother has launched a petition to restore the crossing guards that were cut out of the city budget.

"Right now we need somebody to cross these kids," said DaNita Brewer who is organizing the petition effort to "reinstate or otherwise supply" all nine crossing guards needed around the schools.

"They're basically dodging cars," she explained. "It's too dangerous for those kids."

She said she has seen children trying to cross the street and being afraid to walk across because the drivers won't slow down.

"Drivers don't look, don't care and they just drive right through the crosswalk," said elementary student parent Enid Myers.

Especially once the kids are on a block away from school, the drivers don't slow at all, she said.

And it's not just people without children who speed by. Brewers said she has seen parents picking up their children and then not stopping for other children.

Then, she said, "if they're (students) standing talking to their friend, they're not going to be paying attention."

Like many parents, Brewer said she didn't know until the first day of school that there weren't going to be crossing guards at Fitch Mountain or Healdsburg Elementary where her children attend.

The situation is especially difficult for working parents, according to Myers.

"They're angry. They're scared," she said of parents with small children who walk to school.

Brewers said she has suggested using adult volunteers for the program, but said the schools are concerned about liability and legality of that sort of program.

"There are a number of volunteers willing to do this," said Superintendent Larry Machi. But he said someone must organize the volunteers, train them and accept liability.

Aside from basic education, the schools, he said, have already taken on responsibility for health and child care. Is safety next, he asked.

With already limited resources, the schools are strapped as it is, let alone adding time and money into a crossing guard program since the city dropped most of its program.

"I'm just hoping that none of the kids get hurt before the volunteers get out there," said Brewer.

GEYSERS

(from page one)

drawn during ipe maintenance or repair.

At the plants, huge separators remove as much of the non-steam gases as possible before the steam reaches the generator. These other gases can cut down the efficiency of the electrical generation.

The huge turbines that s in the generator to create electricity are powered by steam pushing the fan blades. While the other gases could help spin the blades, they cannot easily be condensed to liquid after going through the turbine.

Condensing steam to water just after the steam passes the turbine blades multiplies the efficiency of the turbines. Condensation creates a nearly perfect vacuum that means new steam roaring through the turbine meets no resistance from the gas that has passed just ahead of it. The steam rushes even faster and pushes the fan blades harder.

The condensed water is cooled in huge evaporation towers and circulated back to the turbines to help condense yet more steam. Finally, the water is piped to injection wells where it is squirted back into the underground reservoir. About 30 percent of the water in the steam is recovered for reinjection now.

Increas ng the efficiency of the turbines and injecting more water back into the de leting steam reservoir are two strategies for increasing the productive life of the power plants at The Geysers.

Geothermal turbines are already "low pressure" models, designed to operate at steam pressures of about 100 pounds per square inch. That's just seven times normal air pressure, about the pressure your body would feel swimming 200 feet underwater. Conventional power plants flash water into steam at pressures five to 30 times higher.

But the already low steam pressures at The Geysers have declined to closer to 60 or 70 pounds per square inch.

New technologies could help.

Engineers are investigating more efficient turbines that can operate at even lower pressures. And better ways to remove "non-condensible gases" from the steam will be important as the proportion of these gases increases in declining fields.

But the major trouble is that the steam is being used up. Reinjecting water into the ground seems to have slowed the decline. But experiences with water injection have varied.

NCPA's experience has been excellent. Their tests show that nearly 100 percent of the water pumped down their injection wells shows up as steam in adjacent steam wells.

They are looking forward to the completion of Lake County's pipeline that will lift 3,500 gallons per minute of treated wastewater from their treatment ponds to The Geysers for injection into the reservoir. That will provide NCPA with another gallon of water for every six they now re-inject.

Unocal, the owner of about half of the steam wells at The Geysers, is looking forward to the Lake County waste water, too. But their experience with re-injection has been spottier. Water injected at one site almost completely stopped steam flowing from nearby wells.

It could have been that the injection well was too close to the producing wells. It could have been that they injected too much water, too fast. It could have been that the geology of the rock at that location was different f m what is found at the NCPA sites.

Or it could have been bad luck.

Unocal is beginning new injection tests this month. Water injection is one of the few options available to extend the life of the field.

But injection can do no more than slow the reservo r's depleton. Steam is not a renewable resource, at least not on a human time scale. You can use it slowly or you can use it fast, but when it's gone, it's gone.

Some feel the resource was squandered.

"They just put too many straws in the ground," says Richard James, Public Works Superintendent. "They ruined it. It's a real shame."

Slower development could have given knowledge of the field time to catch up with its exploitation, says James.

But two oil crises in the 1970s sparked interest in alternative energy sources. And early estimates of the steam in the fields did not prepare drillers for the rapid reductions in steam that resulted from the quick exploitation of the fields.

Now the power companies are looking at how to deal with a dw ndling resource. There w ll soon not be enough steam to power all the plants at full capacity.

At one of PG&E's power plant at The Geysers, engineers are experimenting with running the generator using just one of the two steam turbines in the plant. Running one turbine at full capacity should, they hope, be more efficient than running two at lower power.

And PG&E is in the process of deciding which plants it will shut down in the next few years as steam becomes scarcer.

"Plants will be shut down," says Bruce Henry, PG&E Operating Specialist, "but wh ch do we shut down and when? Nothing is etched n stone."

When plants are shut down, the steam supply ng those plants will be redirected to other plants.

"The steam lines are all interconnected now," says David Holligan. Holligan is Production Superintendent for Geothermal Resources at Unocal, the supplier of steam to the PG&E plants.

Current Unocal pipes may need upgrading if the steam has to travel over about a mile.

"We may need to insulate more or increase the size of the pipes," says Holligan, "but we'll be able to send all the steam to fewer plants."

Steam field and power lant owners are looking at each other's experience with new technologies or modified designs. What happens in one part of the reservoir affects what happens nearby — and nearby could be someone else's wells.

"There's a new spirit of cooperation up there now," says Bill Duarte, Electric Utility Director for Healdsburg. "We're all in it together."

Chamber of Commerce sponsors the "Best of Healdsburg" awards

The Healdsburg Area Chamber of Commerce is sponsoring a new contest titled the "Best of Healdsburg," with the winners to be announced at the Oct. 27 trade show and awards event at the Villa Chanticleer.

The Best of Healdsburg of Awards and Trade show is a new event. The chamber will continue to sponsor its spring trade show at the Villa

Also dubbed "The Distinguished Dozen," the purpose of the awards is to recognize 12 individuals whose unique skill deserve recognition.

Awards will be given to one individual in the 12 categories; including "Classic Closers" (sales person); "People Works" (waitperson, clerk, secretary); "Vital Signs" (doctor, nurse, dentist, etc); "Body Works" coach); "Good Works" (volunteer); "Money Movers" (bank teller, loan agent, etc.); "Hosts with the Most" (chef, baker, bartender, innkeeper, tasting room host); "Preferred Professionals" (accountant, attorney, financial advisor); and "Barn Raisers" (plumber, carpenter, electrician, pa nter).

Ballots can be dropped off or

POLICE LOG

The following incidents represent a sampling of the calls the Healdsburg Police De-

09:25 - Soda machine in f nt of business in Vineyard Plaza had been broken into last night.

EDITORIAL

Geysers costs should guide future decisions

The Geysers, which at one time almost resembled a scene from the state's famous gold rush days, is in a state of decline.

The once plentiful steam field is being depleted, the victim of too many holes punched into the geothermal reservoirs that lie deep beneath the surface of the rugged mountains east of Healdsburg.

How rapidly the decline will take place remains to be seen. Efforts to prolong the well fields may be effective, but no one believes that the steam will last forever.

The city of Healdsburg has a significant stake in all this, since its share of the Northern California Power Agency's (NCPA) Geysers investment is about $60 million. For the next 20 years the city will continue to pay off that debt, and officials are also amassing large reserves to deal with the "rate shock" when declining steam production will raise the city s energy costs significantly.

In the long run, the investment in The Geysers by NCPA may turn out to be a losing proposition, but no one will know that until the success of prolonging the life of the steam fields is known.

But even if the steam fields are kept alive longer than expected, it seems certain that the Geysers power, at least for NCPA and Healdsburg, was not the most profitable investment the city ever made.

Granted, no one knew at the time how quickly the resource would last, and energy investments can be a risky business.

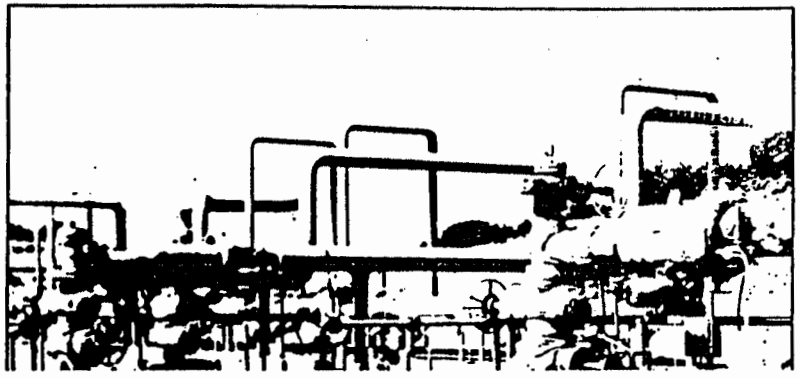
To their credit, city officials are setting aside reserves to deal with the declining steam production, and cope with inevitable power cost increases. That is prudent. That same prudent philosophy should continue to guide future decisions on energy investments.

LETTERS

Bendway gravel impacts

Editor:

In his letter which appeared in the September 1 issue of the Tribune, Tom Freeman applauds the Syar proposal to mine the Bendway and Riverbend river sites in and adjacent to Healdsburg on the basis that it will improve flood control. I would like to point out that nowhere in the exhaustive EIR/EIS which has just been completed on the project is this mentioned as a possible benefit. Other positive factors such as employment and an inexpensive source of aggregate are mentioned, but apparently the independent consulting firm who did the study did not deem flood control of sufficient value to list it. The EIR/EIS does, however, list as "significant impacts" a) cumulative reduction in regional air quality (i.e., dust), b) "unacceptable" noise levels, c) adversely altered views of the



COMMENTARY

You want it? We've got everything in this magazine

by Paula Leinwand

Need to get rid of some unwanted facial hair without the hassle of wax or electrolysis? Looking for a four-legged sweatshirt for your pooch? Can't live without the famous Turkish Head Lopper Knife" (sharp as a sultan's anger - guaranteed to win you respect from family and friends)?

Well then just come on over to my house and sort through some of the ka-zillions of mail order catalogs that have been arriving daily, ever since, in a moment of apparent insanity, I broke down and ordered a Star Trek mug from a magazine.

Hey, it was a cute mug. It had Captain Kirk, Mr. Spock and Scottie all standing on the launching pad, and when you pour hot coffee into it, they "beam up."

Oh, come on. It was a joke, for gosh sakes.

I can just hear the folks at Publishers Clearing House right now. "Holy Toledo! Here's someone ordering the Star Trek beam-me-up mug. Put her on every tacky catalog list we have. Paula Leinwand from California. That's L-E-I-N-W-A-N-D.

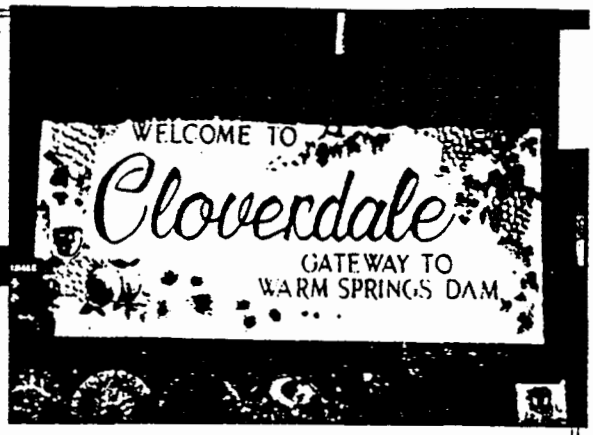
Two days later, the postman's staggering down our street, dragging his mail sack behind him, overladen with magazines selling everything from pewter John Wayne belt buckles big enough to double as cold cut platters, to silly tee-shirts with even sillier slogans ("This Isn't a Beer Belly. It's a Gas Tank for a Sex Machine," or

Sonoma County

CITY WATCH

THE CITIZENS' PERSPECTIVE

CLOVERDALE



Running Out of Steam

by Krista Rector

"It is clear that geothermal power production will have far reaching effects on the water resources of the state, including the quality of its waters... Water resources will play a significant role in the production of electric power," states authors for the Resources Agency for the State of California in the book, Water and Power from Geothermal Resources in California."

This could be the understatement of our generation. Water and electrical production is intertwined and is as hard to define as the proverbial chicken and the egg. Let's see if we can state simply what is happening in The Geysers Geothermal field in California —east of Cloverdale.

The Geysers are losing its steam capacity and can't meet its projected electrical generation. Too much steam has been sucked out of The Geysers and a worrisome drop in production has resulted. It is proposed that Clearlake wastewater be pumped to The Geysers steam fields over a long distance up a huge incline using a lot of electricity. The wastewater will be injected into the ground around steam wells to boost the steam output. This has been successful except that productive wells have been killed.

But, engineers are watching The Geysers, touted to be a renewable resource, because after 33 short years, The Geysers are running out of steam.

The Geysers state-owned plants, as a part of the State Water Project, were counted on to provide 14% of the electrical power to pump water from Northern California via state Water Project (SWP) canals and pipelines to Southern California. The water project is a critical source of water for 20 million residents in Southern California and requires billions of kilowatts each year to carry water from Oroville Dam in Northern California to the end of the state through a 444 mile aqueduct to Lake Perris in Riverside County. Water from the North must be pumped 3,000 feet over the Tehachapi Mountains which requires 4,000 kwh per acre-foot of water. All this effort provides cheap water to Southern California to fuel their growth. But, engineers are watching The Geysers, touted to be a renewable resource, because after 33 short years, The Geysers are running out of steam.

Is there harm in force-feeding what we now know is not a renewable resource? Yes, it could involve poor financial decisions which effect tax bases and draw down funds that would be better used to support state infrastructure. A draft environmental impact report is being prepared to determine the environmental impact of sewer effluent on The Geysers steam field, but a much bigger issue may have to be faced — the financial strain of supporting something non-sustainable.

History

On Fourth of July in 1895, a family would board the train in San Francisco and rise up to Cloverdale. As they traveled ever upward on a back jolting wagon ride, they would gratefully view the entrance to The Geysers Hotel which welcomed them with a white picket fenced arched entryway festooned with flags. The adventure would begin.

"A Trip To The California Geysers" published in Hutchings California Magazine in 1860 eloquently described what they found. "The view of The Geysers, from the hotel is a very striking one, more especially in the morning, when the steam can be plainly seen, issuing from the earth in a hundred different places...Hot springs and cold springs; white, red and black sulphur springs; iron, soda and boiling steam springs; and the deuce only knows what other kind of springs all pour their medicated waters into the little stream...By the time the stream reaches here, its medicated waters become cooled to the temperature of a warm summer day, and the basin forms, perhaps, the most luxurious bath to be opened in the world...Every spring had a voice. Some hissed and sputtered like water poured upon red hot iron; others reminded one of the singing of a tea-kettle, or the purring of a cat...There are a great many other springs — some two hundred in number, I believe — of every gradation of temperature, from boiling hot to icy cold, and impregnated with all sorts of minerals and chemicals compounds; frequently the two extremes of heat and cold are found within a few inches of each other."

Native Americans showed the thermal springs to California settlers and by 1850 organized tourism was established. Energy was first generated from geothermal resources in 1904 in Italy. In 1920, the first attempt to generate electricity from dry steam took place at The Geysers but the project ended in the 1930's. In 1950, modern electrical generation projects began at that same site which lead to the first commercial success in producing electricity in the 1960's.

Ironically, while geothermal energy was being sold to the public as renewable, in 1969 a tax court held that the natural steam at The Geysers qualified for a depletion allowance. The judge reasoned that the steam is locked in enclosed spaces and is not replenished by seepage. The producers of steam were entitled to tax writeoffs for the intangible costs of drilling and developing The Geysers.

In the 1970's, California government identified the need for alternative energy because long-term contracts providing inexpensive electrical power for the State Water Project were soon to expire and officials feared large price hikes. In 1970, Congress passed the Geothermal Steam Act for a leasing system for federal lands to encourage development of geothermal resources. In 1971, the United States designated one million acres of land in California as Known Geothermal Resource Area (KGRA). In 1974 competitive bidding for leasing of Federal lands started. By 1974 the capacity of The Geysers was 396,000 kilowatts with maximum capacity estimated to be more than 1 million kilowatts. To gain a perspective, in the same year of this prediction, Italy, US, New Zealand, Mexico, Japan, Russia and Iceland produced 1,068,000 kilowatts combined.

Modern History

The Geysers area makes up the biggest geothermal complex in the world. Geothermal energy was expected to help us break out of the petroleum dependency on OPEC oil. And, California, one of the world's largest energy users, was backing it with big money.

For a geothermal resource to be economic it must have four characteristics: a heat source; a large volume of high-temperature rock close to the earth's surface; water as a heat conducting fluid and rocks of high permeability to supply a large volume of hot water to wells. This was found at The Geysers.

The Geysers KGRA covers an area of 140 square miles and is primarily vapor dominated steam fields using approximately 1,200 geothermal wells. The wells provide the generating steam to run the twenty power plants. Vapor dominated resources call for routing the steam from the well through a separator to a generator. The separator removes rock particles, dust and condensate (a product of condensation or cooling) which could damage the generator. After the turbine activates the generator, the exhaust steam is cooled with coolant water and then coolant and condensate passes through a condenser to be disposed of. The disposal method at The Geysers is injection of condensate through wells back into the ground.

The major geothermal development over the past 25 years has been concentrated in the Big Sulphur Creek drainage in the southern part of the 140 square miles KGRA but more production was called for and production wells and plants expanded outward into less productive areas.

An example of past activity at The Geysers is what happened when the Department of Water Resources (DWR) wanted to undercut the costs of providing electricity to pump water to Southern California and began to back the building of power plants including Bottle Rock, South Geysers, Brinkley and South Brawley.

The State floated bonds to construct and manage power plants, while steam to run the plants was to be purchased from private companies who would develop, operate and maintain supporting steam fields. Steam to run Bottle Rock and South Geysers was provided from geothermal leases owned by two companies Geothermal Kinetics, Inc. (GKI) and MCR Geothermal (MAXXAM, Inc.) Construction started in 1981 on the $122 million Bottle Rock plant in Lake County.

Meanwhile at the South Geysers plant, the DWR assured the CEC state regulators that there would be enough steam available to run a plant in the south area of the KGRA. The South Geysers wells had been predicted to be plentiful enough to run a facility for 30 years. (Later a State audit of DWR showed that they didn't take time for an independent study to corroborate the production level of the wells even though PG & E was having problems locating enough steam for one of its plants on adjacent property.) The State began construction on this plant but in 1985 they halted construction, having spent $55 million on the South Geysers plant, a plant that never opened.

Texas financier Charles Hurwitz, CEO and corporate owner of MAXXAM Corporation, was the original well driller for Bottle Rock but gave them up as not worth it. Thus the Department of Water Resources took it over on default. The DWR again assured the CEC that there was enough energy for Bottle Rock to last 30 years. Bottle Rock lasted 5 years and was shut down in 1990. Bottle Rock produced 55 megawatts the first year (enough to power Santa Rosa) but by the end of the 80's decade, production had dropped to 7 megawatts.

A Los Angeles Times article published in June 16, 1993, "Ghost Plants are Legacy of State's Geothermal Fiasco, states "When the revenue bonds on the plants are finally paid in 2024, water users will have sunk more than $450 million into the two projects, making them the states most expensive white elephants." The reporter, Virginia Ellis, notes "The customers of the Metropolitan Water District of Southern California will have shouldered 80% of the cost." The State is no longer interested in geothermal power production and would like to sell the plants.

In the May-June, 1986 publication of Ground Water, Santa Rosa geologist Eugene Boudreau in his article "How To Slant A Ground-Water Investigation For Political Purposes" stated that "The general public has but a dim concept of ground water, but it readily understands the stupidity involved in building a $100 million geothermal power plant and then finding out there isn't enough steam to operate it. DWR's handling of its South Geysers power plant project is a clear and irrefutable example of how, with the connivance of the head officials of the California Energy Commission (CEC), it managed to perform the equivalent of launching a battleship in the Sahara Desert." He further states, "Given enough time, the whole State Water Project (SWP) may come crashing down in the same way." Boudreau will be publishing a book analyzing the California Department of Water Resources (DWR) in conjunction with the geothermal operations at The Geysers in early 1994.

Money

There has been a lot of money made at The Geysers and the State hasn't done a good job of monitoring or regulating its regulators. In the rush to produce electricity, bad decisions were made that will have consequences for taxpayers far into the future. E. H. Boudreau states in his 1986 articles, that "A steamfield capable of supplying 55-megawatt plant for 30 years would contain $450 million worth of steam with 40 percent of this going to the operator as profit."

In his analysis of the South Geysers Power plant, he points out that during the time GKI, a subsidiary of United Siscoe, was doing business with DWR, that Siscoe's stock "jumped from $3 to $25, with the high coming in 1980-81, when CEC was approving DWR's application to build South Geysers." He notes that the chief stockholder in United Siscoe was Lou Chesler, a partner of Meyer Lansky (allegedly involved with organized crime and founder of Murder, Inc. of New York) and that William Ruckleshaus, once Acting Director of the FBI, was Chairman of the Board of GKI.

An unpublished summary report prepared by Resource Management International, Inc. for the CA Dept. of Water Resources Geothermal Resources Program states, "The land leases for geothermal operations and the CEC authority on power plant certification...will likely require major expenditures for site restoration in the event of abandonment of either of the projects...DWR has preliminarily estimated the costs of such restoration of the Bottle Rock Power Plant to be approximately $5 million in 1989 dollars."

The report goes on to discuss "Total sales of the Bottle Rock Power Plant and mineral lease would be beneficial to DWR if it could be accomplished...There would be no future liability for power plant removal and site restoration or for mitigation of pollution to air and water resources." In what appears to be icing on the cake, they suggest that should the plant miraculously begin to produce, "DWR should receive some form of production-related royalty which makes some contribution to repayment of debt service. It is not likely, under such an arrangement, that DWR could expect to receive royalty or other payments equal to the full amount of debt service payment."

Not only will the state be out the money for building the plant, but if designated "Closed", the plant will have to be removed and the land reclaimed to its' natural state.

There have been problems even when the state government hasn't been involved directly. There is even a dispute as to who owns power plants such as PG&E Unit 15. GEO had interests in it and ended up in bankruptcy court due to mechanical difficulty and limited plant capacity so the plant reverted back to the landowner who was also bankrupt. GEO Operators Corp. is still listed as owning $218,438.91 for 1988 and 1991 for delinquent assessments and penalties for Area G-3 (The Geysers).

New well drilling continues to be slow at The Geysers, as new

Continued to next page

CLOVERDALE

wells have failed to significantly increase the field's overall production. The only drilling permits for geothermal wells approved from January to September, 1992 was the Aidlin #9 for Geothermal Energy Partner. In October, 1991 1,326 megawatts of electricity was produced. As of August, 1992 only 1,221 megawatts were being produced. The California Energy Plan lists California's electricity system capacity for 1991 and shows 4% is from geothermal resources. Geothermal resources are potentially easy to dump since an equivalent 4% is made up of biomass, wind and solar resources, but the fiscal domino effect of closure may keep decisions frozen for some time.

How much revenue will be lost to the cities, county, state and federal funds from decreased production is unknown. Federal government retains 50% of money received from geothermal leases on Federal lands and 50% goes to the state of origin. In 1991 alone, lands leased from the Federal organization, Bureau of Land Management (BLM), in California earned $15.4 million in Federal rents and royalties. In a State Lands Commission (SLC) DEIR written in October, 1991 they stated that Sonoma County in fiscal year 1985-86 received geothermal property funds of $22,161,862.00 or 13% of the total county tax base for that year.

... steam released during power production could mobilize a variety of elements that ultimately enter the water courses and impact the aquatic environment.

According to Steven Sharpe, former Geothermal Coordinator, the County is now down to 5% of its tax base. The DEIR authors noted that there had been substantial decline in production through 1987. They also note that there is a significant decrease in geothermal property tax income due in large part to the decrease in petroleum prices experienced in the period (to which the steam price formula is tied) which makes it a double hit on the income.

Of the California funds, 40% go to the County where the lease is located and 30% to the California Energy Commission (CEC) for grants to local jurisdictions possessing geothermal resources and 30% is kept by the state. From the Renewable Resources Investment Fund, Sonoma County has received about $7 million between 1980 and 1987. The funds were used, according to Steve Sharpe, for mitigation studies, the rebuilding of roads, an analysis of warm water "direct use" resource in the Sonoma Valley, and for biological resource studies.

Private or publicly held companies are also facing a decrease in revenue which effects their stock and bond holders. One of the main players in The Geysers development, Unocal reorganized in July, 1992 is seeking to reduce their debt by $1.5 billion over the next 5 years. This reorganization will eliminate 450 positions in petroleum and geothermal energy exploration and production. The eventual success or failure of plant operators such as well operators, will have ramifications for the State's taxpayers. Reliance has been placed on prime players in the geothermal production to date because of their track record, but that could be sorely tested by future bankruptcies.

The Healdsburg Tribune, in September, 1993 reported on private/public electric power generation, which the City of Healdsburg is in the business of selling, as well as using. The City has a share in four plants at The Geysers through the Northern California Power Authority (NCPA). They reported that the "City now sets aside large reserves to cope with loss of steam fields...which by 2010 may generate just one-fifth of the electricity they do now."

NCPA owns a $60 million share of the steam wells and geothermal plants. By 2003, the city's electric utility will start to run in the red and they will need to use reserve funds to buffer future price increases. The Tribune article states "Geologists didn't completely understand The Geysers at the time NCPA decided to buy into the geothermal action a decade ago...they still don't know just how long the field can be made to produce useable steam...efforts to inject more water back into the ground could fail and the whole region is geologically unstable...the City has 17 years of payments left on the $60 million." The Tribune quotes Bruce Henry, PG&E Operating Specialist, "Plants will be shut down but which do we shut down and when? Nothing is etched in stone."

Shutting down wells and plants will be based on financial criteria, but the environmental cost should receive equal weight.

Toxicity, Seismicity

The Geysers has had other problems than just the decrease in steam from too many straws in the glass. A 1974 revision of Geothermal regulations was required due to the discovery of unstable terrain under both plants and wells. Plants that are located on unstable terrain are PG&E Units 1, 2, 3, 4, 5, 6, 9 10, 11, and 12. A 1974 count of wells on unstable terrain showed of 168 drilled, 91 are on landslide areas. Seismicity is also a concern when removal of steam causes subsidence.

In 1975, Union Oil geothermal well CDG 65-28 blew out. It had been completed in 1968 and was on standby. This well is like 50% of other wells (at the time of blowout there were 90 others). It was drilled on a site of Quaternary Landslide. The blown out well was drilled using now-outdated methods and Union Oil did rework old wells but it is undocumented as to whether other company wells were redone.

Geothermal water tends to be more mineralized because at high temperatures it more readily dissolves salts from the rocks that surround it. Trace components of geothermal fluids include copper, rubidium, cesium, iron, manganese, mercury, lead and zinc. In 1985, an analysis of the chemical elements in The Geysers was conducted and reported that the highest mineral levels to fish are from mercury, lead, zinc and copper. The report stated, "resultant soil exposure, and that from past mining activities, may increase metal burdens as rain water and leaches trace elements into streams. Further the venting of steam wells and fallout from cooling towers also contribute to the total burden."

The geothermal supply and disposal systems are subject to failure. There may be a rupture in the well casing, at the well head, and in the above ground piping. In accidents, spills have resulted from broken or leaky condensate pipelines, overflows from cooling basins or condensate storage ponds. There have been spills from condensate reinjection and sump failures which occur during operation. If released geothermal fluids reach surface waters, there is a potential for impact on the surrounding aquatic life. A KGRA Fish and Element Loads study in 1990 shows that steam released during power production could mobilize a variety of elements that ultimately enter the water courses and impact the aquatic environment. Results point to more accumulative impact on fish from mining and geothermal activity rather than from either alone.

Both Big Sulpher Creek and Squaw Creek, tributaries of the Russian River at Cloverdale, have been subject to water pollution incidents in the past from geothermal operations. The primary toxic hazard is the possibility of accumulation in soil or in plant and animal tissues. In 1976, there was a large kill of steelhead trout in Big Sulphur Creek from a condensate spill and boron was seen as the possible toxin. In the event of an accidental condensate spill, the steam supplier must analyze the water and report to the Regional Water Quality Control Board (RWQCB). The Board may take appropriate enforcement action requiring either the steam supplier or the plant operator to take measures to prevent future spills. (See Table 1) While the spills are usually documented by RWQCB or DFG, the effects of most spills on fish go undetected.

Records from the RWQCB files for just PG&E spills shows a graph covering 1985 to 1992 stating that in 8 years 57 spills occurred and 15 or 25% reached a creek. No spills have been judged significant since 1988 and fish kills occurred in only tens of feet downstream from spill per the opinion of Dave Snestinger of the RWQCB. Snestinger reported that the record for spills has gotten better.

The continuation of the geothermal production becomes questionable when there is a significant toll on the environment. Potential impact to sensitive and unique species may be too high a price (see October Sonoma County E.I.R.). Potential degradation of drinking water is too high a risk. Further degradation to the area waterways and fisheries (See November Sonoma County E.I.R.) which include the Russian River and the Sacramento River watersheds may be too high a cost for cheap, shipped-out electricity.

Needs

The regulation of the geothermal industry is deficient. For example, if bankruptcy of steam operators or plant operators occur, the taxpayer gets stuck. A suggestion is to increase the bond required so that it really covers costs. Also, make operators buy the private land rather than lease it to make them solely responsible and take the burden off of private landowners.

The Dept. of Oil and Gas administers the Order of Abandonment in California Laws of Conservation of Geothermal Resources and California Code of Regulations, but they have jurisdiction over wells only. The California Energy Commission (CEC) requires abandonment and plants be covered in their recent EIRs, but unfortunately many plants were permitted prior to written controls. The counties have jurisdiction only so far as their land use permits allow. A county may petition the CEC for delegation of the CEC authority, however, they must adopt a geothermal element in their general plan that conforms to state guidelines and be ready to provide technically trained and available staff.

Legislation or new rules for decisions at the top level of state authority may need to be considered for the legally subsaturated right to control plant closure. A monitoring of toxic releases and effects on fish needs to be upgraded and penalized appropriately. Monitoring must be more accurate and consistent for problem companies to avoid bankruptcy issues and impacts on the state taxpayers. But since the Geothermal Resources Board was disbanded in 1984, there seems to be no special task force for such action. The Department of Oil and Gas needs to enforce a contractual agreement making the steam operator responsible and financially penalized if steam is not producible as promised, thus predictions will likely be more accurate and responsible. This might need to include the reliability of injecting shipped-in water such as the Clearlake wastewater effluent.

Higher penalties need to be imposed for unpaid delinquent Assessments and Penalties imposed by the Department of Oil and Gas. A financial analysis that address shutting down plants and wells that are problems due to toxicity spills, seismicity concerns, and inefficiency is needed. There needs to be a conscious effort by the public to reduce their use of electricity and finally, the people of California need to look closely at the costs, both financial and environmental, for producing electricity and for supporting growth when now more people are leaving the state then are coming in.

Linda Ritter is a resident of Cloverdale and a member of Citizens of Cloverdale, a local citizens group dedicated to protecting the environment and support citizen participation.

REGIONAL WATER QUALITY CONTROL BOARD HEARINGS ON GEOTHERMAL CONDENSATE SPILLS

6/85	PG&E	20,000 gallon		$29,000 fine
4/86	Union	540 gallon	Big Sulphur Creek	$ 4,000 fine
8/86	Union	11,440 gallon	Big Sulphur Creek	$20,000 fine
2/87	NCPA	up to 15,000 gallon	Big Sulphur Creek	$ 5,000 fine
4/88	PG&E	30,700 gallon	Big Sulphur Creek	$30,000 fine

Table 1

Keep Those Geysers Gushing — Inject Them With Effluent

A dam was proposed on Big Sulphur Creek to enclose surface water runoff that would be used to inject water into steam wells in The Geysers. At the North Coast Regional Water Quality Control Board (RCRWQCB) workshop held in August, 1993, Bill Cox of the Department of Fish and Game, stated "I am opposed to this project and I am really concerned about it."

NCPA and Calpine/Santa Rosa Geothermal Co. have postponed the application because they couldn't get around the water rights issue and because they plan on tapping into the waste effluent proposed for stripping from Clearlake. Clearlake's proposal is to ship 8,500 gallons per minute of wastewater effluent to the Clearlake and Sonoma County steam suppliers. Unocal, owner of about half of the steam wells, is looking forward to the lake County wastewater water. Unocal should have begun new injection tests in September, 1993.

Past work to assess the predictions of reservoir behavior has shown that liquid saturation, permeability of the rock and the fracture characteristics for steam release are still poorly understood. Studies are hampered by the fact that much of the reservoir engineering data from The Geysers steam fields are proprietary and not available to the public. A recent study on hydrothermal upflow zones shows that rock permeability controls fluid circulation, and permeability may vary in geologic structures over time in response to thermal stress and in response to seismic action. Fractures where the steam normally would rise become sealed, thus reducing the ability to reinject fluids. The engineers who propose injection don't know what will work, but they sure would like to try a very expensive solution.

EIR REQUIREMENTS

There needs to be a discussion of issues relating to water development. The State Water Resources Control Board (SWRCB), Division of Water Rights, has stated in their Outline For EIRs involving water development, that a project must demonstrate:

- The amount of power to be generated and the amount of water used is not in excess of what is required.
- For power generation projects, indicate what demand forecasts are used.
- Discuss assumptions concerning the timing of energy demand.
- Describe measures implemented to reduce energy and water consumption.
- If water is sold, the pricing structure.
- Describe the economics and financing of the entire project.
- Seismic effect.
- Groundwater and surface water resources available in the area.
- Specifically addressed point and non-point sources of pollution such as mines.
- Describe impact on fish and riparian plants, habitat of rare and endangered species.
- Describe current land use planning by all levels of government.
- If power generation or power consumption then describe use patterns in the region.
- Physical changes such as drainage and temperature.

The question arises, is wastewater effluent as a resource controlled under the SWRCB?

HOW TO GET INVOLVED

The Lake County Planning Department and Bureau of Lands Management is preparing a "Joint EIR/EIS for Sewer Effluent for Injection at Geysers Steam Fields." The Public Draft will be available December 1993 and can be obtained by calling (707) 263-2273 or writing Clearlake Planning Department at 238 Main Street, Lakeport, CA. Hearings on the EIR will take place in the first quarter of 1994 at Lake County Board of Supervisors Chambers in Lakeport.

What Your County Planning Department Thinks About Geysers and Effluent Injection

Steve Sharpe, former Geothermal Coordinator, who currently is the staff for LAFCO and serves as the advisor on geothermal matters in the County Planning Department, feels that "The Wastewater effluent project is a good project." According to Sharpe, prior treatment of the effluent and on-site storage will be important considerations in analyzing the impact of the project. In general, Sharpe states that the record for the DWR plants should not be used to judge the entire process at The Geysers.

He considers the steam fields do represent a renewable resource and that it is a clean source of electricity in comparison to other options. He proposes that the technology is limited due to lack of research and development funds because the oil price drops in the 1980's meant that not enough money was coming in to pay for advancements in techniques. Sharpe says, "It is a grand experiment." Sharpe notes that "Geothermal industries and regulators (Fish and Game, Counties, State Lands Commission, Bureau of Lands Management, Water Quality Control Board and Regional Air Quality Boards) are working together on regulations to control the abandonment of plants. There is cooperation between all members to make sure things happen consistently."

Sharpe notes that fish counts are up significantly in the last year with a wet weather pattern and would like to see the county perform a follow-up study on effects on fish habitat in The Geysers steamfield.

Sonoma County

CITY WATCH

THE CITIZENS' PERSPECTIVE

CLOVERDALE

Casters

by Krista Rector

What happens when "the one that got away" isn't a fish, but one of California's most prized blue ribbon fishing rivers? The Russian River used to be known as a world renowned steelhead and salmon fishery, and the number of fish were in the hundreds of thousands. Now, fish counts on the Russian River are in the hundreds.

In 1989, volunteers from the Cloverdale area came together to form the CASTERS, which stands for Cloverdale Anglers for Steelhead and Trout Enhancement in our River and Streams. They shared a common goal to make a long term commitment towards restoring the Russian River's fishery. They contacted the Department of Fish and Game (DFG) and offered their volunteer labor force in placing Warm Springs Dam hatchery fish back into the wild.

... rapid destruction of river-runs through gravel mining, forest clear cutting, sewer discharge, toxic pollutants, over-fishing and damming of water ways have resulted in increases of sedimentation, depletion of oxygen, and reduction of healthy numbers of procreative fish.

The DFG surveys tributaries of the Russian River to identify areas that meet their guidelines, such as the criteria which prohibits wild resident fish. The volunteers take returning sea-run, pre-spawn adult steelhead from the Hatchery and place them in the targeted tributaries. In 1993, they placed a total of 500 pairs into spawning nurseries in six major tributaries of the Russian River.

The CASTERS face an uphill battle against the many obstacles in the way of a healthy river and fish hatchery. Many forces, mostly man-made, have caused the destruction of this once healthy river system. In 1905, the Eel River Power and Irrigation Company built a diversion dam and tunnel at the Eel River. The Eel River water is stored in Lake Pillsbury in Mendocino County for release to the Van Arsdale Reservoir where it is diverted to a PG&E plant in Potter Valley where the water exists into the Russian River. Thus, at times, 70% of Russian River water is from the Eel River which comes through the Potter Valley tunnel. The introduction of Eel River water had one of the largest impacts in non-glacial history on the genetic purity of Russian River steelhead because the Eel River fish followed the imprint of the Eel River water and diverged into the Russian into their return from their ocean migration. Thus, a rapid and artificial mixing of the genetic strain of the Russian River fish occurred.

Life Cycle

Life for the fish begin with a concurrent implanting of sperm and eggs into the bottom of a nest made of gravel. In 30 to 50 days, the eggs hatch and the fish continue to lie in the gravel, feeding from the egg sacs attached to their bellies. The fish grow to fingerling size and remain near their hatchery from one to two years till they imprint and transform to survive life in salt water. They move downstream to the ocean where they may spend three to four years making 10,000 miles circuits.

They then seek out the freshwater flows that lead to their old hatcheries and move upstream to spawn, once again sustaining the life cycle. Those that do not survive the rigors of spawning, die — their rotting bodies become a supply of minerals which feed the forests that in turn protect their hatcheries from siltation and cool the water for their migrations. The ones that survive may be caught and become a part of the food chain for animals, including man. Ultimately, they become a part of the system that moves ocean nutrients up into inland water ways and feed the land.

Genetic Diversity

Bruce Brown in his book, "Mountain in the Clouds," discusses how fish develop high adaptation rate for the specific rivers that they run in. Brown says, "They know through the genetic legacy of their parents where to hide, what their prey looks like, when to run to the sea and when to return. Since every river is unique in its flow

Steelhead and salmon over the last two million years have been depleted and genetically mixed by natural disasters --- but at a rate that allowed for progressive adaptation. Now the rapid destruction of river-runs through gravel mining, forest clear cutting, sewer discharge, toxic pollutants, over fishing and damming of water ways have resulted in increases of sedimentation, depletion of oxygen, and reduction of healthy numbers of procreative fish. We are killing off our fish stock and destroying the options of genetic diversity.

One of the controversies in fish genetics is the introduction of fish raised in hatchery plants. Fish hatcheries were introduced to offset the effects of the buildings of dams. They are regulated by the Department of Fish and Game. Hatcheries will frequently follow the practice of milking only a few females for the eggs and fertilize from only one male's sperm, thus reducing the diversity. Hatchery fish, particularly Silver salmon, can sometimes be infected with bacterial kidney disease (BKD) which is believed to be passed from mother to egg.

According to Royce Gunter of the Warm Springs Hatchery, their hatchery method of breeding progeny for steelhead and chinook salmon is to use three to five males, mixing the sperm of the males then use that mix with the eggs of two females. They use two males to one female for coho salmon, plus they isolate groups of progeny to test for BKD positive fish. They do not combine eggs from one female with another female at the time of spawning.

They are aware of the need to enhance diversity and use the method of taking random selection rather than selecting one type such as the largest. The hatchery staff uses a more complex method of selection by taking eggs from the earliest through the latest returning fish in various quantities. Another method aimed at protecting diversity is to take the late season of "blue backs" and allow them to only be breed with other blue backs in case they represent a separate strain.

Bill Cox, Fishery biologist of the DFG, feels that the work at the hatchery to protect diversity is substantiated by the work of biologist Dr. Jennifer Nielsen. He concluded that her report showed that the Hatchery fish have a higher rate of diversity than wild fish. Cox has said, "I am apprehensive about trucking of fish into tributaries and would be more comfortable with putting them into the main stream and let them find their own way, but as long as there isn't a large number in any particular stream to overwhelm the resident fish, it may be okay. I've only authorized placement in Sulphur Creek because it is difficult for wild fish to get there."

The CASTERS are not planting silver salmon, a breed prone to BKD. The adult fish they use in their program are held in completely separate water supply from any silver salmon as a further protection from the BKD disease. The CASTERS are very aware of the need for diversity and follow the strict guidelines enforced by the DFG. They stressed that the DFG have set some streams off-limits to protect what may be a viable wild population. Lester Rosenthal, spokesman for the CASTERS states, "Hatcheries are here to stay and we must work to fold hatchery offspring into the native element by placing them in the tributaries." He states further, "We are not taking fingerling juveniles, but only adult fish for stream placement."

Restoration

Rosenthal has expressed his concern when he asserts, "The fish are so adaptable, yet we killed them, how did we do that? We have to start over and have to redesign. Complete restoration will take many years because the restoration of the river will take time. We must educate the public to use this resource more responsibly." Rosenthal speaks to the CASTERS sense of urgency when he says, "In fishery restoration there are two camps, the doers and the sayers. The CASTERS are the doers because they have accepted the facts and the current situation and have developed a plan and are acting on it."

The CASTERS restoration work has encompassed the cleaning of stream obstruction for a clear migratory path for a return to the spawning nursery. They are stabilizing bank erosion and creating a cooling canopy with restoration planting of native planet species. In the school year of 1004-1005, they will initiate an Adapt-A-Stream project which is designed to involve school children in the Cloverdale area. The CASTERS view is that a healthy river with a healthy fishery will help boost Cloverdale's economy all year long.

Krista Rector is a resident of Cloverdale and a member of Citizens of Cloverdale, a local citizens group dedicated to protecting the environment and support citizen participation.

Hatchery — How to Help

CASTERS is seeking the support of Cloverdale and County residents. They are compiling an oral history of the Russian River to expand their extensive knowledge of the river's past fishing history and encourage people to share their memories and the stories they heard as children. The volunteers can use help in placing the fish in the streams and creeks. Interested landowners who would like a stream stocked can call for information. They could use financial assistance to offset their costs such as the video tape which helps educate people on their program. They encourage people who are interested to contact them and become members. Call Lester Rosenthal at 894-5104 or Jim Wirt at 894-2014.

Fish Kill Count Not Available

Sulphur Creek tributary, Squaw Creek, contains 23% of the steelhead nursery habitat. They are important watersheds of the Russian River located within the Geysers steam fields. A two year study of the metal burdens in fish from 28 stations located on 9 streams in the Sonoma County section of the Geysers steam fields was completed in 1990. The report was to address additional or alternative mitigation measures for protection of fish. An accurate count of fish kills from spills of condensate and other pollutants is apparently unavailable. Dave Snetsinger of the North Coast Regional Water Quality Control Board (NCRWQCB) doesn't have records of the fish kills in his monitoring of the compliance of operators at the Geysers and referred the question to the Department of Fish and Game (DFG). DFG representative, Bill Cox, advises that the NCRWQCB would have those figures. In a second verification discussion with Dave Snetsinger, he stated that the NCRWQCB documents the why and the wherefore of the accidental condensate or pollutant spills in the Geysers to determine negligence, however, they rely on the DFG if there is an environmental loss. Mitigation is only as good as the monitoring that is being done and apparently not much is being done.

Possible Fisheries Plan At the North Coast Region

A North Coast Water Quality Control Board (NCRWQCB) workshop was held on 8-24-93, state and local representatives spoke about the Russian River's disappearing fish. They announced that the State will begin work on a "basin plan" for Russian River fisheries. The plan will discuss the reasons for the fish decline and recommend ways to improve the health of the River and its watershed. Your concerns/ comments should be directed to Cathy Goodwin or Robert Klamt at 707/576-2220.

For More Information:

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Unique and Endangered

by Krista Rector

I had a laugh not long ago when I was thumbing through a trade magazine for developers and came across an advertisement that said, "Your worst nightmare." Below this statement was a picture of a beautiful, but obviously unique and endangered plant species that was apparently found on a developer's newly purchased lot.

I share this with you simply because it is an example of what is one man's joy is another man's sorrow. Yet the protection of unique species really needs to be recognized as a preservation of something necessary for all mankind. Unique species are unique because there are so few left, but what is really behind preservation is the fact that unique species are the holders of genetic material and unknown resources for the good of all mankind.

Yet the protection of unique species really needs to be recognized as a preservation of something necessary for all mankind.

Our pharmaceutical, and the subsequent preservation of life, is based on recognition and utilization of our botanical resources. Because we don't have all the answers yet and don't know all the possible cures for mankind's ills, it means that we can't afford to cut off possible avenues of future success by destroying even one unique plant.

Plant Life Ignored

The California Environmental Quality Act (CEQA) recognizes the need to protect unique or endangered species. The Lead Agency which acts on behalf of the state to enforce CEQA guidelines will use a checklist to identify significant environmental aspects potentially impacted by development or use of resources. The checklist itemizes such things as noise, air, water, transportation, and it must assess plant life too. Much too often the plant life is overshadowed or ignored altogether.

This happened in the Clover Springs EIR assessment for the 500+ homes development in the south west area of Cloverdale. The development covered areas inside and outside of the city limits. The area was to have been completely surveyed for unique and endangered species, but was not surveyed because, according to the EIR comment responses, "although requested, topographic maps were not available to biological survey teams, thus the total 375 acres could not be accurately surveyed and mapped."

The ruling under CEQA specified that the criteria for plant life impact is based on 1) The change in diversity of a species or number of species; 2) or reduction of the number of a unique, rare or endangered species of plant; 3) the introduction of a new species of plant or a barrier to the normal replenishment of an existing species; and 4) the reduction of any agricultural crop.

What was potentially unique in the Clover Springs proposed development area was the serpentine soils indigenous plant.

Serpentine Soils

Cloverdale geology and the neighboring Macayamas Mountains are substantially composed of serpentine soils. Serpentine consists mainly of the minerals chrysotile, lizardite and antigonite, plus magnesium. Chrysotile is the most common fibrous mineral and is most widely mined, processed and manufactured as asbestos.

Serpentine soils were originally mapped in the early 1800's in northern California, but really came into significance with the mapping in the early 1900's for showing Quicksilver or liquid Mercury. (Mercuryville with a population of 10 or so is on the road up to the Geysers east of Cloverdale). The link between serpentine soils and plant life was made in a description of the ore deposits in the Mayacamas Mountain region.

Plants on the surface tell the tale of what is under the ground. Serpentine soils are relatively infertile and inhospitable to many kinds of plants. Both the scarcity of some minerals and the superabundance of others is the cause of the infertility.

Gleason and Cronquest in their book, *The Natural Geography of Plant*, noted that "Many species are wholly restricted to serpentine soils in nature, sometimes to a single outcrop only a few acres in extent. One of the best places in the U.S. to look for previously unknown species of flowering plants, species that are 'new to science' is on serpentine."

Preservation of serpentine habitat is an expected outcome of recognizing a rare plant's endangered status. It is important because much of the regional serpentine habitat is falling victim to land development including mining and geothermal power development.

Serpentines in California occur at moderate elevations and wholly west of the Sierra Nevada crest. Some specific sites are the Presidio in San Francisco, the section reaching from the ocean and leading up to Mount Tam, "The Cedars" in Cazadero in the Austin Creek drainage and in the vicinity of the Geysers at the Macayamas Mountains spreading through the counties of Napa, Sonoma and Mendocino.

Sections of serpentine soils can be identified by the abrupt change from oak woodland to chaparral or areas of low thorny shrubs. Maps will show serpentine or serpentinite as a shocking purple, and the symbol will be "ub", "Sp" or "Sc." A substantial number of serpentine-endemic taxa or Serpentine indicator plants are rare enough to be on the Federal and California rare and endangered species list.

The ones in the Cloverdale area are: Socrates Mine jewelflower or Streptanthus brachiatus of the mustard family (first identified in the area of Socrates Mine east of Cloverdale), the Serpentine reed grass or Calamagrostis ophiditis, the Napa Lomatium or Lomatium repostrum of the parsley family (a type of plant used by Northern California Indian tribes as medicine, as food and in tribal rites).

Arthur Kruckeberg in *California Serpentine*, showed in a 1981 study in California, a remarkable association between a unique serpentine plant and a unique butterfly. The larvae or young of the Pieris sisymbri butterfly prefer to feed on serpentine streptanthus species. In turn, the streptanthus have developed a deterrent based on growing what looks like a mimic egg of the butterfly. When the butterfly see the mimic eggs, they pass on to lay their eggs elsewhere, thinking that the plant is already taken.

A sample of serpentine is on display at the Fish Hatchery building at Lake Sonoma. After seeing the display, it is easy to recognize the serpentine outcropping along the trails lining the lake. If you are in luck, you may have the opportunity of seeing one of the unique plants that inhabit our part of the world.

Diligence is needed to protect our indigenous plant species and thorough EIR preparations with close application of the CEQA rules will be required. Getting to know what is around you is the first step. Don't wait until you have only 30 days to review an EIR to get to know your surrounding area. Start today to build the knowledge that you just might need in the future.

Krista Rector is a resident of Cloverdale and a member of Citizens of Cloverdale, a local citizens group dedicated to protecting the environment and support citizen participation.

For More Information:

Call Krista Rector, Citizens For Cloverdale: 894-3027

Taking Hostages on the Santa Rosa City Council, continued from previous page

Although the original charter provided for an independently elected city treasurer, that position was eliminated many years ago.

Please The City Manager

The City Council may not hire, fire or in any direct way control the staff's actions. To advance and prosper within the system, members must please the city manager, not the council. Staff members who have publicly disagreed with Ken Blackman have had short careers.

How can a council member who has another full time job and no staff compete for power with a skilled and experienced full-time bureaucrat who has access to more than 1,000 employees and the resources of a budget that approaches $140 million? The answer is that they can't.

There was a time when council members had greater influence, but that was when the manager was less experienced and entrenched, the staff and budget were smaller and the issues confronting city government were simpler.

Manager tenure is a major factor in the dilution of citizen and elected legislative power under a city manager government. A new manager is on probation and must cater to the concerns of the council that hire him or her. The staff that he/she inherits includes entrenched department heads with independent powers.

Unassailable Institution

Once in office longer than a majority of the council, the manager acquires increased independence. When he/she has served longer than any member of the council, the manager approaches the status of an unassailable institution. (In the case of Santa Rosa it is unlikely that any council member recalls when Ken Blackman was not city manager.)

At the same time, that long tenure allows the manager to carve and shape the bureaucracy he/she inherited and to insure that its key personnel are indebted to him/her for the position each holds and that policy direction emanates only from his/her office.

During his 23-year term, Ken Blackman has concentrated power in his hands through development of a compliant staff and a system that limits and delays council citizen access to information. (Agendas and reports are often provided to the council members and the public Friday evening, three days before the Tuesday meeting at which they are considered. The Marketplace subsidy item was made public on the Friday evening prior to the three-day Labor Day weekend).

In addition, he has developed a constituency of his own and a status that make it almost impossible for the council to exercise the theoretical power they have to discharge him. Those ingredients add up to a recipe for non-responsive and non-accountable government.

Ignoring tenure's demeaning effect on democracy, its effect on innovation and imaginative response to change is also stultifying. Aviators point out that although there are old pilots and there are bold pilots, there are no old bold pilots.

That statement could apply equally to long tenured city managers whose main stock in trade is knowledge of what won't work.

Although as an airline passenger I cheer the pilot's caution, that same caution on the part of a public administrator prevents constructive change in an era in which it is desperately needed.

I'm not suggesting that the city manager system hasn't worked for the public benefit. In light of his great power, we have been fortunate that Ken Blackman, who has much to recommend him, holds the position.

What I am saying is that the system as practiced in Santa Rosa dilutes democracy and accountability and makes it difficult for elected officials or voters to change or influence policy.

A Strong Mayor System?

There is not space to detail possible reforms but only to mention in passing that they do exist. One alternative is the strong mayor system. That involves a full-time elected mayor who works with a city administrator in running the city. Unlike our system, the elected mayor can be held responsible for the way the city is run.

Another possibility is the institution of a term limit for the city manager. Proponents of term limits support their position with the argument that long stays in office enhance the power of officeholders while isolating them from everyday concerns and voter control.

If you buy that argument for legislators who regularly face election, it applies in spades to city managers who don't.

Another possibility would be to elect the city manager so that he is required to answer directly to the voters on a regular basis.

I fervently believe that democracy works and that to the extent it is frustrated, as it presently is in Santa Rosa, we all lose.

Whatever we do, we must give citizens a greater share in the governing process and find some way to release our elected representatives from the bondage that prevents them from playing the role that was intended for them.

Richard Day of Santa Rosa is an environmental activist, lawyer and former Municipal Court judge.

Cloverdale article for August-September, 1994 issue of EIR Reporter, 7/4/94

QUEEN OF THE WORLD'S GEYSERS IS GETTING THE ROYAL FLUSH

"Government funding agencies are attracted to innovative, resource-saving ideas", stated Mark Dellinger, resource manager for the Lake County Sanitation District, when presenting the Lake County Board of Supervisors with the option of injecting their wastewater into The Geysers. The supervisors were aghast at the potential rate increase that they would have to impose on the residents of the southeast area of Lake County and were worried about how likely was the Federal and/or state government to kick in the needed funds to cover the county's costs of $16 million. Sixteen million for what? What was being proposed was that in order to cope with a cease and desist order slapped on them for polluting waters of the state, and in order to break the logjam of housing development restrictions, they needed to come up with a solution to get rid of their secondary treated effluent and increase the capacity of their sewer treatment plants. Everybody knows what the answers are but nobody knows where the money would come from.

So the Royal Flush was devised. The Geysers, a Known Geothermal Resource Area covering 140 acres east of Cloverdale, is the biggest geothermal resource in the world. In the production of electricity by the use of a natural resource, steam, it is the Queen, the largest site in the world. But the Queen, rather than being one of the most valuable playing cards that you protect above all else, was being stripped clean. Too much steam was being taken out to feed too many power plants. Rather than recoup and redesign, the power operators are trying boost steam production to run their power plants. They want to do overnight what it takes nature 500 years to do. Rather than natural recharge through meteoric recharge or rain, the proposal was to spend more than $39 million to build a grander treatment plant, a 26 mile effluent pipeline carrying 3.6 million gallons of secondary effluent crossing 11 creeks 66 times, a series of pumping stations and 600,000 gallon surge tank, and the use of 16 injection wells to put wastewater into the ground. The problem is, the tests for re-injection of water to flush the system and kickstart steam production has been limited in scope and limited in time; that is, it is still experimental.

And what is King in The Geysers game? Water and power. Water to produce the electrical power and power to pump other water to the urban areas. And the Ace ~~in the~~ is the money that keeps it all flowing in this gambling game.

GETTING TO KNOW THE GAME

No one came to the first public hearing on the proposed Geysers Effluent Injection EIR before the Lake County Planning commission. Maybe it was because the meeting unfortunately was held on a work day at 9:00 am, or because the project is so massive it is hard to grasp. But grasp it we must and even though the next hearing before the Planning commission will be over when this article is going to press, but you have another chance to comment as there will be hearings before the Lake County Board of Supervisors probably in September of 1994. Why should residents of Cloverdale or Sonoma County be concerned? Because, after nine years of debate, the City of Santa Rosa is seriously considering six options for discharge of their wastewater and one of them is the option of Geysers effluent injection. Because, once more, a grand experiment is being paid for, ultimately, by the taxpayers. Because, one of the greatest natural wonders is being further trampled on. And because the experiment might effect resources in our own backyard and the cumulative impacts of all proposed projects hasn't been fully explored.

Let's examine what is being proposed. First, wastewater discharge problems are supposed to be solved. The City of Clearlake housing has been limited by the availability of sewer hookups and Lake County's sewage treatment plant was slapped with a cease and desist order by the state Regional Water Quality Control Board. Santa Rosa wants to discharge with the least opposition possible. Then, electrical power plant production

deterioration due to the decline in steam pressure is to be solved. However simply the EIR tries to state the idea that "steam pressure is in decline", it is not so simple to understand and to fix. An understanding of the growth in electrical power production and an understanding of the unique geology resource is needed. And finally, an appreciation is needed of what is at risk. The risks include destruction to the habitat of plants and wildlife, the risk of killing a productive resource and the risk of spending money at a loss.

WASTEWATER

Let's explore the sewage problem. As of January 1993, no city is allowed to discharge secondary treated wastewater into a waterway and must treat effluent to a tertiary state. For instance, the Regional Water Quality Control Board (RWQCB), who has discretionary oversite powers, has determined that for the Russian River Basin Plan, discharges to the Russian River and it's tributaries shall be tertiary or advanced treated wastewater. However, the Lake County residents sewage treatment plants including the City of Clearlake, Clearlake Highlands and the Town of Middletown find that the cost of tertiary treatment is prohibitive for release into their area watersheds.

What does secondary or tertiary mean? Secondary sewage treatment means there is removal of 80-90% of organic materials and over 80% of suspended solids. It involves a multiple-step operation involving one biological process and one or more processes for settling of suspended solids. The cost is generally between 10 cents and 70 cents per 1,000 gallons treated. Tertiary treatment is now required because synthetic organic compounds and inorganic ions are now in the waste stream and the tertiary or advanced wastewater treatment includes additional steps in order to remove of such things as phosphate and nitrate. Tertiary treatment costs generally 20 cents and 90 cents per 1,000 gallons treated. Cities and towns of Lake County, and potentially cities in Sonoma County, could avoid of cost for mandatory advanced wastewater treatment by using the Geysers effluent injection option.

Why don't the cities in Lake County treat and discharge to surface area waters? There is a prohibitive ordinance about discharging to Clear Lake. An original solution was a proposal to discharge into Cache Creek drainage basin, a Clear Lake run off of the Sacramento River. However, protests against the proposed discharge by residents of downstream water users in Yolo County caused Lake County to regroup and rethink. Then the proposal was made to ship their effluent to The Geysers. This proposal had been given before. It had been offered to the City of Santa Rosa but they turned it down. And because the biggest player, Santa Rosa, turned it down, it wasn't offered to the smaller cities in Sonoma County. What was different now? The cost could now be justified.

GEYSERS GEOLOGY AND NATURAL WATER RECHARGE

Shipping effluent to The Geysers was now cost effective not because the raw materials were cheaper but because the power operators were becoming more desperate. They were desperate because pressure has dropped from 500 pounds per square inch (psi) to less than 200 psi. This means the steam isn't coming to the surface anymore. They were desperate because the steam is superheated and dry. This is a problem because the hot steam holds ammonium and carbon dioxide which is corrosive and destroys the plants valves and pipes and affected turbine performance. They were desperate because a large number of expensive plants were built (California has 50% of the world's geothermal power plants), and there just wasn't the power to generate the electricity they were designed to create. They were desperate because the costly plants and wells (Calpine 1991 well, Wolfe No. 1 cost $2 million) were developed with long term financing and they can't back out. They were desperate because the steam isn't there anymore. How could this happen? To understand this, we must comprehend what is The Geysers and what influences it.

Geysers exist because volcanoes and magma exist. There have been 500 active volcanoes in the history of man on earth but geysers are found at only 40 of them. The Geysers is one of the most unique and with the magma flow beneath Mt. Konocti and Mt.

Hannah, it is where the earth's crust is thinnest. The Geysers are being created by the juncture of the Pacific and North American plates causing magma to rise from the deep to an unusually shallow depth. The evolution of The Geysers field into a steam system occurred over 10,000 years ago.

Geysers exist because they are a "pressure cooker". That is, geysers are created because a sealed area contains trapped water that is heated. If small openings are made into the pressure cooker, steam or fumaroles are released to the surface. Geysers are rare because a special set of geological conditions has to be met. Heat comes from a volcanic source. The enclosed pressure cooker is fed water very slowly because there are never open channels but just tiny cracks or water movement around mineral grains in rock. All geysers are recharged from rain and snow with only 5% of surface runoff becoming a part of the system. They require enormous amounts of water (Yellowstone uses 70 million gallons per day). The steam in a geysers never evaporates because it in kept under great pressure by the confining pressure of the water and rocks around it. The length of time for water to naturally move from the surface down into a geysers and then return to the surface is believed to be 500 years.

The Geysers consists of two unique areas, the north and south areas which have different conditions and react differently. The north contains less vapor dominated conditions while the south contains a shallower, leaky and mature steam reservoir. The type of plant built depends on whether it is dry steam or water vapor steam. The steam in the reservoir is about 475 degrees Fahrenheit and pressures of 500 pounds per inch exist because hydrostatic pressure exists, indicating that the steam reservoir is substantially cut off from the ground water overlying the system. The boiling brine contained in The Geysers is made up of a high concentration of dissolved minerals, silica, boron and arsenic. (The condensate left over after the hot steam is used to produce electricity must be cooled and re-injected, otherwise it would have to be trucked to Kettleman Hills toxic waste dump.) Dissolved minerals in a hydrothermal system creates veins of minerals sealing fissures or fractures that radiate out from the heat source. The hydrothermal system at The Geysers deposited the veins of mercury which has been mined commercially.

In 1981, the estimated capacity for The Geysers was to be 2,000 megawatts of electricity (MWe) and to have lasted 129 years. From 1968 to 1987 (when 4 plants were brought on line in one year), production at The Geysers has risen from 4 MWe to 2000 MWe and then dropped in 1992 to 1400 MWe. Capacity addition to The Geysers had been gradual until the end of 1982, but in the following 7 years, power production was doubled from 943 to 2056 Mwe. By 1990, most of the geothermal field was declining at rates exceeding 15% and the southern part of the reservoir was experiencing declines of 20% to 25%. In less than 30 years, The Geysers production has lost significant resource output. There were simply too many straws in the geothermal glass.

RESOURCES AND RISKS

At one time, The Geysers were known as the 8th wonder of the world and in the not too distant past, The Geysers were considered second only to Yosemite for California's natural wonders (see December, 1993 EIR Reporter). Most of the world's major geothermal areas have been depleted though steam and power development. Only the Krontoski Biological Reserve in the U.S.S.R and Yellowstone National Park remain intact among the world's major geothermal areas. (Yellowstone is under the ax with proposed, nearby geothermal development.)

Clear Lake is over 2.9 millions years old and perhaps the oldest lake on the North American Continent. This project proposes to remove water from the lake to make up the difference between the amount of wastewater available now and what is anticipated in the future. Removal of the water is a potential impact on the lake which suffers algal blooms. The Lake is the source of water for Solano County, Yolo County and Lake County residents and business. This project proposes the removal of water from its' watershed. Watershed or area-of-origin protective legislation was enacted in order to alleviate the fear of

Northern California interests that local water supplies would become depleted. The California Legislation enacted the Watershed Protection Act wherein section 11460 states that "a watershed or area wherein water originates, or an area immediately adjacent thereto which can be conveniently be supplied with water therefrom,...the prior right to all of the water reasonably required to adequately supply the beneficial needs of the watershed area."

This project has the potential to cause permanent reduction of habitat of the northwestern pond turtle, red-legged frog, yellow-legged frog, California horned lark, loggerhead shrike, black-shouldered kite, Cooper's hawk and sharp-shinned hawk, and the Federally listed endangered species, the Bald Eagle. Species of special concern are species with breeding populations within California that may face extinction in the near future. There are potential cumulative losses of individual plants including listed and candidate plant species and other special status plant species. The Serpentine or asbestos soils, and the accompanying botany and insects are unique (see October 1993 EIR Reporter).

The Geysers area shows very high levels of the toxic elements mercury, lead, zinc and copper from the soil sedimentation and past mining activities which increase metal burdens and leach trace elements into streams. Furthermore, the venting of steam wells and mineral laden steam with atmospheric fallout from cooling towers also contribute to the total or cumulative burden that effect aquatic life (see November 1993 EIR Reporter). Note that in the past 20 years, there has been a 90% reduction of the total count of native fish in the Russian River.

IS THERE SOMETHING BETTER?

What a deal. The cities come up with something innovative that has that "resource-saving" hook for the government funding. The power brokers get a source of water to experiment with. And the taxpayers who don't grasp a thing will pay for anything that goes wrong. Is there something better?

Perhaps. Perhaps you could save a natural resource that has been overplayed by mankind but maybe the recharge could be in a natural system such as at the Collayomi Fault or Cobb Mountain. But then that might take a while and might benefit the areas wider resources rather than specific power brokers individual steam wells. It might affect natural springs and drinking water sources. Perhaps the injection needs to be phased in over a period of time with smaller amounts of water to really test the feasibility of re-injection and suspend operation and reduce the cost of reclamation if injection doesn't work, but who would pay for it? Perhaps the wastewater needs to be adequately cleaned so that if there are problems with injection or accidental runoff, it won't effect the native habitats or the downstream water users, but who will pay for it? Perhaps power plants need to be run when power is needed instead of all the time, but only some of the plants are owned by the steam producers themselves and it's out of the others control. Perhaps the costs for this promised steam needs to be covered by bonds put up by the people selling the idea and which will be used if they default on what they promise to deliver. When royalties to the counties from one plant operator, NCPA, alone will be $120,461,000 between 1995 and 2028 then a bond to fully cover restoration is appropriate. Perhaps power plants that are obsolete and inappropriately built can be closed so steam isn't wasted and the land can be reclaimed, but who will pay the $5 to $15 million for reclamation and who will cover the cost of dropped 30 year stocks and bonds sold to the public? Perhaps a reliance on a 20 year agreement between business with only a 2 year "walk-away" notice isn't good enough for a public system and a better deal is needed. Perhaps a combination of options could be enacted that would allow for a renewable resource, not just a secondary recovery. Perhaps more conservation of both water and electricity needs to take place so the demands on our resources are reduced.

Other concerns are out there, like why the increased seismicity from the current steam withdrawal and condensate re-injection? But ultimately your concern should be that

Sonoma County and Lake County are playing a game, a gambling game and this one isn't being proposed by the Indians. The public officials know one certainty, the certainty that citizens will continue to ploddingly pay taxes, and they know one uncertainty, that there will be uncertain results from wastewater injection. The gambling game is dependent on you, the taxpayer, willing to pay, one way or another. What is certain for the taxpayers is that there is a spiral of costs for The Geysers and what once was a depletion of natural resources has now moved into a depletion of a local economy. Please consider commenting on this project and get involved. Call Mark Dellinger at (707) 263-2273 or contact your local city and county representatives and voice your concerns.

BOX
INJECTION WELLS SUCCESS AND FAILURE

The Geysers is suffering a decline in electrical production because the steam is no longer being produced and is no longer rising to the surface. The Geysers development is based on a natural resource of heat or energy. The heat or energy is exploited by the extraction of heated steam. The heated steam is piped from extraction wells to run turbine steam engines which in turn generate electricity. The heat source is volcanic and comes from magma close to the earth's surface. The heat source is constant and is not declining. What has declined is the naturally trapped water sandwiched between the hot rock reservoir and the cooled magma that caps the reservoir with impermeable rock.

During the production of the electricity, the hot steam must pass through the turbines and then must be cooled or condensed for further handling. The condensate is toxic and must be disposed of. The disposal method used for the past 25 years is to re-inject the condensate into the ground at The Geysers. Steam well suppliers and the power production companies have seen the use of condensate as a means to manage the use of the steam field. They know that the source of decline in production is due to the extraction in an area with little or no natural recharge.

Results of re-injection have been variable. The varied success or failure rates depend on the ability of the liquid to move successfully through small cracks and fractures or around the minute spaces inside a rocks structure. The liquid must also get past rising steam which is moving upwards with great pressure. Unsuccessful injection is when the injection material is injected too close to a hot steam well. The steam well is watered out or killed by the cool liquid. Re-injection of liquids can also be unsuccessful when there is no replenishment of area steam because there are no open pathways between the injection well and the source of the steam for a production well. Further complicating the matter is the fact that injection and natural recharge seem to be a smaller and smaller fraction of the total steam still being produced. Something is causing the sealing of the internal structure and it is unknown whether it is mineral sealing of fractures and fissures or seismic collapse of fractures.

BOX

WHO IS INVOLVED

- Lake County Sanitation District Board of Directors (LACOSAN) seeking a way to dump wastewater for City of Clearlake, Clearlake Highlands, and Middletown

- U.S. Bureau of Land Management (BLM) oversite of Federal land and through a Memorandum of Understanding between the United States Geological Society and the Fish and Wildlife Service, formulates the general requirements of geothermal leases and are concerned with environmental protection.

- Environmental Protection Agency with oversite of waterway criteria whereby exceeding recommended criteria (ammonia, aluminum, arsenic, boron, chromium, copper, iron, manganese, mercury, nickel and zinc) with increased amounts entering Russian River drainage from tributaries like Big Sulphur Creek. EPA criteria determines that an area already significantly impacted cannot be impacted more. EPA approval for State Revolving Fund.

- Department of Health Services

- Army Core of Engineers

- Caltrans

- North Coast Regional Water Quality Control Board with oversite of waterways and water pollution.

- California Department of Conservation, Division of Oil and Gas and Geothermal Resources with oversite over wells and protection of water.

- State Lands Commission (SLC), Governor Wilson is proposing to eliminate the Energy Commission and the State Lands Commission and replace them with a Department of Conservation which will "absorb" their functions. He is proposing to transfer the SLC's land and mineral management as well as its public trust responsibilities to a new Department of Energy and Conservation which will assume the oil, gas and geothermal programs and the mining and geology activities of the Department of Conservation, which is proposed for elimination as well. The proposed changes are designed to "reduce the size of government and conform regulatory practices to the market realities of the 1990's."'

- Air Quality Management Districts for each County

- Sonoma County and the City of Santa Rosa, a last minute addition with the proposal of Unocal to the city while scoping of options for its wastewater options

- Consortium of Northern California Power Agency (NCPA) and three private geothermal companies, Calpine Corporation, Unocal Geothermal Division, and the Pacific Gas & Electric (PG&E) company
    - NCPA of which one member is the City of Healdsburg who owns a $60 million share of the steam wells and two geothermal power plants in the southern part of the Geysers, Healdsburg is now setting up funds to cover future power fees increases
    - Calpine of San Jose (also known as Santa Rosa Geothermal Co. located in Santa Rosa) in 7/94 bought out Thermal Power Co 25% interest in a geothermal steam field with the remaining 75% held by Union Oil Co, and supplies steam to 12 power plants operated by PG&E, Calpine operates two power plants Units 13 and 16 (formerly owned by the bankrupt company GEO)
    - Unocal or Union Oil Co. owner of about half of the wells in The Geysers and principal steam supplier for PG&E (owner of 20 power plants)
    - PG&E a utility company that faces the impacts from the Public Utilities Commission proposal to deregulate or reorganize large utilities and open up the field to small operators.

BOX

THE ROYAL FLUSH

The Royal Flush proposal will serve six existing power plants. The proposal outlines the use of 12 injections wells for NCPA and Calpine for steam for PG&E Units 13 and 16, and 4 injection wells for Unocal leaseholds to supply steam to PG&E Units 18 and 20, and NCPA units 1 and 2. Power plants Unit 20, Unit 18, and NCPA Units 1 and 2 are located in Sonoma County. Units 13 and 16 are located in Lake County. There is to be 26 miles of piping over landslide and fault line areas in the watershed areas for five counties with 66 crossings over 11 tributaries for the Russian and Sacramento Rivers. There could be, in the future, the potential for supplying a total of 5 plants in Lake and 20 in Sonoma County using the wastewater from all 9 cities in Sonoma and more from the surrounding areas.

Krista Rector, Citizens For Cloverdale, 894-3027
3903 words

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July 13, 1994

Lake County Planning Commission
255 North Forbes Street
Lakeport, California, 95453

Dear Board Members:

My name is Elio Giusti, I am the owner of Howard Hot Springs which is located in section 30, two and one-half miles northwest from Childers Peak. I have been associated with Howard Hot Springs since 1946. From the late forties thru the fifties I used to hunt deer with a neighbor who owned property in sections 28, 29, 32 and 33. We used to hunt from Howard Hot Springs thru to Childers Peak and beyond. I am very familiar with the steep canyons and rough topography of this area. I have a degree in geology from the University of California, Berkeley and state of California Registered Geologist license number 3052.

I have been reading about the pipeline to the geysers in the Record Bee, the Clearlake Observer and the Times Star. I was amazed to read in the July 7, issue of the Times Star that there was no comment on the first hearing of the EIR/EIS which included the Childers Peak route and surge tank. I obtained a copy of the draft EIR/EIS to see how they addressed the complex geology of the area. This area is highly folded and faulted and contains highly unstable areas. I could find no geologic maps in the EIR/EIS that dealt with Childers Peak. I contacted Mark Dellinger on Monday July 11 and expressed by concerns with him. Mark sent me a copy of the Draft EIR/EIS volumes 1 & 2 and he marked the parts that dealt with geology and structure.

1

I do not believe that the problems with the Childers Peak area have been properly mitigated and without proper geologic maps of the area that the pipeline will actually pass thru, it would be difficult to say that it would ever be safe to put the pipeline thru this area with any reasonable cost. The initial route of the pipeline which would have followed Highway 29 to Coyote Valley and then up Putah Creek to Big Canyon Road, would have been a safer route. See figure 13-4 on page 13-22 of the initial EIR/EIS. I have this labeled M1.

2

The major geologic structures in the Childers Peak area trend from the NW to the SE, where they cross the pipeline. Because of my lack ot time, I will have to rely on other published geologic reports on this area and will refer to them when used.

The pipeline route is shown on a small scale map in figure 2.1.3A on page 2-9 in the EIR/EIS. I tried to project the pipeline from Highway 29 to Big Canyon Road using the section outlines of a larger scale topographic map. In this map M2 I am only showing the sections that the pipeline will pass thru. There is no way that I could accurately project the pipeline on the topographic and geologic maps that I am using. The only accurate point that can be projected is the saddle to the west of Childers Peak where the surge tank will be located. This is an area where serpentine and silica carbonate rock may be located.

Map M3 is part of a larger scale U.S.G.S. topographic map that shows the Childers Peak area which will show how rough and steep the terrain actually is. Each contour line on this map shows a vertical change of 40 feet. This map also shows Sweet Springs Creek which is the path the pipeline follows up to Childers Peak.

Map M4 is part of a geologic map from Division of Mines Bulletin 166, published in 1953 by James C. Brice. The title was, Geology of Lower Lake Quadrangle. Brice did his mapping on a topographic map of one inch equals a mile scale. On a map of this scale it is impossible to show small details, but you can show rock types and major structures and faults. What this map shows is the Childers Peak Fault, the anticlinal structure, and rock types. I have outlined inblue the serpentine outcrops thru the pipeline area in sections 33, 4, 3, and 10. I also colored inorange the silica carbonate outcrop in the Childers Peak saddle. You will see in section 4, below Childers Peak, an x with an a and x with a cr. The xa refers to workings for asbestos, the cr refers to chromite which is a chrome ore. The serpentine from Bad Creek to Childers Peak contains minor veins of asbestos, in places with major outcrops you see xa. The silica carbonate which I have colored orange, is serpentine which has been altered by hydrothermal solutions. Silica carbonate rock almost always contains iron sulfides and quite often it contains cinnabar, from which mercury is obtained. The other orange silica carbonate area to the NW which is located in Bad Creek, contains iron sulfides, minor cinnabar and there is a small warm spring which containes hydrogen sulfide gas. There is also a small old mercure mine in this area. There is no reference in the EIR/EIS
3 as to the possible occurence of iron sulfides, cinnabar or asbestos in this area. On map M4 you will see lines running across across the page labeled C,D,E. See map M5 for a possible cross section of the geology. Also from Brices report you will find pages 54 to 61,which describe in more detail the geologic structure, folding, faulting and location of some ore deposits.

Map M6 is a small part of a U.S.G.S. mapping of the geysers area. They stopped mapping just southeast of Howard Hot Springs. They did not map in sections 33, 4, 3, and 10 where the pipeline goes thru. They did map up to Big Canyon Road in section 5. In sections 31, 32, 5 and 8 you will see outlined areas enclosing an arrow. The outlined area indicates a slide area and the arrow is the direction of the slide. If you drive on Big Canyon Road in the area of section 5, you can see the hillside sliding down into the creek. Brices map M4, shows the structural trend from NW to SE. As the same rocks and structure from sections 31, 32, 5 and 8 continues into sections 33, 4, 3 and 10, you can expect the same type of slides thru the pipeline area. There should be
4 a geologic map in the EIR/EIS showing the pipeline in relation to slide areas.

References to geologic conditions are referred to in table 4.3.2-1 in the EIR/EIS. I included pages 4-31, 4-32, 4-33, 4-34, 4-35, 4-36 and 4-38. I will make references to some items on these pages. Page 4-31 (under terrain) The outside edge of the road has been narrowed by erosion and slope failure. Under (geologic hazards) There is high potential for slope instability

to occur at several locations. There is potential to lose the entire road section at some of these locations and damage the pipeline from natural or induced slope failure. Page 4-31 (geologic hazards) High potential for accelerated erosion. Page 4-34 (geologic hazards) Potential for slope instability. About a ten foot section of this road has been removed by accelerated erosion. The described soft serpentine soils are likely subject to soil creep and present poor foundation conditions.

Over the years at Howard Hot Springs, I have seen as much as 3 1/2 feet of snow at one time. I have also measured as much as 12 inches of rain in 24 hours. During a very heavy rainstorm, if unstable ground should move on the slopes leading up to Childers Peak, you might have movement of the pipeline creating a leak. 5 Depending upon the water level in the tank at that time, you could have up to 600,000 gallons leak into the already saturated slide, possibly causing a major leak or total rupture of the pipeline. In the remote area of Childers Peak under very wet conditions, 6 repairs could take a considerable period of time, possibly up to weeks. Under extreme wet conditions, how long would the holding ponds at Clearlake be able to contain the effluent before they 7 would overflow and cause enviromental problems, adding to the enviromental problems caused by the leak or rupture of the pipeline.

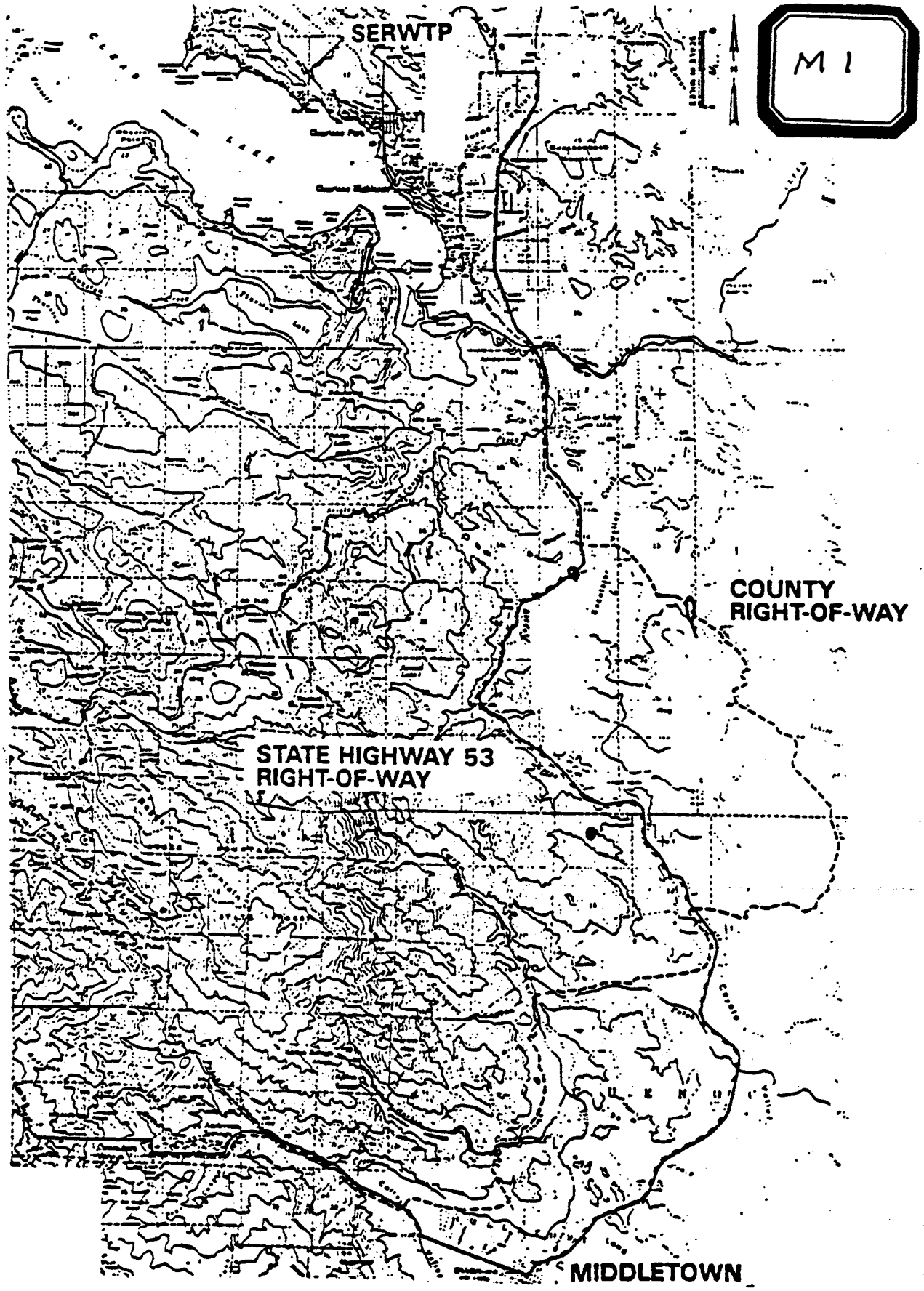
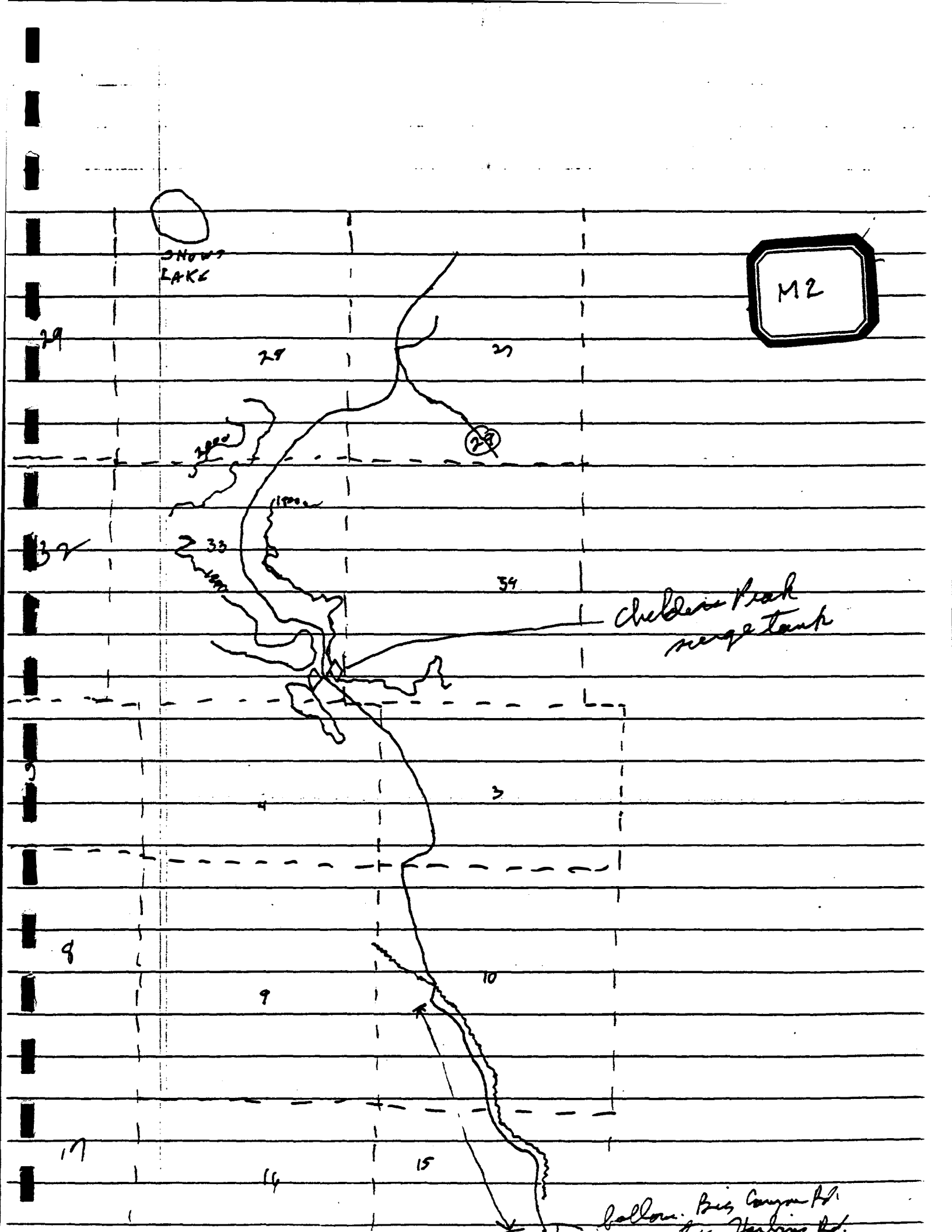


FIGURE 13-4 ALTERNATIVE G POSSIBLE PIPELINE ROUTE


SNOW'S LAKE
M2
29
28
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Chelderia Peak
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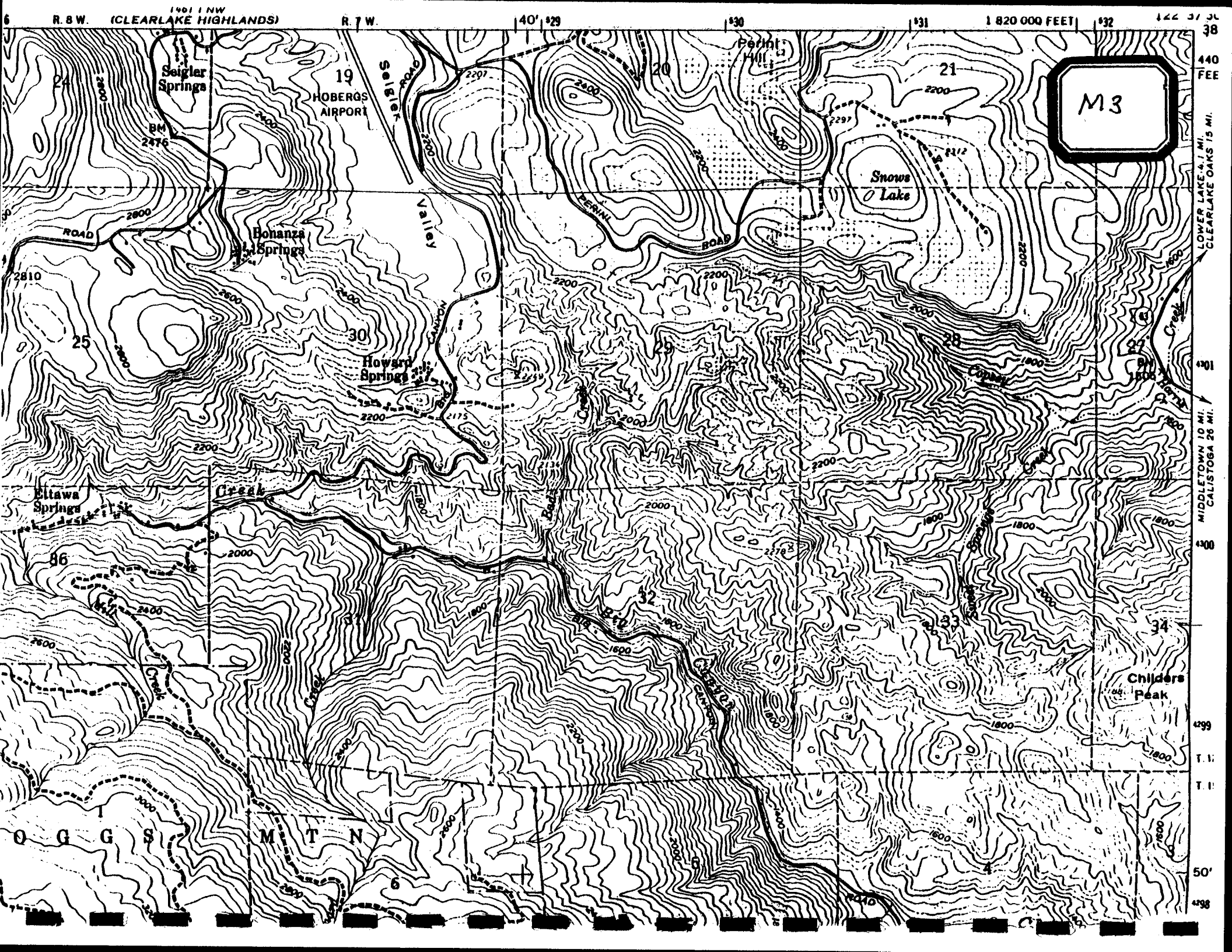
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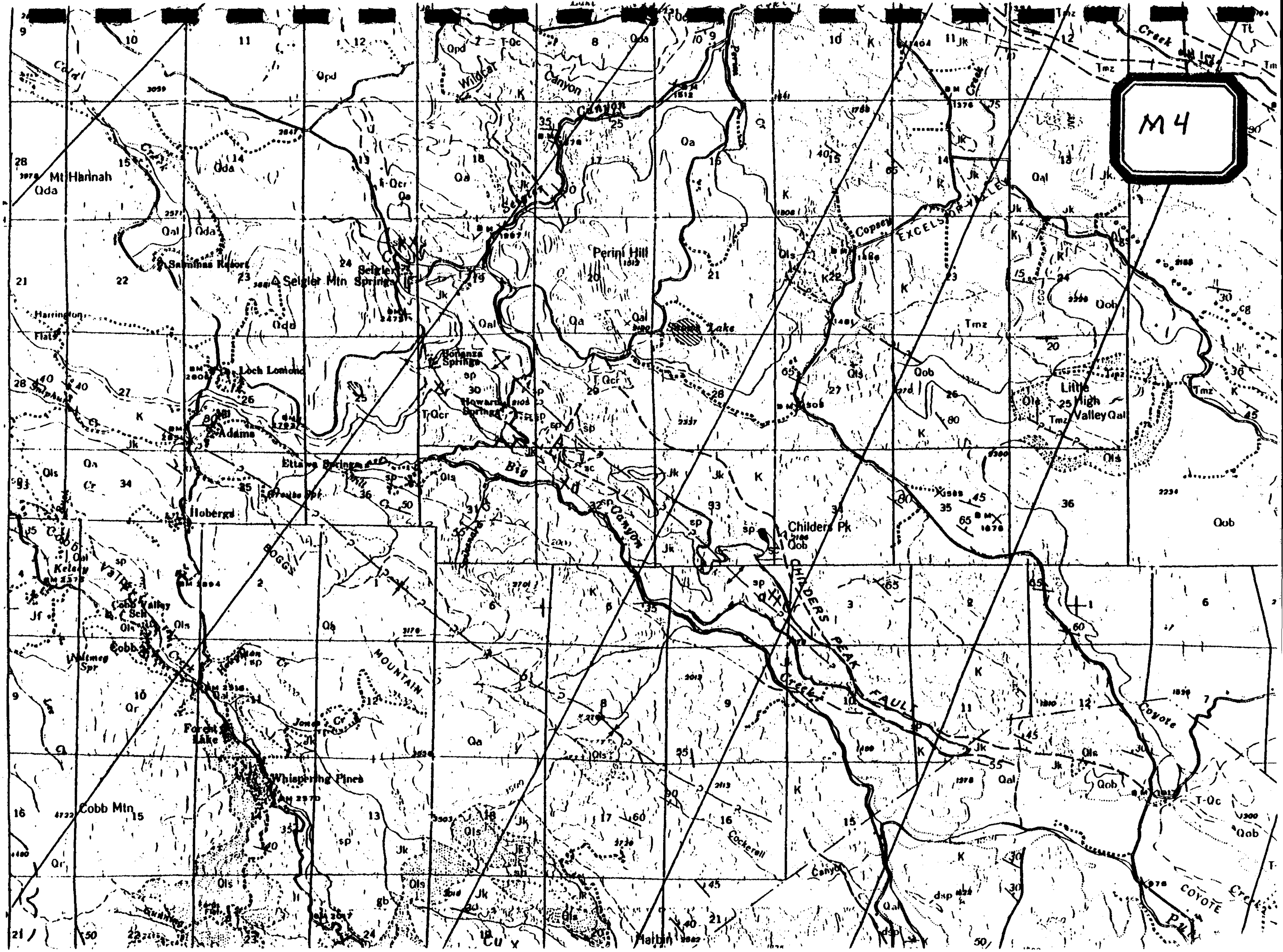
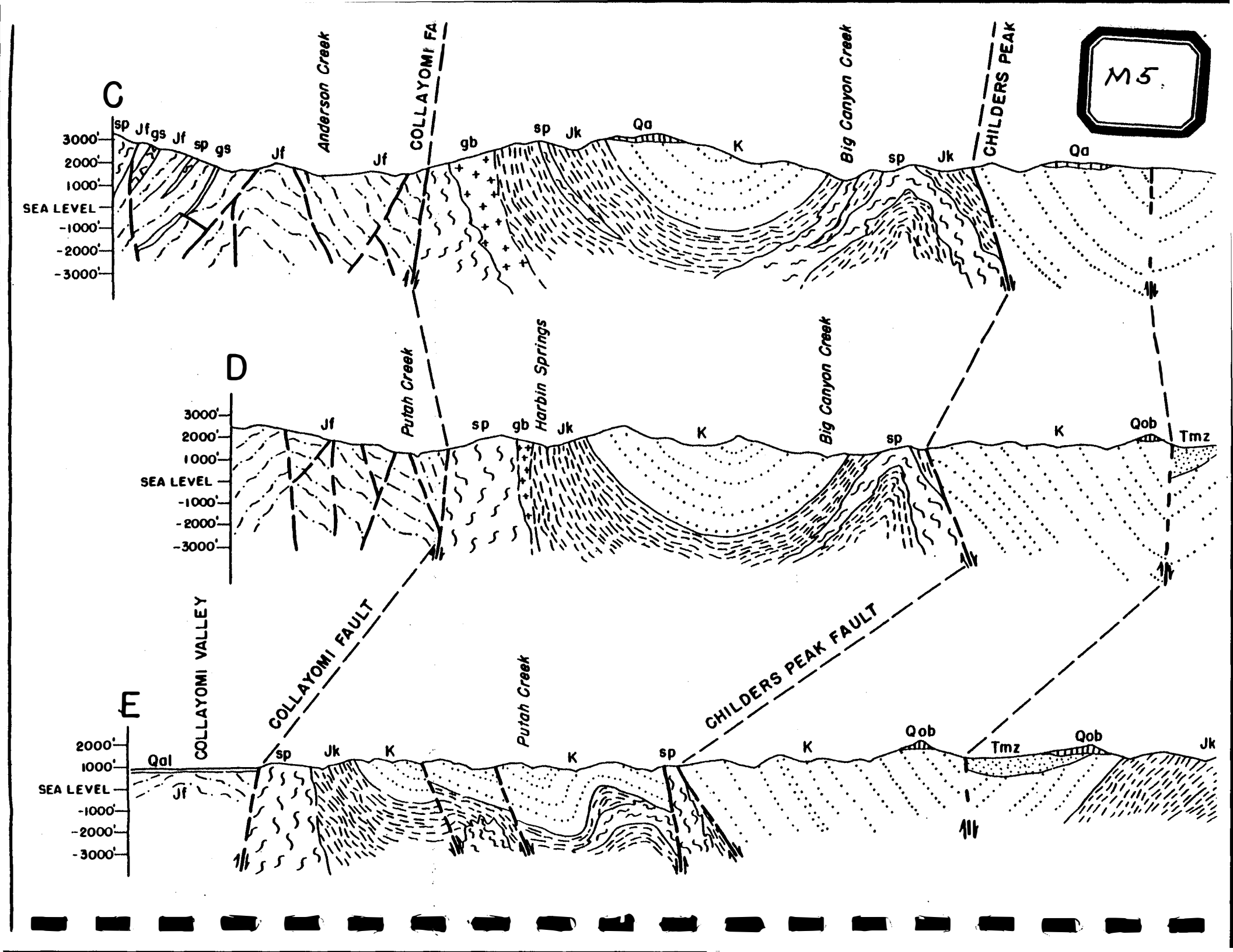
(CLEARLAKE HIGHLANDS)
R. 7 W.
1 820 000 FEET
M3
Seigler Springs
HOBERGS AIRPORT
Seigler Road
Perini Hill
Snows Lake
Perini Road
Bonanza Springs
Valley
Howard Springs
Howard Canyon
Ottawa Springs
Big Canyon Creek
Childers Peak
LOWER LAKE 4 MI.
CLEARLAKE OAKS 15 MI.
MIDDLETOWN 10 MI.
CALISTOGA 26 MI.
OGGS MTN


M4
Mt Hannah
Seigler Mtn
Seigler Springs
Perini Hill
Loch Lomond
Adams
Hoberg
Bonanza Springs
Howard Springs
Wildcat
Canyon
Big
Canyon
Childers Pk
CHILDERS PEAK FAULT
EXCELSIOR VALLEY
Copsey
Little High Valley
BOGGS
MOUNTAIN
Cobb Valley
Cobb
Creek
Forest Lake
Whispering Pines
Cobb Mtn
Harrington Flats
Cockerell
Coyote
COYOTE
Creek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Big Canyon Creek
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Harbin Springs
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Big Canyon Creek
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Tmz
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COLLAYOMI FAULT
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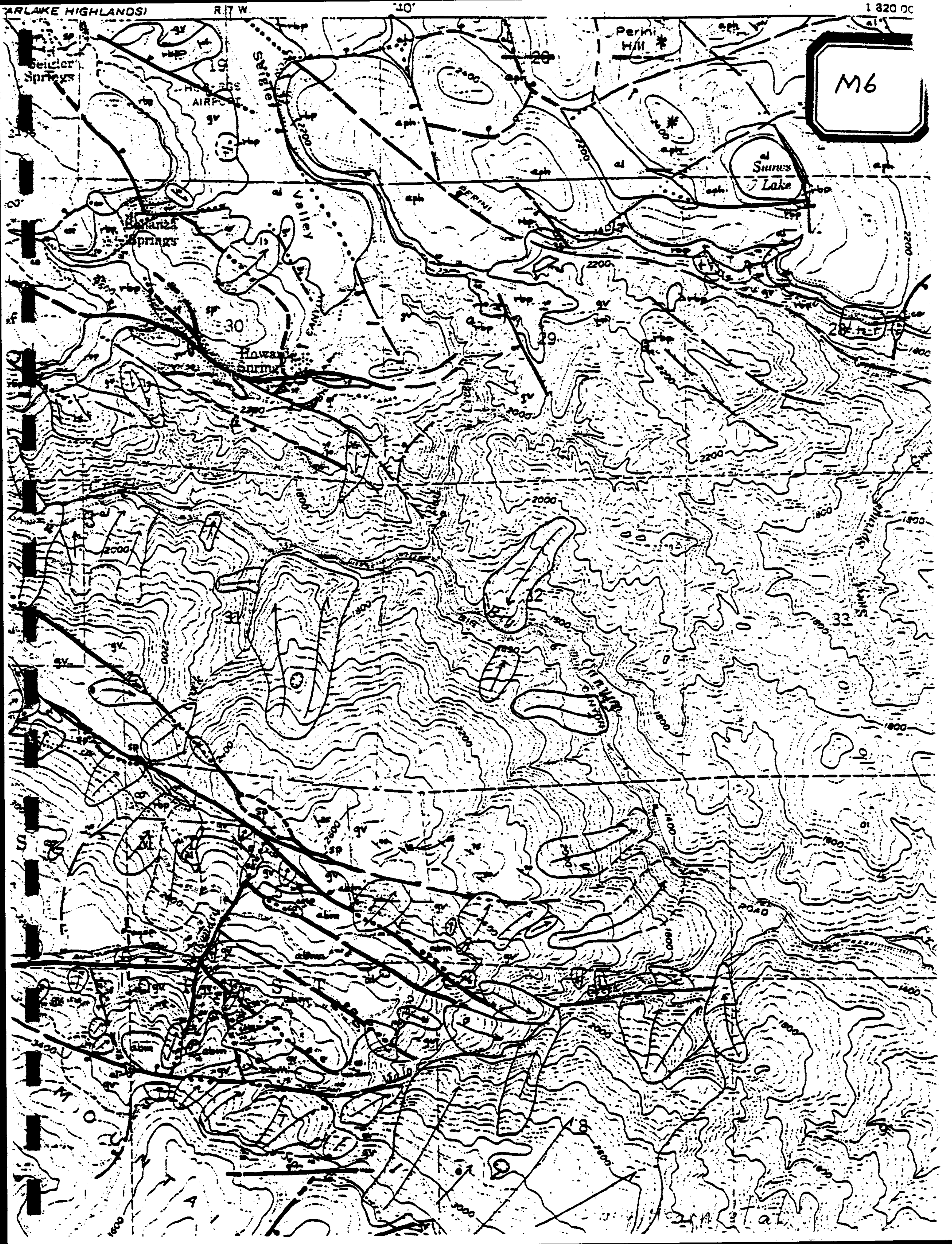

R 7 W
30'
M6
Seigler Springs
AIRPORT
Valley
Perini Hill
Lake
PERINI
Bonanza Springs
19
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CANYON
ROAD
2200
2000
1800

the southwest, narrowing as it goes. Its surface is not flat, but surmounted by broad mounds, which rise as much as 500 feet above the general level. Flats between these mounds form the floors of a number of intermittent lakes, such as the Stienhart Lakes. Compared to the highly dissected topography of the older rocks which it overlies, the surface of the basalt area is much subdued. Lava cliffs, 50 to 150 feet high, form the edges of the basalt cap, and testify to a former greater extent. There is little evidence to show what this former extent might have been; but Childers Peak, located 1½ miles south of the basalt tongue, is capped by a tiny remnant of basalt, at nearly the same elevation as the base of the main flow. This suggests that the flow extended farther to the south. The large mounds on the lava cap mark the probable sites of extrusion; the lava cap was no doubt thickest at this point, hence its preservation. As revealed by the elevations of the base of the lava, the surface over which it poured had a rolling topography with a maximum relief of some 750 feet.

Borax Lake basin was apparently formed when obsidian flows dammed the western end of a valley cut in Franciscan rocks. Although the water level fluctuates considerably, the lake is always shallow, drying up completely during periods of drouth. In March, 1944, the water surface stood only 6 feet above that of Clear Lake; such close correspondence of level suggests that the valley was occupied by the waters of Clear Lake before formation of the lava dam.

Borax Lake is so named because of the considerable quantities of borax crystals which were removed from its muds in the 1860's. It has been described in detail by Becker (1888) and also by Anderson (1936). The source of the borax appears to have been a group of hot solfataric springs issuing from the obsidian at the southeastern end of the lake. Becker in 1888 noted that the ground was hot and moist, that impure sulfur had been found in excavations, and that no water was flowing at the time of his visit. At present the ground around the former springs is bleached white over an area of several acres, and the odor of sulfur can be detected; there has been no renewal of flow from the springs. Becker showed by analyses that no borax is present in the surrounding rocks, and that the springs must have been the source of the borax crystals. If the springs are indeed extinct, no replenishment of the borax deposit may be expected.

Clear Lake. Only the narrow southern part of Clear Lake, less than one-fourth of its total area, lies within the Lower Lake quadrangle. The lake broadens considerably in its upper part: it is locally described as having the shape of a tadpole with two tails, the broad upper part being the head, and the part in this quadrangle being one of the tails. The lake has a total area of about 60 square miles, a length of about 18 miles, and a maximum width of about 7 miles. A contour map of the bottom, based on more than 100 soundings compiled by the Wallis Marine Service at Clear Lake Park, shows that the lake floor has the configuration of a shallow, irregular basin, whose deepest part (52 feet) is directly east of Mount Konocti.

Geologic work in this quadrangle has shed some light on the origin of the large topographic depression which is occupied, although not fully, by the waters of Clear Lake. A casual examination indicates that the southern edge of the basin is formed entirely of lava flows, but sediments

appear from beneath the lava at Baylis Point, and, as previously noted, there is evidence that the pre-lava surface sloped toward this depression. That the Cache formation is somehow related to the present depression is indicated by the fact that lacustrine deposits of the Cache—marls, limestones, and diatomites—appear only in the vicinity of Clear Lake. Furthermore, the dips of the Cache beds are mostly gentle in the immediate vicinity of Clear Lake, and although the beds on the north shore dip gently beneath the lake, the dips steepen away from the lake.

Two hypotheses regarding the origin of Clear Lake have been proposed: (1) Clear Lake occupies the lowest part of a shallow downwarp or fault depression, which is related to the basin in which the Cache sediments were deposited. This is essentially the origin proposed by Becker. (2) The waters of Clear Lake occupy an intermontane basin plain whose outlets have been dammed in some manner. The detailed sequence of events for this hypothesis has been worked out by Davis (1933), and Anderson concurred in general with these, after making a few minor corrections. As for the age of the lake, Anderson showed that high-level lake sediments at Sulphur Banks and at Buckingham peninsula are older than volcanic activity at these localities, and it seems likely that "Clear Lake came into existence some tens of centuries ago, prior to some, if not all, of the recent volcanic activity."

Davis' hypothesis hinges in part upon the formation of a lava dam at the southern outlet of the lake. Although the present outlet of the lake is cut though sediments of the Cache formation rather than through lava, there are small remnants of lava flows scattered in and about the southernmost tip of the lake. Whether these might represent remnants of a former barrier now destroyed, or whether there is perhaps a buried channel filled with lava is not known. Recently, however, the elevation of the channel of Cache Creek just below the Clear Lake Water Company dam, which has a bottom of resistant Cretaceous sandstone, was determined as 1300 feet above sea level, whereas the bottom of the lake at its deepest part stands at 1284 feet. Thus the lake would not be completely drained if any possible barrier were removed from its southern end.

It therefore seems that the origin of Clear Lake is more fundamentally related to the origin of the large topographic depression which it partially fills, than to barriers across its outlets. No direct evidence bearing on the origin of the depression was found, but its relationships with the Cache formation are considered highly suggestive. The presence of Cache sediments around the southeastern border of Clear Lake, extending as far west as Kelseyville, indicates that the area has been one of instability in the recent geologic past. Two large depressions have thus occupied the same general areas, in part overlapping, and the beginning of the younger is essentially continuous with the end of the older. The Cache depression, in which thousands of feet of sediment accumulated, is unquestionably a downwarped or downfaulted feature, and the Clear Lake depression is probably of similar origin.

GEOLOGIC STRUCTURE

The Mesozoic and Tertiary sedimentary rocks of the Lower Lake quadrangle strike persistently in a northwesterly direction, and the dip is generally moderate to steep. The sediments are interrupted by numerous irregular areas of serpentine rock, which are broadly aligned with the

regional strike. These generalizations apply to the greater part of the northern Coast Range, and the geologic structural features of this quadrangle will be regarded as parts of this larger structural unit.

Geologic work in adjoining areas of the Coast Range has shown that the basic structural features are large complex folds, several miles in length and moderately narrow in proportion, having northwestward-trending axes; and northwestward-trending faults, some having a length of many miles and displacements measurable in hundreds of feet. Most investigators have believed that these faults were steeply dipping, although Weaver (1949) has postulated low-angle thrust faulting in the Napa Valley region. Evidence seen in isolated localities, as in mines or cuts by road or stream, indicates that these large structural features are very complex in detail, so that the large folds include many folds and are complexly faulted, and the larger faults are perhaps wide zones rather than single planes of faulting. Unraveling of these complexities is precluded by poor exposures and lack of suitable map units. None of the large structural features which had been distinguished by geologic work in quadrangles adjoining to the south and west could be traced directly into the Lower Lake quadrangle.

Although there is no apparent difference in degree of deformation between Cretaceous and Tertiary rocks of this quadrangle, the Franciscan rocks show a somewhat greater degree of deformation. In particular, the Franciscan area is crossed by a large number of northwestward-trending shear zones, along which the sediments are sheared on a microscopic scale, and crumpled into open folds ranging in size from microscopic to several feet across. Outside the shear zones, the variable attitudes in the Franciscan may be explained either by complex folding, or by complex high-angle faulting whereby the different blocks are tilted in different directions; available evidence in this quadrangle suggests the faulting.

The structural role of the serpentine bodies is important but difficult to evaluate and to distinguish from the effects of other agents. Shearing within and at the contacts of serpentine bodies indicates that they have been squeezed into their present positions while solid, or nearly solid. As emplacement by assimilation or even by stoping is not reasonable, the intruded sediments have doubtless been thrust up and aside, perhaps before they were fully consolidated. The apparent structural effect of the serpentine is to locate the movements of major faults, which commonly follow the border of a mass of serpentine.

Folding

The dominant structural features of the quadrangle are broad, plunging, northwest-trending folds, several miles in width and extending nearly across the quadrangle. These folds are neither simple nor symmetrical, but include minor folds, and are extensively faulted. Their borders are not sharply defined, because the stratigraphic units which form them differ, for purposes of mapping, only in their different relative proportions of sandstone and shale.

The large wedge-shaped area of Cretaceous rocks ending just north of Middletown has the general form of a doubly-plunging syncline, but its structure is much complicated by faulting and minor folding, so that most of the rocks composing it dip to the northeast. At the eastern end, it terminates abruptly against a large body of serpentine. There is evi-

dence of strong faulting within the eastern end of the syncline, which may have raised a block near the center, exposing detrital serpentine near the base of the Cretaceous.

The large area of Cretaceous rocks in the center of the quadrangle form a broad, well-defined syncline, but this, too, includes numerous structural complications. The belt of Cretaceous forming the northern limb is not so wide as that forming the southern limb, and it appears that movement along a fault trending near the fold axis may have caused uplift of the northern limb. Such direction of movement of the fault is contradicted by the presence of a patch of Martinez rocks north of the fault, and a reversal of fault movement must therefore be proposed. Such an assumption is not justified by the evidence, but reversal of movement along faults has been demonstrated in the Coast Range (Hucy, 1948).

The isolated patch of Paleocene rocks east of Lower Lake has been identified as synclinal in structure by Dickerson (1914) and by Stanton (1895). Both men based their opinion largely upon faunal evidence: similar fauna appeared at localities 2 miles apart, and younger fauna appeared in the intervening rocks. The present study indicates that these rocks are folded into a complex syncline which plunges gently to the north. The Martinez rocks of the northern limb swing southward beneath the cover of Cache beds on the west, and may join with those of the southern limb, forming part of a basin. The center and southern limb of the syncline are complexly faulted by northwestward-trending faults and by cross-faults. Within the Martinez outcrops, there appears an elongate area of Tejon conglomeratic sandstone, folded roughly into synclinal shape, but structurally complex in detail, as indicated by many steep dips and erratic strikes. The Martinez rocks were probably folded and faulted before deposition of the Tejon, as well as afterwards. As in the Mesozoic rocks, the lack of suitable map units precludes detailed mapping of geologic structure.

The Cache beds are considerably less deformed than the older rocks, having dips which rarely exceed 30 degrees and commonly approach the horizontal. In the northeastern part of the quadrangle, the Cache beds are folded into a broad but well-defined anticline whose axis trends northwestward, nearly parallel to the North Fork of Cache Creek.

As for the lavas, some of these are interbedded with the Cache formation, and have been tilted. However, outcrop patterns of most flows indicate that they are essentially undisturbed, if allowance be made for the relief of the surface over which they flowed. Slumping is prevalent near the edges of lava flows, and care must be taken not to confuse this with folding.

Faulting

Faulting in this quadrangle is indicated by zones of crushed and slickensided shale, by abnormally straight contact lines, by linear outcrops of silica carbonate rock, and, for some minor faults, by the observed displacement of strata. Faults between the major rock units were traced for distances up to several miles, and where well exposed these may show zones of gouge and fault breccia several tens of feet in width; other large faults are probably present within the major rock units, but are not discernible because of the uniformity of the unit and the soil cover. That most of the faults are steeply dipping is indicated by the fault trends, which are nearly straight or broadly curved.

The longest fault which could be continuously traced extends for some 8 miles, from Coyote Valley to Seigler Canyon, and it passes beneath lava flows at both ends. It forms the contact between the Knoxville and the Cretaceous rocks, and is marked by zones of sheared and brecciated rocks, also by silica carbonate rocks near Childers Peak.

The Cache formation seems to be commonly downfaulted at its contacts with older formations. Such a fault contact is well exposed east of Deadman Canyon, in the northeastern corner of the quadrangle, where it shows a minimum displacement of 150 feet. Furthermore, the Cache-Franciscan contact in Burns Valley, although concealed by alluvium, may be traced northwestward into the Bartlett Springs quadrangle, where it is well exposed and clearly faulted. The south contact of the main area of Cache sediments trends for over four miles in a nearly straight line. The actual contact with older beds is covered by slumped material from the unconsolidated Cache beds; but because the Cache beds strike into the contact while consistently appearing at lower topographic elevations than the older rocks, the contact is believed to be faulted.

Minor faults in the lavas on the east flank of Mount Konocti and the adjoining lava fields are marked by sharp breaks in the topography. The faults show clearly on the aerial photographs, but no pattern or general trend emerges. Slumping and consequent tilting of lava blocks, some of very considerable size, is common along the lava cliffs.

GEOLOGIC HISTORY

The geologic record in this quadrangle begins in Upper Jurassic time, some 125 million years ago, with the deposition of Franciscan sediments. The Franciscan lithologic association is typical of geosynclines which are orogenically and volcanically active; the high ratio of graywacke to shale suggests that transitional or perhaps continental conditions prevailed in the geosyncline, although other evidence indicates that the rate of subsidence was irregular both in space and time. The source of sediments is thought to have been a volcanic archipelago located to the west of the present coastline, but much of the later sedimentary material was probably derived from the reworking of earlier sediments, uplifted within the geosyncline. During Knoxville time, subsidence was more rapid than deposition, as indicated by the predominance of gray clay shale, and the outlying island arcs projected only slightly above sea level. Although Franciscan rocks crop out in only a small portion of the quadrangle, they undoubtedly underlie the whole, being covered in most places by Knoxville or younger rocks. Thus the Jurassic sea covered the whole quadrangle for a long period of time, sufficient to deposit some 15,000 feet of sedimentary rocks. As for the geographic extent of the Jurassic sea, Taliaferro concluded from a regional study that it covered the region now occupied by the central and northern Coast Ranges of California, and reached northward into Oregon. Although there is no recognizable break between Franciscan and Knoxville sediments, the greater deformation of Franciscan rocks indicates some orogeny before deposition of the Knoxville. Such orogeny would not necessarily be accompanied by uplift.

The beginning of Cretaceous time is not marked by any recognizable break in the rock record, although the somewhat greater degree of

deformation of Knoxville rocks suggests that mild orogeny, perhaps accompanied by uplift, preceded Cretaceous deposition. The Cretaceous lithologic association is characteristic of non-volcanic geosynclines which may develop adjacent to geosynclines such as the Franciscan-Knoxville. The high ratio of sandstone to shale suggests that water depths generally exceeded 120 feet, and the relatively small amounts of chert and mudstone fragments suggests that earlier geosynclinal sediments had been stripped from old Franciscan-Knoxville source areas, exposing the granitic basement. The Cretaceous sea occupied, according to Taliaferro (1943), a "long, probably continuous but far from uniform trough which lay along the west border of the Great Valley." It is questionable whether this quadrangle was entirely covered by the sea, but large parts of the quadrangle were covered for long periods of time.

The Paleocene rocks are similar to the Cretaceous, and clear-cut contact relationships were not observed; but the areal distribution of sediments shows that uplift and erosion preceded Paleocene deposition. Martinez deposition of massive feldspathic sandstone followed by shale was closed by uplift, deformation, and erosion before deposition of the overlying Tejon coarse conglomeratic sandstone. These Paleocene rocks, confined to a small area east of Lower Lake, are evidently but remnants of more widespread deposits laid down in a shallow marine geosyncline which extended northward from the region of San Francisco Bay.

Both Martinez and Tejon rocks are considerably more faulted and folded than is the overlying Plio-Pleistocene Cache formation. Probably the Tejon and older rocks underwent deformation at several times during the Tertiary, but there are no sediments or other evidence to record the diastrophic history. In late Pliocene time, the Cache formation began to accumulate in a large structural basin. Streams from the surrounding highlands carried debris into the subsiding basin, forming a large basin plain whose surface was probably covered with lakes from time to time. A maximum thickness of about 6,500 feet of clastic sediments accumulated in the basin. Toward the end of Cache deposition, a large lake was formed in the eastern part of the basin, in which marl and diatomite accumulated in association with tuffaceous sediments and flows of basalt. The volcanism continued intermittently through the Pleistocene, with the extrusion, from scattered northwest-trending fissures, of a number of separate lava flows, including three distinct major flows of basic lava. In addition, there were extruded, from fissures or centers, flows and bulbous protrusions of dacite and andesite (Cobb Mountain, Mount Hannah, Mount Konocti), and an extensive flow of obsidian. Following the extrusion of the earliest volcanics, but before the extrusion of most, the Cache formation was folded and locally downfaulted against older rocks. The basin in which the Cache formation accumulated has been uplifted in the western part, but its eastern part coincides with the present structural basin which Clear Lake partially fills.

The most recent volcanic activity formed the cinder cone named Roundtop Mountain, and this episode occurred many thousands of years ago, judging from the effects of weathering and erosion. Still more recent volcanism in the area may be evidenced by the accumulation of "recent-appearing" pyroclastic material found by Anderson on Mount Konocti.

ECONOMIC GEOLOGY

By James C. Bruce and J. Grant Goodwin *

The Jurassic (?) Franciscan and Tertiary-Quaternary volcanic rocks of the Lower Lake quadrangle are a potential source of a number of mineral commodities in Lake County. Quicksilver occurs in Franciscan sandstone and chert adjacent to serpentine bodies. It is also associated with silica-carbonate rock, resulting from alteration of the serpentine. The cinnabar is thought to have been deposited by the carbonate solutions which altered the serpentine late in the Tertiary period. Mineralization has generally taken place along serpentine contacts in shear zones. Chrysotile asbestos is common in the sheared serpentine bodies. The mineralized zones of anastomosing veinlets trend roughly parallel with the elongation of the serpentine bodies. Chromite, disseminated and in pods, also occurs in the serpentine and some high-grade ore has been mined in the area. Sulfur has been produced from the Tertiary-Quaternary volcanic rock where sublimation around solfataric orifices has occurred. Hot springs containing sulfur and carbon dioxide gases are still active in the area. The volcanic rocks are also a source of building materials such as pumice, plaster sand, lightweight aggregate and ornamental stone.

During both World Wars the shortage of critical minerals stimulated prospecting and small-scale development of chromite, asbestos, and quicksilver deposits.

Asbestos

Copsey and Jones prospect, located by Arthur Copsey of Spruce Grove and Herbert Jones of Lakeport, is located in the NW¼ sec. 32, T. 12 N., R. 7 W., in Big Canyon about 1 mile southeast of Howard Springs. This property was prospected in 1928 by Johns-Manville during which time they are reported to have taken out 7 or 8 tons of chrysotile asbestos (Averill, 1947, p. 17). The main working is an open cut about 150 feet long by 30 feet wide by 20 feet deep. Five smaller pits have been opened in the mineralized zone of the serpentine. Some asbestos was seen in place and much of the serpentine on the dump is cut by anastomosing veinlets of chrysotile with fibers which average about one-quarter inch in length and are of good quality. Maximum fiber length is three-quarters of an inch. About 6 sacks of fiber have been handcobbed from the serpentine and remain on the dump near the largest open cut.

Marylyne prospect, claimed by Mr. Ira E. Klein, is located in the NE¼ sec. 3, T. 12 N., R. 6 W., 2,500 feet north of the U. S. Geological Survey Bench Mark on Brushy Sky High. The prospect is reached by a bulldozer trail from the Halle Bond Ranch in Morgan Valley. In the spring of 1952, soil was removed with a bulldozer and prospect trenches were cut at 4 points across the mineralized zone, which trends N. 44° E. and dips 52° W. The zone of chrysotile is about 18 inches wide at the point of discovery and pinches to 6 inches within 100 feet along the strike. The serpentine is highly sheared and altered to picrolite in the vicinity of the prospect. The fibers average only an eighth of an inch and are slightly brittle; however, the total asbestos content of the vein is high.

An asbestos prospect located in the NE¼ of sec. 4, T. 11 N., R. 7 W. has been prospected by shallow pits at 4 points along the 200-foot length of outcrop which strikes about N. 30 W. The mineralized zone ranges from about 2 to 4 feet in width with an asbestos content of from 15 to 25 percent consisting of good quality fibers of chrysotile about a quarter to half an inch in length.

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Borax

Borax was probably first produced in California from Borax Lake, 8 miles west of north from Lower Lake, and 2 miles south of Sulphur Bank mine (Hanks, 1883, pp. 15-26). Commercial production of 590 tons of refined borax was made from 1864-68 by the California Borax Company. For analysis of Borax Lake, see section on soda.

Chromite

Chromite, disseminated and in pods, occurs throughout much of the serpentine in this area. Production has been small, but considerable tonnage of low-grade ore is present.

Copsey chromite prospect, located by Arthur Copsey of Spruce Grove, is in the NE¼ of sec. 4, T. 11 N., R. 7 W., about half a mile north of the Big Canyon road. A 25-foot open cut was made and a 30-degree inclined shaft was sunk. Chromite on the dump is of fair grade and low-grade ore occurs as float along the entire hillside. Three other claims were filed by Copsey along the same ridge in sec. 33, T. 12 N., R. 7 W., near Childers Peak.

Gordon Springs prospect (Averill, 1929) is in sec. 2, T. 11 N., R. 8 W., a quarter of a mile northwest of Cobb Valley School at the serpentine and Franciscan sandstone contact. The adit which ran north into the hillside is now caved and the workings inaccessible. No ore was found on the dump.

Harpe and Sons Ranch (Averill, 1929) chromite prospect is in the NE¼ of sec. 29, T. 11 N., R. 7 W., a quarter of a mile S.E. of Harbin Springs. The Sawyer Tanning Company mined several pockets of high-grade ore containing 50 to 52 percent chromic oxide. Low-grade float is common along this entire ridge.

Popp and Nichelini prospect is in the NE¼ of sec. 24, T. 12 N., R. 7 W., just north of Seigler Springs in a small body of serpentine. Low-grade float is common, but nothing of commercial interest was seen during this investigation.

Other areas where considerable float is reported are sec. 14, T. 11 N., R. 8 W., just east of Whispering Pines (Averill, 1947); Mastick Ranch (Averill, 1947), sec. 3, T. 10 N., R. 6 W., just south of McCreary Lake; and east of Deadmans Canyon in secs. 7 and 13, T. 13 N., R. 6 W.

Clay

Clay of doubtful economic interest was found in the Cache formation in sec. 8, T. 13 N., R. 6 W., along the North Fork of Cache Creek. The material is a silty clay, interbedded with sand and pebble beds. The low-grade clay might have limited uses in the brick and cement industry.

Copper

Three places (Jenkins, 1948) in sec. 19, T. 11 N., R. 7 W., in a body of gabbro-diabase show traces of copper mineralization. Small prospect pits have been sunk along fracture zones showing azurite- and malachite-stained rock. The pits disclosed some primary ore which is disseminated chalcopyrite cut by veinlets of chalcocite in zones of altered gabbro. One of the prospects was in a 5-foot vein of aragonite. Most of the ore seen is highly oxidized and it seems probable that disseminated primary sulfides

TABLE 4.3.2-1: GEOLOGICAL CONDITIONS ON THE PROPOSED ALIGNMENT AND FACILITIES SITES (Continued)

Alignment Segment	Existing Geologic Environment
Approximate Stationing: Station 60 to 63.7 Principal Improvements: Improvements consist of the existing, narrow 4-wheel-drive road through unimproved hill country. The road is up to about 12 feet wide.	Terrain: In this segment is a narrow steep sided stream canyon which carries Sweet Springs Creek. At Station 60.2 the road slowly climbs up onto the lower portion of the easterly canyon wall and remains between 15 and 20, to as high as 40 feet above the stream bottom. The side slopes are steep to very steep below the road and somewhat less steep to occasionally moderate above the road. The outside edge of the road has been narrowed by erosion and slope failures. Localized failures have also occurred on the uphill side of the road. Elevations range from slightly less to slightly more than 1,600 feet msl. Drainages: The principal drainage is Sweet Springs Creek which flows along the narrow, moderate gradient canyon bottom. Sweet Springs Creek is crossed at Station 60.2. Several natural, small drainages pass across the road or under via culvert and empty below into Sweet Springs Creek. Bedrock Formations: Scattered small to large blocks of hard sandstone indicate that this segment is primarily underlain by sandstone of the Great Valley sequence. Interbedded shales are also likely present. Near- surface bedrock is probably present along the inside edge of the road at various locations. Surficial Deposits: Soil mantels most of the segment, but is occasionally thin and patchy as evidenced by the presence of sandstone blocks. Artificial fill is present along the outside edge of the road. Principal soil type (SCS) present are those of the Maymen-Hopland-Mayacama association which consist of gravelly to very gravelly loams which are shallow, excessively drained and have a severe erosion hazard. These soils develop on hilly and mountainous areas and contain rock outcrops and rock blocks randomly scattered throughout. Springs/Seepages: Areas of seepage and ponded water were noted along the roadway at a few locations where positive drainage does not exist. Geologic Hazards: There is high potential for slope instability to occur at several locations. There is potential to lose the entire road section at some of these locations and damage the pipeline from natural or induced slope failure. There is also high potential for accelerated erosion along the roadway and resultant stream siltation. Important Conditions and Comments: Geologic hazards as noted. This entire segment is very sensitive due to slope steepness, slope instability, existing erosion and potential for accelerated erosion due to project construction. Large blocks of hard sandstone will probably be locally encountered in excavations.

(Continued)

TABLE 4.3.2-1: GEOLOGICAL CONDITIONS ON THE PROPOSED ALIGNMENT AND FACILITIES SITES (Continued)

Alignment Segment	Existing Geologic Environment
Approximate Stationing: Station 63.7 to 65 Principal Improvements: Undeveloped hill country.	Terrain: In this segment the alignment continues southwest and then southeast along the canyon bottom of Sweet Springs Creek, approaching near the upper reaches of the creek at the end of the segment. The width of the canyon, and thus space available for construction varies along the segment. From about Station 63 to 63.5 the alignment traverses along a narrow (one hundred feet±) alluvial-filled stream valley with a relatively gentle gradient. From about Station 63.5 to 63.6 the valley narrows to a canyon bottom a few tens of feet in width. The active channel, which has incised a few feet through the alluvium, and in some cases to bedrock, meanders back and forth across the narrow width of the canyon bottom. The base of the canyon sidewalls at creek elevation are steep. South of Station 63.5 the canyon bottom widens to a narrow stream valley through which the active channel continues to meander. Except where small side tributaries enter, the valley width usually ranges between 60 to slightly over 100 feet. Progressing toward the southern end of the segment, the active channel again begins to narrow and is less incised. Commencing at about Station 65 the canyon once more narrows with the base of the steep canyon sideslopes terminating near the edges of the narrow active channel. Elevations along the segment range from about 1,600 feet msl on the north to about 1,700 feet msl on the south. Drainages: The principal drainage is Sweet Springs Creek with side tributaries entering at about Stations 63.5 (from the east), 64 (entering from the east) and 65 (entering from the east). Four to five smaller side tributaries were also noted. Due to the meandering nature of the creek, the alignment crosses the active channel on the order of 15 times throughout the length of this segment. The channel is incised into shallow alluvial deposits between about 2 and 6 feet in the northern part of the segment and 1 to 2 feet in the southern part. Banks are vertical or nearly so. Bedrock Formations: Scattered rock outcrops visible in the bottom of the active channel at the base of shallow valley alluvium consist of hard, massive, fractured, graywacke sandstone which has been mapped as belonging to the Great Valley sequence. Other rock types possibly present include shale and siltstone. Surficial Deposits: Surficial deposits present along the narrow canyon bottom and stream valley consist of sands, silts and gravels deposited by Sweet Springs Creek. These deposits are mostly 2 to 6 feet in thickness and are thinner to absent near the north end of the segment. At the base of the canyon sidewalls and stream valleys, colluvial soils transition into the periphery of these stream deposits. These consist of sandy clay soils with intermixed rock fragments. Soil types present (SCS) on nearby sideslopes consist of Millshom-Bressa-Hopland association, Mayem-Etsel-Mayacamas complex, and Mayem-Millsholm-Bressa complex. The first of these soils occupies a small portion at the north end of the segment and has been previously described. The second of these soils occupies most of the segment. It consists of shallow, gravelly to very gravelly loams which are excessively drained and have high erosion hazard. The third of the soil types occupy a southern part of the segment, are shallow, gravelly loams which are excessively drained and which have severe erosion hazard. Rock outcrops and large rock fragments are present.

(Continued)

TABLE 4.3.2-1: GEOLOGICAL CONDITIONS ON THE PROPOSED ALIGNMENT AND FACILITIES SITES (Continued)

Alignment Segment	Existing Geologic Environment
Approximate Stationing: Station 63.7 to 65 (Continued)	Springs/Seepages: None observed on 4/15/93, but considering the steep sideslopes and colluvial soils present, seasonal seepages may develop. Geologic Hazards: High potential for accelerated erosion. Important Conditions and Comments: Erosion hazards as noted. The numerous (25±) stream crossings by the alignment within the narrow confines of the stream canyon/valley result in very sensitive conditions. Along the northern part of the segment (narrow canyon area) very limited space is available to gain access for construction equipment. Because of shallow, hard bedrock, special excavation techniques including blasting will likely be necessary, or the pipe will have to be constructed on piers with aerial stream crossings.
Approximate Stationing: Stations 65 to 66.3 Principal Improvements: Unimproved hill county. A narrow, abandoned 4-wheel-drive trail traverses along the north side of the steep canyon sideslope a few to several feet above the active stream channel.	Terrain: At Station 65 the stream canyon turns easterly and narrows. Slopes drop moderately steeply directly into the stream channel which is about 1 to 2 feet wide and incised to a depth of 1 to 2 feet. The alignment has been positioned along the 4-wheel-drive trail which is no more than six to eight feet in width, with steep slopes below and above. Three small side canyons come in from the north between Stations 65 and 66. At Station 66 the alignment turns southward and climbs up a steeply inclined portion of the narrow trail. Below the outside edge of the trail slopes drop off steeply into one of the small drainages comprising the headwaters of Sweet Springs Creek. The drop-offs are up to 25 feet high. Cutslopes above the inside edge of the road are up to 10 to 15 feet and near vertical. At Station 66.5 the 4-wheel-drive trail tops out at the drainage divide. The divide is about 350 feet below and west of Childer's Peak, the prominent geographic feature of the immediate area. Elevations along this segment range from about 1,680 feet msl on the west to 1,720 feet msl at the top of the drainage divide. Drainages: This segment continues along the upper reaches of Sweet Springs Creek. At Station 66.1 the alignment pulls away from the main branch of the creek and continues upslope on the trail along one of the creek's smaller tributaries. Along the central part of the segment well-incised, secondary canyons drain into Sweet Springs Creek from the north at the Stations indicated above. On 4/19/93 the creek and main tributaries were flowing. Bedrock Formations: Several outcrops of hard, fractured graywacke sandstone were observed along the creek and on adjacent sideslopes to the east. This bedrock possibly belongs to the Franciscan complex. If so the contact between the Franciscan complex and Great Valley sequence rocks would be located at approximately Station 65.0 to 65.5. At Station 66.1 serpentine fragments were noted in the soil indicating the presence of serpentine bedrock beneath soils at this location. From Station 66.1 to 66.3 serpentine bedrock is exposed along the 4-wheel-drive trail cutslopes and on the ridges above. This rock varies from blocky and hard to highly fractured to crushed and sheared.

(Continued)

TABLE 4.3.2-1: GEOLOGICAL CONDITIONS ON THE PROPOSED ALIGNMENT AND FACILITIES SITES (Continued)

Alignment Segment	Existing Geologic Environment
Approximate Stationing: Stations 65 to 66.3 (Continued)	Surficial Deposits: From Station 65 to 66 soils are thin and patchy and are primarily gravelly clayey sands. At Station 66 a small fan shaped deposit of clayey soils derived from serpentinite is exposed. These soils are at least a few feet deep, soft and compressible when wet and highly expansive. From this location to about Station 66.5, the soil cover is very thin and patchy and consists of rocky sands to clay weathered from serpentine bedrock. Artificial fill is present along the outside edge of the 4-wheel-drive trail. Soil types present (SCS) are Maymen-Millsholm-Bressa complex and have been described previously. Springs/Seepages: At Station 66.1 an area of surface wetness was noted which included the above described serpentine soils. The area was saturated on 4/19/93. Geologic Hazards: Between Stations 66.1 and 66.3 there is potential for slope instability along the outside and inside edge of the existing 4-wheel-drive trail. In the event of such failures the pipe alignment would be at risk. About a ten foot section of this road has been removed by accelerated erosion due to upslope runoff being intercepted by the sloping road surface. The described soft serpentine soils are likely subject to soil creep and present poor foundation conditions. Important Conditions and Comments: Geologic hazards as noted. Very difficult trenching conditions due to shallow bedrock. From Station 66.1 to 66.3 conditions are very sensitive due to the narrowness of the 4-wheel-drive trail, potential instability, serpentine soils and the steep drop-off into the tributary creek. The remaining areas of segment are moderately sensitive to sensitive due to mostly steep short drop offs into creek channel and resultant erosion/siltation potential.

(Continued)

TABLE 4.3.2-1: GEOLOGICAL CONDITIONS ON THE PROPOSED ALIGNMENT AND FACILITIES SITES (Continued)

Alignment Segment	Existing Geologic Environment
Approximate Stationing: Stations 66.3 to 67.6 Principal Improvements: Unimproved hill country. Alignment sited along existing 4-wheel-drive trail. At about Station 67 is one of two sites for the surge equalization facility. It is located immediately east of the align-ment. The second site is immed-iately to the west of the alignment at Station 67.0. The westerly tank site is the preferred site (probably less grading required) and the easterly site is the alternate.	Terrain: The northern part of the segment traverses across moderate to moderately gentle sideslopes which drain to the west. These slopes are contained within a large, gently to moderately sloping declivity located just below the drainage divide downslope of Childer's Peak. The south, southwesterly portion of the segment is on sideslopes which steepen beyond this declivity and which drain into the upper reaches of a creek which is tributary to Big Canyon Creek. Elevations range from about 1,720 feet msl on the north to about 1,680 feet msl on the south southwest. Drainages: The principal drainage is the unnamed tributary to Big Canyon Creek which is located downslope to the west southwest from the alignment. The slopes are moderately gentle to moderately steep. The stream channel is narrow and there are steep slopes immediately above the channel on both sides. The slopes flatten somewhat in the upslope direction on to the east, northeast as the alignment is approached. Small side tributaries enter the channel from both sides of the stream canyon. Bedrock Formations: The entire segment is underlain by serpentine associated with the Franciscan complex. The Childer's Peak fault, located a short distance to the northeast is the geologic contact between a serpentine/Franciscan complex rocks and the Great Valley sequence rocks which lie along the northeastern side of this fault. The fault is not considered active. Surficial Deposits: Thin and patchy soils up to few feet in thickness are present. They consist of serpentinite rock fragments intermixed with smaller amounts of sandy material with clays at the base of thicker soils. Some fragments of volcanic rock intermixed with serpentinite. These fragments are derived from upslope beyond the boundaries of the serpentine body. Soil types present (SCS) consist predominantly of Mayem-Etsel-Snook complex which consist of shallow, well drained gravelly loams with large rock fragments and rock outcrops. They have severe erosion hazard. Springs/Seepages: At Station 67.1 a small seepage was noted across the alignment (4-wheel-drive trail). Seepage was active on 4/19/93. Geologic Hazards: If deeper serpentine soils are present, weak, clayey foundation materials may be encountered beneath the surge equalization facility sites. Important Conditions and Comments: Possibly weak soils as noted. Locally shallow bedrock will likely result in difficult trenching conditions. This segment is not particularly sensitive. Tank sites require foundation investigation (geotechnical investigation).

(Continued)

TABLE 4.3.2-1: GEOLOGICAL CONDITIONS ON THE PROPOSED ALIGNMENT AND FACILITIES SITES (Continued)

Alignment Segment	Existing Geologic Environment
Approximate Stationing: Stations 67.6 to 72.5 Principal Improvements: Unimproved hill country with alignment located along existing 4-wheel-drive trail.	Terrain: The entire segment traverses along the east, northeast base of the moderately well-dissected canyon side walls tributary to Putah Creek whose slopes range from steep to moderate. The west southwest canyon sidewalls are formed by a lower, less dissected linear ridgeline. Elevations along the alignment range from about 1,780 feet msl along the north end of the segment to 1,550 feet msl at the south end. Drainages: The principal drainage is an unnamed tributary to Big Canyon Creek. There are numerous secondary drainages entering the stream canyon particularly from the east-northeast side. At the north end of the segment the stream is well-incised into a narrow stream canyon. As the southern end of the segment is approached this canyon slowly widens into a narrow stream valley through which the channel meanders, and into which it has incised. Channel width varies from 1 to 2 feet to up to 8 feet along the segment and has incised between 1 and 3 feet into stream deposits. Along this segment the alignment crosses the creek channel on the order of ten times. Between Station 68.0 and 69.1 the alignment pulls away from the stream along the 4-wheel-drive trail reducing the potential for stream degradation in this interval. Bedrock Formations: Rock consists of fractured , massive graywacke sandstone and interbedded shales. These rocks probably belong to the Great Valley sequence. Surficial Deposits: Surficial deposits consist of clayey soils developed on the shale and sandstone bedrock. On more steeply sloping areas they exhibit soil creep and local potential for slope failure. The soils appear to be at least moderately expansive. Artificial fill is likely present along the outside edge of the jeep trail. Soil types present (SCS) consist of Millsholm-Bressa loams which vary from loams to rocky loams. They are shallow, well drained with clay loam in the subsoil. The erosion hazard is severe. These soils develop over sandstone and shale bedrock. Springs/Seepages: Active spring and seepages were not observed. Geologic Hazards: The soils and weathered bedrock present on the slopes within this segment are locally undergoing soil creep and have the potential for accelerated erosion. There is also the potential for localized slope failures. No active landslides were noted crossing the alignment.

(Continued)

TABLE 4.3.2-1: GEOLOGICAL CONDITIONS ON THE PROPOSED ALIGNMENT AND FACILITIES SITES (Continued)

Alignment Segment	Existing Geologic Environment
Approximate Stationing: Stations 72.5 to 77 (Continued)	Henneke-Montara-Rock outcrop complex, Millsholm-Bressa-Hopland association, and Xerofluvents-Riverwash complex. The first of these soils is present over the serpentine bedrock and is shallow, well-drained consisting of gravelly loam and clay loam which has a severe erosion hazard. The second of the soils has developed over the Great Valley sequence rocks and is shallow, well-drained loam with a clayey loam subsoil. The hazard of erosion is severe. A third of these soils has developed along the channel and nearby floodplain of Big Canyon Creek and consist of very gravelly sandy loam with underlying very gravelly loamy coarse sand and very gravelly coarse sand. There is generally no hazard of erosion except along stream for there is streambank erosion during high intensity storms. Intermixed with the soils are numerous sub-rounded to sub-angular hard cobbles. Springs/Seepages: None observed. Geologic Hazards: Due to the locally steep to very steep gradients of the 4-wheel-drive trail as well as the short alternate segment, there is a high potential for accelerated erosion. Between about Station 74.8 and 75.3 on the prime alignment the 4-wheel-drive trail crosses very steep sideslopes. An extensive cutslope failure has developed along this interval. This failure plus the steep slopes below make this interval very hazardous in its present condition. More localized areas of deep clayey serpentine soils are present. They will be weak and expansive. Important Conditions and Comments: Geologic hazards as noted. Due to massive serpentine bedrock along the portions of the segment, expect very difficult excavation conditions. Smaller areas of deeper serpentine clay soils where present will result in poor foundation conditions and the possibility of unstable trench sidewalls. The short segment of alternate alignment is preferable. Both stream crossings present potential for erosion/siltation. Big Canyon Creek Crossing is very sensitive due to the large size of the stream and the under-stream crossing proposed.

(Continued)

Response to request for review

Dated: June 13, 1994

TO THE LAKE COUNTY SANITATION DISTRICT
ATTN: MARK DELLINGER
225 N. FORBES ST
LAKEPORT, CA 95453

In regard to the Draft Environmental Impact Report on the Southeast Regional Wastewater Treatment Plant Facilities Improvements Project and Geysers Effluent Pipeline Project, I should like to make the following comments.

1 *The plan proposes to draw up to two inches of water from Clear Lake on an annual basis. Yet the Draft EIR does not address any cumulative effect on the water quality and quantity of the lake over time. Clear Lake is an extremely marginal lake that requires all the water it can store during the wet season in order to combat drawdowns and evaporation during the remaining months. Clear Lake is a vital resource for Lake County. Any adverse impact on the lake will be a detriment to the county as a whole as well as to rimlanders and the county's resort and recreation industry.*

2 *Furthermore, this project will also include an attempt to amend the Solano Agreement that governs the present operation of Clear Lake. Even though the proposal is to amend only one stage limitation curve, the impacts of such an amendment should be addressed and they are not.*

The operation of Clear Lake under the Solano Agreement was won after an expensive and lengthy court battle. It sought to maintain a fair balance between the interests of all parties. Any alteration of the operation of Clear Lake is a matter of vital importance. The entire proposal to amend the Solano Agreement and its impacts on Clear Lake must be addressed in this draft EIR.

Thank you.

Bonny J. Hanchett

Bonny J. Hanchett
13806 Cliff Drive
Lower Lake, Ca 95457

To Thoes it Should Concern:

Clearlake CA.
July 12, 1994

I have been so ingrossed in other matters of importance to Clearlake, that the matter of "THE PIPELINE" eluded me! I do intend to attend the second and perhaps not the final hearing Thurs: July 14th. at 9: A. M. of the Planning Commission in the courthaouse in Lakeport. I urge thoes who can attend do it. Listen , say your peice and take part in this. Let the commission know where you stand on this...Fax your comments to them prior to the hearing if possible. Lets not allow another mistake in Lake County History!

1 ? Why cant the wastewater/effluent if so pure/so safe after treatment be added to our Lake? After all, we know worse things go into the Lake!

2 ? Whay cant the effluent be aprayed over the dry hills to the North thus eliminating fire hazzards?

3 ? How can you use any of the Lake water for the Geyser use when we do not own the water? Yolo owns it, remember?

4 ? Why should we, the citizens of Lake County pay the 10 to 15 % of the costs for maintenance of the pipeline feeding the Geothermal wells, when we receive no benifit from it?

? Why do the little people allways have to help finance such boondoggling ventures that make some richer and the taxpayers poorer?

5 ? Why should we of Lake County support this venture in order to provide jobs for 100, while ruining 26 miles of our scenic Lake County?
I cannot see pumps placed anywhere along the proposed route, how large would they be, HOW NOISY ARE THEY? We are trying to work for the beautification of the Lake and the surrounding areas, as we grapple with the algae problem! That is enough to contend with! We do not need a 26 mile ditch dug to bury the pipeline, or an exposed 24 inch pipeline where it cannot be buried! The destruction of woodland and chaparral vegetation

6 would cause errosion in areas that sutain wildlife and the areas could come down in massive slides when and if we get heavy rainfalls! I

7 cannot understand why the people who built the Geysers could not forsee the decline in steam levels, being expert in thier feild they should

8 have! Whats in it for Lake County? We should see an increase in capacity levels in our S.E. Regional wastewater Treatment Facillity. And we get to pay for the maitenance of the pipeline. Hidden Valley could tap into

8 it, middletown also will . Terrific! we will become known for having the longest , largest sewer line in California. I do not like the term "short term" used ininforming us that the pipeline will impact the

9 quality of the creeks of the area and thier tributaries. And the steam was supposed to last forever? At a cost of 39 million dollars the pipeline is the countys single largest project ever: Wow! all

10 that State and Federal money in grants just cannot be ignored, we allways have to spend grant money whether we need it or not! And we do not need this! Reminds me of another great pipeline that was supposed to benefit all of the U.S. of A. by lowering oil and oil products costs! TOO much SULFUR in it , cant be used, sell it ti Japan! Think about it!

Mignon Perry
POB 1761
Lower Lake Ca.
95457

since Writing the above, I read not all of the Draft EIR/EIS of SERWTP. But Read an initial Checklist of E. impacts. I found too many maybes in this one list. 31 Maybes to 3 Yes ans. 16 No ans. You have to read the questions in the list to understand how important or unimportant they are but! (G) Exposure of people or property to geologic hazards such as earthquakes landslides mud slides - ground failure or similar hazards? ans. Maybe.

11 (I) Noise (a) increase in existing noise levels ans. Maybe

(B) Exposure of people to severe Noise levels - and Maybe.

11

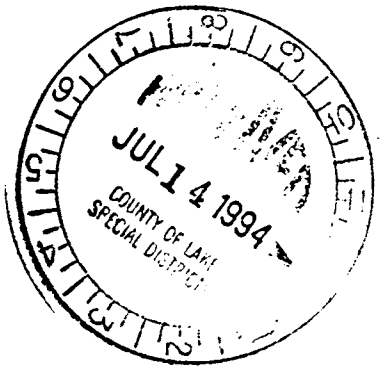
To name a few!

This is really the tip of an iceberg!

Mignon Perry

STATE OF CALIFORNIA PETE WILSON, *Governor*

GOVERNOR'S OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET
SACRAMENTO, CA 95814



July 11, 1994

MARK DELLINGER
LAKE COUNTY PLANNING DEPT.
255 NORTH FORBESWW STREET
LAKEPORT, CA 95453

Subject: SOUTHEAST REGIONAL WASTEWATER TREATMENT FACILITY SCH #: 86021101

Dear MARK DELLINGER:

The State Clearinghouse has submitted the above named draft Environmental Impact Report (EIR) to selected state agencies for review. The review period is now closed and the comments from the responding agency(ies) is(are) enclosed. On the enclosed Notice of Completion form you will note that the Clearinghouse has checked the agencies that have commented. Please review the Notice of Completion to ensure that your comment package is complete. If the comment package is not in order, please notify the State Clearinghouse immediately. Remember to refer to the project's eight-digit State Clearinghouse number so that we may respond promptly.

Please note that Section 21104 of the California Public Resources Code required that:

> "a responsible agency or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency."

Commenting agencies are also required by this section to support their comments with specific documentation.

These comments are forwarded for your use in preparing your final EIR. Should you need more information or clarification, we recommend that you contact the commenting agency(ies).

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Michael Chiriatti, Jr.
Chief, State Clearinghouse

Enclosures
cc: Resources Agency

Mail to: State Clearinghouse, 1400 Tenth Street, Room 121, Sacramento, CA 95814 — 916/445-0613

NOTICE OF COMPLETION AND ENVIRONMENTAL DOCUMENT TRANSMITTAL FORM

For OPR Use Only
SCH # 86-021102

1. Project Title: Southeast Regional Wastewater Treatment Plant Facilities Improvements & Geysers Effluent Pipeline Proje
2. Lead Agency: Lake County Sanitation District — 3. Contact Person: Mark Dellinger
3a. Street Address: 255 North Forbes Street — 3b. City: Lakeport
3c. County: Lake — 3d. Zip: 95453 — 3e. Phone: (707) 263-2273
PROJECT LOCATION 4. County: Lake — 4a. City/Community: Clearlake, Lower Lake, Middletown
4b. Assessor's Parcel No.: various — 4c. Section — Twp. — Range
5a. Cross Streets: various- see location maps — 5b. For Rural, Describe Community: Lower Lake, Middletown
6. Within 2 miles: a. State Hwy # 53, 29, 175 — b. Airports pierce — c. Railways — d. Waterways Clear Lake, Putah Creek

7. DOCUMENT TYPE	8. LOCAL ACTION TYPE	9. DEVELOPMENT TYPE
CEQA	01. ___ General Plan Update	01. ___ Residential: Units ___ Acres ___
01. ___ NOP	02. ___ New Element	02. ___ Office: Sq. Ft. ___
02. ___ Early Cons	03. ___ General Plan Amendment	Acres ___ Employees ___
03. ___ Neg Dec	04. ___ Master Plan	03. ___ Shopping/Commercial: Sq. Ft. ___
04. X Draft EIR	05. ___ Annexation	Acres ___ Employees ___
05. ___ Supplement/Subsequent EIR (Prior SCH No.: 86-021102)	06. ___ Specific Plan	04. ___ Industrial: Sq. Ft. ___
	07. ___ Community Plan	Acres ___ Employees ___
	08. ___ Redevelopment	05. ___ Water Facilities: MGD ___
NEPA	09. ___ Coastal Permit	06. ___ Transportation: Type ___
09. ___ JCP	10. ___ Land Division (Subdivision, Parcel Map, Tract Map, etc.)	07. ___ Mining: Mineral ___
10. ___ FONSI	11. ___ Use Permit	08. ___ Power: Type ___ MW ___
11. X Draft EIS	12. ___ Sign	09. X Waste Treatment: Type secondary
12. ___ EA		10. ___ CCR Related
OTHER		11. ___ Other: ___
13. X Joint Document		
14. ___ Final Document		
15. ___ Other		

16. Total Acres: 25-30 — 17. Total Jobs Created: approximately 100

18. PROJECT ISSUES DISCUSSED IN DOCUMENT			
01. X Aesthetic/Visual	08. X Flooding/Tsunami	15. X Public Systems	22. X Water Quality
02. X Agricultural Land	09. X Geologic/Seismic	16. X Sewer Capacity	24. ___ Water Supply
03. X Air Quality	10. X Jobs/Housing Balance	17. X Social	25. X Wetland/Riparian
04. X Archeological/Historical	11. X Minerals	18. X Soil Erosion	26. X Wildlife
05. ___ Coastal Zone	12. X Noise	19. X Solid Waste	27. X Growth Inducing
06. X Economic	13. X Public Services	20. X Toxic/Hazardous	28. X Incompatible Landuse
07. X Fire Hazard	14. X Schools	21. X Traffic/Circulation	29. X Cumulative Effects
		22. X Vegetation	30. X Other energy recovery, wastewater reclamation

31. FUNDING (approx) Federal $ 10,000,000 — State $ 1-2 mil. grant — Local $ 39,000,000
32. ESTIMATED LAND USE AND ACREAGE: industry: $20,000,000 $ 5-8 mil. loan

various; see EIR/EIS

33. PROJECT DESCRIPTION: This environmental analysis will focus on improvements to the SRWTP facilities and a 24" diameter pipeline designed to carry up to 5,400 gallons per minute of secondarily treated wastewater. The wastewater will be transported from the Lake County Sanitation District's Southeast Regional Wastewater Treatment Plant with additional make-up water from Clear Lake to the southeast portion of the Geysers geothermal field in Lake and Sonoma Counties.

CLEARINGHOUSE CONTACT: MIKE CHIRIATTI
(916) 445-0613

DATE REVIEW BEGAN: 5-26-94
DUE REV TO AGENCY: 7-5
AGENCY REV TO SCH : 7-8
SCH COMPLIANCE : 7-11

PLEASE NOTE SCH NUMBER ON ALL COMMENTS

PLEASE FORWARD LATE COMMENTS DIRECTLY TO THE LEAD AGENCY ONLY

AQMD/APCD: 13 (Resources: 5/26)

CNT SNT		CNT SNT	
— X	Resources		State/Consumer Svcs
	[redacted]		[redacted]
		—	ARB
— X	Fish & Game 2	— X	CA Waste Mgmt Bd
	[redacted]		[redacted]
		— X	SWRCB:--Wtr Quality
— X	Reclamation		[redacted]
		— X	Reg. WQCB # 5SAC
— X	DWR	— X	DTSC/CTC
	[redacted]		[redacted]
— X	Caltrans # 1		[redacted]
	[redacted]	— X	State Lands Comm
			Tahoe Rgl Plan

(* = sent by lead / "" = sent by SCH)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

In Reply Refer To:
FPN 1371

July 20, 1994

Mark Dellinger
Lake County Sanitation District
255 North Forbes Street
Lakeport, California 95453

Rich Estabrook
U.S. Bureau of Land Management
2550 North State Street
Ukiah, California 95482

Subject: Lake County Sanitation District, Southeast Regional Wastewater Treatment Plant Facilities Improvements Project and Geysers Project Draft Environmental Impact Report/Statement, City of Clearlake, Lake County, California.

Dear Sirs:

The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Environmental Impact Report/Statement (DEIR/S) for the Southeast Regional Wastewater Treatment Plant Facilities Improvements Project and Geysers Project in Lake County. The following comments are provided to assist in your preparation of the Final Environmental Impact Report/Statement and are not intended to take the place of any formal comments which may be required at a later date under the auspices of the Fish and Wildlife Coordination Act.

Project Description

The Lake County Sanitation District (LCSD) proposes to improve existing plant capacity and wastewater treatment facilities at the Southeast Regional Wastewater Treatment Plant and transport treated effluent in a 26-mile pipeline to the Geysers for power generation. Inadequate storage and disposal facilities for existing effluent have resulted in emergency discharges into Burns Valley Creek and ultimately into Clear Lake, resulting in a Cease and Desist Order issued by the Central Valley Regional Water Quality Control Board.

Specific Comments

The DEIR/S states that the amount of appropriated water sent to the Geysers represents a small fraction of the available water supply within Clear Lake (approximately 0.6% under dry conditions). Although the total amount of water

1 may be small, resolution of LCSD's wastewater problems may facilitate residential growth in the area. Therefore, we recommend that the DEIR/S consider both the loss of Clear Lake water to the Geysers and increased diversions due to residential growth facilitated by this project.

2 Any diversion should comply with the California Department of Fish and Game's (CDFG) screening criteria to minimize impingement and entrainment of aquatic life (Contact: Rick Macedo, CDFG). The CDFG typically recommends screens with mesh sizes less than 0.25 inches and screen approach velocities less than 0.33 feet/second. In addition, a monitoring and cleaning program needs to be developed that maintains the effectiveness of the screen. The intake structure should be located away from any nearshore areas or in-water structures which are areas of high fish use.

3 The DEIR/S notes that the pipeline and related features (e.g., roads) will cross areas with high erosion potential due to steep terrain and unstable soils. Although mitigation measures such as jute matting and hydroseeding will undoubtedly reduce the risk of erosion, the applicant should commit to long-term remediation of any erosion problems should mitigation measures fail. This commitment requires long-term monitoring to identify problems. Also, replanting and/or mulching should occur in all situations where soils are disturbed and any replantings should use locally, native materials. Plantings that occur in the dry season should be irrigated.

4 Based on conversations with Lake County Sanitation personnel, we understand that exposed pipelines would be placed in geologically and biologically sensitive areas on tranchions, elevated 1-2 feet above ground. Changes in this proposal that involve the placement of pipeline directly on the land surface may interrupt movements of wildlife including western pond turtles and should be avoided.

5 The DEIR/S does not quantify the loss of habitat associated with project construction activities. The final environmental document should include a table that displays acreage of habitat loss for each alternative. This would help in identifying the alternative, particularly for pipeline routes, that best minimizes the impacts to sensitive habitats. Unavoidable, temporary and permanent losses of wetland, aquatic, riparian, serpentine, and woodland/savanna habitats should be suitably compensated. To our knowledge, no compensatory mitigation for loss of sensitive habitats has been proposed by the project proponent.

6 To assist in your monitoring efforts for the California red-legged frog, we enclose the following survey protocol. The results of these surveys should be published in the final EIR/S. Survey results should also be provided to our office. Should these surveys determine that the frog may be affected by the proposed project and irrespective of whether the California red-legged frog is listed as either endangered or threatened (Mitigation 5.2.3.1B), the project proponent should develop a plan that mitigates for the project's direct, indirect, and unavoidable impacts to this species and compensates for project-related loss of habitat.

7 At this time, we do not have enough information to conclude that the mitigation measures for sensitive plants would reduce impacts to insignificant levels (Impact 5.2.3.10). Salvaging and transplanting of sensitive species and their seed banks are experimental technologies. The specifics of the mitigation plans including the location and long-term protection of transplanted species have not been fully developed. Therefore, if any unavoidable impacts to listed, candidate, or proposed plant species are identified, we recommend that the project proponent contact our Botanical Group (Contact: Jan Knight) for technical assistance in developing and implementing appropriate mitigation.

8 In the event of project termination, the DEIR/S (Page 2-125) notes that pipelines would be abandoned in place and plugged or sealed. We recommend that the project proponents be required to remove any exposed pipeline segments, particularly pipes spanning watercourses. This commitment should be explicitly stated in the final EIR/S.

9 The DEIR/S notes that the proposed wastewater disposal alternative would allow continued geothermal energy production in the southeast Geysers at higher production levels than would occur otherwise. The DEIR/S concludes that these increases in steam production would not substantially affect emissions from geothermal development (Impact 5.3.5.3). However, no information is provided as to the levels of existing sulfur emissions or the anticipated levels if the proposed project is implemented. This information is important because the Geysers are possibly the largest anthropogenic source of atmospheric sulfur in California (Suter, 1978) and sulfur dioxide has been shown to be a phytotoxicant. Research by Thompson et al. (1977) found that trees near the Geysers power plants exhibited reduced cover and diversity of lichens when compared to trees further away. The final environmental document should address potential biological impacts resulting from increased power production and recommend appropriate mitigation measures.

Thank you for considering our comments in the development of your final EIR/S. If you have any questions regarding these comments, please contact Darren Fong at (916) 978-5408 (Ext. 348) regarding wetland issues or Betty Warne at (916) 978-4866 regarding sensitive plant issues.

Sincerely,

For Joel A. Medlin
Field Supervisor

cc: Reg. Dir., (ARD-ES), FWS, Portland, OR
CDFG, Region III, Yountville, CA
CDFG (R. Macedo), POB 1338, Cobb, CA 95426

Enclosure

SURVEYING PROTOCOL FOR THE CALIFORNIA RED-LEGGED FROG

U.S. FISH AND WILDLIFE SERVICE

MARCH 1994

1. To determine presence or absence of red-legged frogs or establish population sizes, surveys should be conductad at night. The first half of the night is the best time period to survey.

2. A powerful light should be used to detect eye shine. To accurately identify red-legged frogs, the surveyor must be close enough to see the dorsolateral folds that distinguish red-legged frogs from bullfrogs.

3. The optimum time of the year to survey is March through the end of April. Surveys can be continued through September if necessary.

4. Tadpoles can be positively identified only by teeth patterns and requires considerable expertise. This technique is not recommended.

Literature Cited:

Suter, G.W. October 1978. Effects of geothermal energy development on fish and wildlife. USDI Fish and Wildlife Service. FWS/OBS-76/20.6. 20 pp.

Thompson, R.J., R.F. Smith, L.M. Hain, L.J. Price, P.C. Muick, and R.J. Sherman. January 1977. The effects of geothermal emissions on the distribution and physiology of lichens at The Geysers, California. Sonoma State College

United States Department of the Interior
NATIONAL PARK SERVICE
Western Region
600 Harrison Street, Suite 600
San Francisco, California 94107-1372

IN REPLY REFER TO:

L7619(WR-RP)
X-DES-94/0027

July 26, 1994

Bureau of Land Management
Attention: Richard Estabrook
2550 North State Street
Ukiah, CA 95482

Dear Mr. Estabrook:

This letter is in response to the draft Environmental Impact Statement/Environmental Impact Report for the Southeast Regional Wastewater Treatment Plant Facilities Improvement Project and Geysers Effluent Pipeline Project. The National Park Service has the following comments about the discussion of cultural resources.

GENERAL COMMENTS

1 We believe the sections on cultural resources could be more specific. We recommend that they specify what resources are present and what the potential effect of the project might be on these resources. For example, consideration might be given to the following factors: general locations for the known sites including graphic displays on maps, the estimated site dimensions, the potential effect of related construction activities on the known sites, and individual site integrity.

SPECIFIC COMMENTS

2 We recommend the data displayed in Table 4.8.1-1: TABLE OF PREHISTORIC AND HISTORIC ARCHAEOLOGIC SITES in Volume 1, page 4-154 be more completely addressed. Further consideration of Site CA-LAK-510 might evaluate the entry "recently excavated." What does this mean? By whom? Why? Similarly, the reference to "human burials" at the same site could be explained. Are the burials currently exposed? Have they been disturbed? Do they need immediate attention? Also, the entries "round alignments," "displaced materials," and "midden-like material" respectively describing Sites CA-LAK-269, CA-LAK-1787, and CA-LAK-1792 could be explained in more detail.

3 We recommend further analysis of the Ethnographic Sites and Historic Sites sections in Volume 1, pages 4-153 to 4-155. The following questions might be posed: What are the "eight ethnographic village locations?" How do they stand to be affected by the proposed

3 pipeline? Can these village locations be confirmed and to what contemporary groups can they be affiliated? Similarly, what does it mean to say that two historic village sites are "Native American"? Can the latter villages be more accurately identified?

4 We also recommend greater analysis of the cultural resources and design alternatives in Volume 1 pages 4-156 to 4-157. If it has been decided that a discussion is warranted here, it should include information sufficient to compare and contrast each alternative's potential to affect significant cultural resources (i.e., listed, eligible, or potentially eligible National Register sites).

5 We recommend reassessment and rewriting of sections in Chapters 5 and 6 regarding cultural resources. The Chapter 5.2.6 entries (Impact Significance Criteria) should be related more rigorously to the California Environmental Quality Act (CEQA) and the National Historic Preservation Act (NHPA). We do not believe that the Native American Graves Protection and Repatriation Act (NAGPRA) mentioned in this section is pertinent to the production of this draft EIS.

6 We believe that the subsequent Chapter 5 and 6 entries, which address some aspect of cultural resources, should to be more specific to offer utility for planning purposes to the decision makers. In particular, the questions at hand for Chapters 5 and 6, i.e., environmental consequences and mitigation measures, could be more completely addressed.

7 Unlike our concerns about Chapters 4, 5, and 6, we believe that the cumulative impact discussion (Chapter 7.4.4.6) is brief but adequate.

Please contact Thomas L. Burge at (415) 744-3916 if you have any questions about these comments.

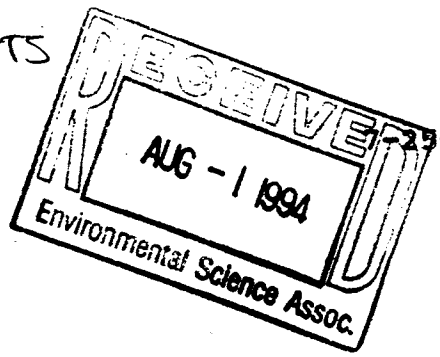
Stanley T. Albright

cc:
Lake County Planning Department
255 N. Forbes St., Room 329
Lakeport, CA 95453

Lake County Sanitation Department
230A Main St.
Lakeport, CA 95453

Thomas L. Burge, WRO, National Register Program

BLM COMMENTS



7-25-94

Mark Winsor
ESA
301 Brannon Street
Suite 200
San Francisco, California 94107-1811

Dear Mr. Winsor

On July 12, 1994 Gregg Mangan, Wildlife Biologist, Rich Estabrook, Petroleum Engineer, Dan Brown, District Soil Scientist inspected a proposed road and geothermal pipeline to be constructed on BLM land at T. 10 N., R. 8 W., of section 1, see attached Whispering Pines topo map and attachment 1. About one half mile of road is proposed to be constructed on BLM using heavy equipment e.g. dozer and trucks. The road width will be about 10-20 feet wide at various areas and about 170 feet wide at the stream-crossing. One concrete bridge with a culvert will be installed to cross the one intermittent unnamed stream. This intermittent stream runs water during winter months delivering flows into Bear Canyon Creek, hence, Putah Creek, hence Lake Berressa. Soils located at this site are located on steep slopes and are highly erosive.

I recommend the following protective prescriptions to reduce possible soil erosion sedimentation impacts to riparian and water quality values aiding in the protection of downstream fisheries riparian and aquatic ecosystems.

The following prescriptions pertain to BLM administered land.

1. Construction, seeding and fertilizer shall be completed by October to protect disturbed soils, reduce rainfall impacts and possible sediment load dispersal into the unnamed stream.

2. Within the 150 feet stream buffer, straight line measurement, of the un-named stream, use an excavator (back-hoe) to extract road soils/materials and haul material to disposal site, not on BLM land. Cut banks within the 150 foot buffer shall be hydromulched using rates A and B below. There should be no fill material down-slope from the new road within 150 feet of the stream buffer. See attachment no. 1 for 150 foot straight measurement example.

   A. Seed Rate: 50 lbs./acre of California certified wymmera ryegrass

   B. Fertilizer: 400 lbs./acre of 12-16-16

   C. Rice Mulch: 1,000 lbs./acre applied evenly over fill slopes (Noxious weed-free rice straw)

Note: Estimated surface disturbance activities on BLM, excluding the road surface is about 1/2 of an acre.

3. Fill slopes out of the 150 foot buffer shall be seeded, fertilized and mulched to achieve a 75 percent vegetative cover. Use mulch rate C above.

4. Water shall not be taken from the un-named stream for construction purposes.

5. Fuel materials shall not be stored within the 150 foot stream buffer.

6. Any hazardous spill(s) of fuels, chemicals or unknown fluids shall be immediately reported to the appropriate state, county and federal hazardous materials specialist. In case of a hazardous spill on BLM land, contact Dave Fatch, Hazardous Materials Specialist, at (707) 468-4053 or Renee Snyder, Clear Lake Area Manager, at (707)-468-4070 , BLM office in Ukiah.

7. All trash, cans, debris shall be disposed of in an authorized refuge site.

8. BLM shall have a project coordinator occasionally visit the work site when work is performed on BLM land.

9. A BLM employee below shall be notified before work on BLM land commences.
Renee Snyder (707) 468-4070
Greg Managan (707) 468-4078
Rich Estabrook (707) 468-4052 or
Dan Brown (707) 468-4049

10. BLM shall monitor protective vegetative prescriptions approximately 1 year after project completion.

11. In the event of any road or construction failure on BLM land, corrective measures shall be taken.

cc: Mr. Mark Dellinger, Lake County Special Districts

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT
CLEAR LAKE RESOURCE AREA
2550 N. State Street
Ukiah, California 95482-3023

IN REPLY REFER TO:

July 18, 1994

Memorandum

To: Dan Brown

From: Gregg Mangan

Subject: Proposed Road and Culvert for Geysers Effluent Pipeline

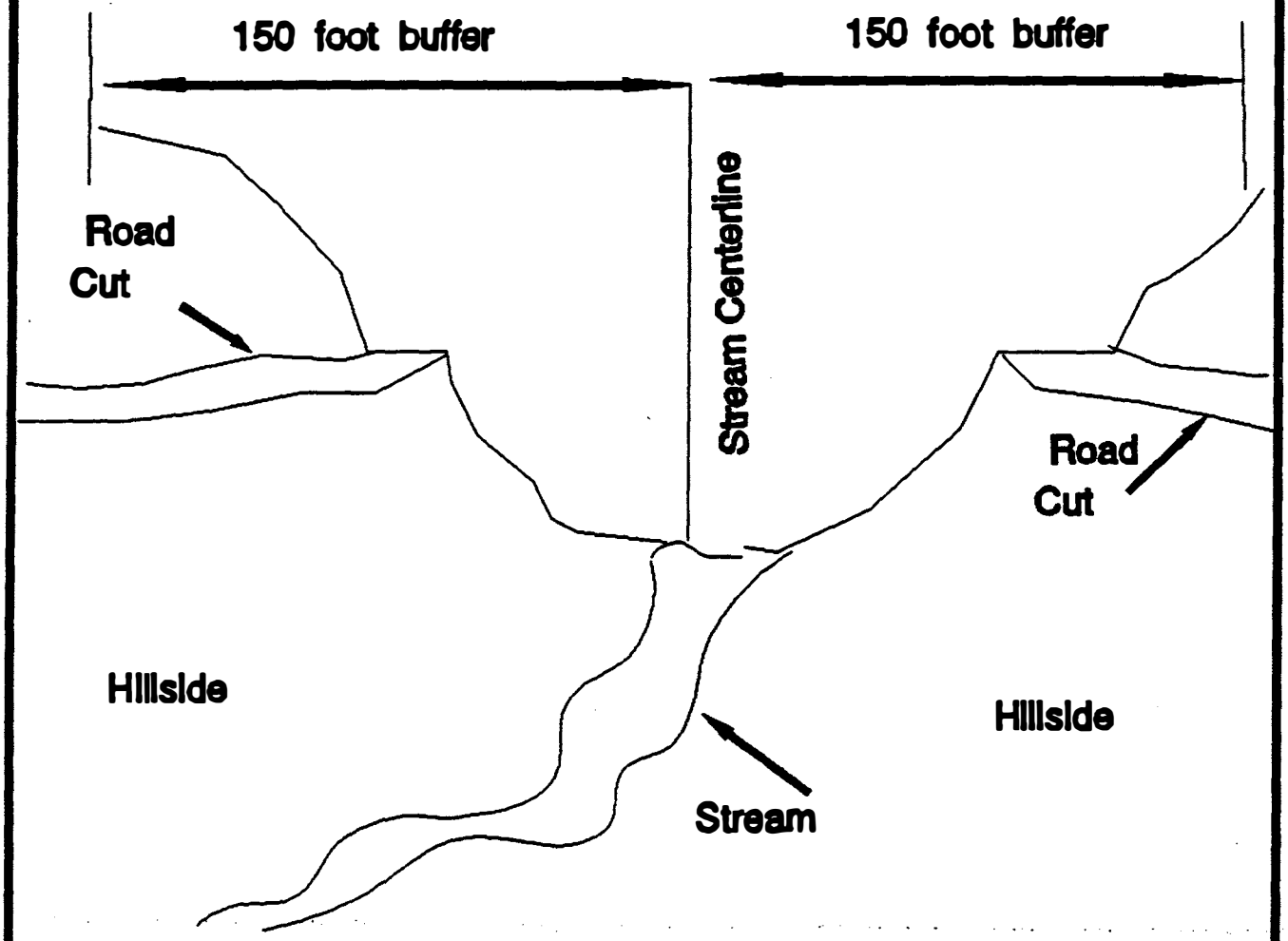
I talked with Rick Macedo, Fisheries Biologist with CDFG about the proposed road/culvert and what he knew about the local fisheries situation.

The proposed culvert crossing is located approximately 0.9 miles up from Bear Canyon Creek on an unnamed tributary. Rick said that rainbow trout and a non-anadramous strain of steelhead have been found in Bear Canyon Creek. The northwestern pond turtle (federal candidate-2 species), California red-legged frog (federally proposed as endangered), and the foothill yellow-legged frog (federal candidate-2 species) could also be found in Bear Canyon Creek. To his knowledge none of these species have been confirmed in the unnamed tributary.

I explained to Rick that we had noticed what appeared to be barriers to fish passage when we stopped at the location near the Bear Canyon plant where we walked through the existing culvert under the roadway. I told him that the location of the proposed culvert crossing had a steep gradient with steep side slopes and had no riparian vegetation to speak of. From my description of the project area and Rick's professional opinion, we both agreed that the project site would not support a fishery.

The concern to the above-listed species therefore would arise from sedimentation resultant from the construction of the culvert crossing. Stipulations should be listed which will minimize the amount of sedimentation. This could include the use of an excavator within 150' of either side of the culvert crossing and then removal of this cut material off-site.

ATTACHMENT 1
Straight line Measurement



U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT	
Proposed Road and Pipeline Construction	
DESIGNED	
REVIEWED	Dan Brown
APPROVED	
DRAWN D.B.	SCALE NONE
DATE 7-18-94	SHEET 1 OF 1
DRAWING NO.	

b:bearcan DP

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

Rich Estabrook
US Bureau of Land Management
2550 North State Street
Ukiah, CA. 95482

Dear Mr. Estabrook:

The Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the project entitled **Southeast Regional Wastewater Treatment Plant (SERWWTP) Facilities Improvement Project and Geysers Effluent Pipeline Project, Lake County, California.** Our review is pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act.

The Lake County Sanitation District is under a 1991 Central Valley Regional Water Quality Control Board Cease and Desist Order, with associated building moratorium, until adequate wastewater treatment capacity is provided. A previously prepared Facilities Plan Environmental Impact Report (EIR) evaluated SERWWTP facility improvements and 12 options for the disposal of treated effluent. At that time, the preferred effluent disposal alternative was discharge to Cache Creek. Subsequent environmental review and public comment has resulted in a shift to effluent injection in the Southeast Geysers Geothermal Field as the preferred effluent disposal alternative.

The present DEIS/EIR focuses on three project components: a 26 mile Geysers effluent pipeline, Geysers effluent injection, and SERWWTP facility improvements. Alternatives include no action, alternative SERWWTP facility designs, and alternative routes for pipeline segments. The proposed action includes an average annual flow of 7.8 million gallons per day (mgd) of treated effluent and make-up water diverted from Clear Lake to the Southeast Geysers Geothermal Field. The effluent would be distributed to 16 injection wells owned and operated by Unocal, Calpine, and the Northern California Power Agency (NCPA). These wells are located on private lands and a federal leasehold managed by the US Bureau of Land Management (BLM). BLM approval will be required for proposed construction and well injection on the federal leasehold.

1 EPA commends the project proponents for their effort to reuse treated effluent. Pollution prevention and reuse of wastewater are EPA priorities. However, we urge maximum reduction of the infiltration and inflow (I/I) problem and implementation of maximum water conservation techniques (e.g., retrofit program) prior to consideration of effluent disposal

alternatives. Reduction of the amount of treated effluent should be the primary focus before reuse and disposal is considered. The Final EIS (FEIS) should describe in detail the efforts which are being made in the I/I reduction and water conservation areas. 1

We support the environmentally preferred alternative (page 1-78) which will eliminate the need for placing a substantial amount of fill in an intermittent creek. Furthermore, given the 38 or more stream crossings, Clear Lake intake and associated pipeline impacts, and potentially significant cumulative impacts to Sweet Springs Creek and a Bear Canyon Creek tributary, it is our belief that an individual Section 404 permit from the US Corps of Engineers may be required. 2

The FEIS should demonstrate compliance with the Federal Guidelines for Specification of Disposal Sites for Dredged or Fill Materials (40 CFR 230), promulgated pursuant to Section 404(b)(1) of the Clean Water Act (CWA). The proposed action must meet all of the following criteria: there is no practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem; the proposed action does not violate State water quality standards, toxic effluent standards, or jeopardize the continued existence of federally listed species or their critical habitat; the proposed action will not cause or contribute to significant degradation of waters of the United States, including wetlands and fish and wildlife habitat; and all appropriate and practicable steps are taken to minimize adverse impacts on the aquatic ecosystem. 3

EPA has concerns regarding potential impacts to water quality, water supply, wetlands, riparian habitat, and fish and wildlife. Furthermore, there is insufficient information on water conservation, potential impacts to Clear Lake, water supply, and compliance with Clean Water Act Section 404(b)(1) requirements. Based upon our review of the DEIS, we have classified this document as category EC-2, Environmental Concerns - Insufficient Information (see attached "Summary of the EPA Rating System"). Detailed comments are enclosed. 4

We appreciate the opportunity to review this DEIS. Please send two copies of the FEIS to this office at the same time it is officially filed with our Washington D.C. Office. If you have any questions, please call me at (415) 744-1574, or Laura Fujii, of my staff, at (415) 744-1579.

Sincerely,

Edward Yates for

David J. Farrel, Chief
Environmental Review Section
Office of Federal Activities

Enclosure: Detailed Comments, 3 pages
EPA Rating System, 1 page.
E.O. Environmental Justice, 2 pages

94-191
MI001878
Filename: WWTPGEYS.DEI

cc: Mark Dellinger, Lake County Sanitation District
Wayne White, USFWS, Sacramento
Linda Campion, CDOGGR, Sacramento
Central Valley RWQCB
CDFG, Yountville
Lake County AQMD
Northern Sonoma County APCD

COMMENTS

Water Resource Comments

Water Quality

We commend the project proponents for the proposed erosion control mitigation measures. However, we remain concerned with the significant short-term accelerated erosion in some areas and the short-term water quality impacts to Clear Lake, Sweet Springs Creek, and an unnamed tributary of Bear Creek (pg.7-1). We recommend the use of silt curtains and techniques which minimize turbidity during installation of the buried Clear Lake intake and
5 pipeline. In addition, sediment testing for potential contaminants and biological surveys for fishery habitat should be conducted prior to excavation. Emergency response plans for the project should include a clean-up plan to mitigate wash-out impacts and to provide instructions on sediment and mud removal, stabilization of creek beds, and habitat restoration.

EPA has delegated regulation of geothermal activities to the California Department of Oil and Gas Resources (CDOGGR). We recommend BLM and project proponents coordinate with Linda Campion or Mary Lou Habble, 916-324-1268 of CDOGGR.

Water Supply

The proposed project would utilize up to 6,994 acre-feet of water per year from Clear Lake. This water would be purchased from the Yolo County Flood Control and Water Conservation
6 District (YCFCWCD). The FEIS should describe in detail current and future water supply demands, current and future water allocation from Clear Lake, the status of negotiations with YCFCWCD, and the likelihood for water use conflicts (e.g., drinking water vs make-up water) resulting from direct, indirect, and cumulative impacts and induced growth.

Air Quality Comments

Federal agencies are required by the Clean Air Act to assure that actions conform to an approved air quality implementation plan. BLM may need to demonstrate compliance with conformity requirements of the Clean Air Act [Section 176(c)]. General
7 Conformity Regulations can be found in 40 CFR Parts 51 and 93 (58 Federal Register, page 63214, November 30, 1993). These regulations should be examined for applicability to the proposed action. We recommend that project proponents work with the Lake County Air Quality Management District and Northern Sonoma County Air Pollution Control District to ensure the project conforms to air quality planning activities. In addition, the FEIS should

7 evaluate potential cumulative impacts to air quality which may result from induced growth and expanded activity within the Geysers Geothermal Field.

General Comments

8 1. The FEIS should provide more detail regarding previously evaluated SERWWTP improvement and effluent disposal alternatives. Even though the previous Facility Plan EIR may be incorporated by reference, the FEIS should provide a summary of critical issues, results, assumptions and decisions complete enough to stand alone without depending upon continued referencing of the other document. We strongly recommend the FEIS include a detailed summary of the environmental consequences of previously evaluated effluent treatment alternatives and the rationale for the elimination of these alternatives from consideration.

9 2. We approve of the many mitigation measures which are proposed. We urge adoption of these measures and the recommended, but not required, mitigation measures. Recommended mitigation measures which we believe may be of potential benefit are those recommended for fish and wildlife, sensitive plant species, and sludge disposal. To address public concerns, viral and bacterial contamination evaluation prior to atmospheric release of gases may be of benefit during the initial stages of the project.

10 3. As stated in the DEIS, studies have demonstrated a clear correlation between increased injection and gas production within the Geysers Geothermal Field with an increase in local microseismicity. However, induced seismicity is still not well understood. We urge BLM and the project proponents to make a commitment in the Record of Decision to develop and implement a plan for additional seismic monitoring in the Southeast Geysers and for increased outreach and information dissemination to the concerned public.

11 4. The DEIS states that Clear Lake could be drawn down by approximately 2 inches. Although this change in surface water elevation may not appear significant, it could have impacts on associated riparian habitat, wetlands, and shoreline wet meadows. The FEIS should evaluate potential impacts of the proposed change in surface water elevation on the above associated natural resources.

12 5. Although the California red-legged frog is not yet listed as a Federally endangered species, we urge preparation of a preliminary mitigation program prior to ground moving activities. Having such a plan on hand will prevent unnecessary delays if the species is listed during construction.

13 6. A recommended mitigation measure for odorous emissions, if anaerobic conditions develop, is to add sufficient chlorine to the effluent to reduce these odor problems. If a chlorine effluent additive is considered, the FEIS should evaluate the potential risk to fish and wildlife in the event of a pipeline leak, break, or blow-out.

14 7. The DEIS states that the proposed pipeline and associated facilities would have permanent strong visual contrast to the surrounding background. Mitigation measures that are described are only recommended versus required. Given the scenic role of this area, we urge adoption of these recommended visual mitigation measures.

15 8. Current project design includes a number of pumps which would not be enclosed (e.g., SERWWTP pumps). These pumps have the potential to significantly increase noise levels. We urge the project proponents to adopt the mitigation measures which recommend enclosure of these pumps.

16 9. Thirty-eight or more stream crossings are proposed along the pipeline alignment. In winter, flows in some of these stream channels (e.g., Big Canyon Creek) may be substantial. The FEIS should provide a more detailed description of winter flood flows and the risk to the buried or elevated pipeline. Describe how the risk will be prevented or reduced and the safety and spill contingency plans which will be implemented.

17 10. In keeping with Executive Order 12898, **Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations** (EO 12898), the FEIS should describe the measures taken by the BLM and project proponents to: 1) fully analyze the environmental effects of the proposed Federal action on minority communities and low-income populations, and 2) present opportunities for affected communities to provide input into the NEPA process. The intent and requirements of EO 12898 are clearly illustrated in the President's February 11, 1994 Memorandum for the Heads of all Departments and Agencies, attached.

18 11. Table 4.4.4-4, page 4-92. For comparison, we recommend a third column be included which provides the minimum water quality/effluent quality standards.

19 12. Page 9-6. Add the Clean Air Act Section 176 on Conformity as a possible requirement.

SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

Environmental Impact of the Action

LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of environmental quality, public health or welfare. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommend for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1-Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

THE WHITE HOUSE

WASHINGTON

February 11, 1994

MEMORANDUM FOR THE HEADS OF ALL DEPARTMENTS AND AGENCIES

SUBJECT: Executive Order on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Today I have issued an Executive order on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. That order is designed to focus Federal attention on the environmental and human health conditions in minority communities and low-income communities with the goal of achieving environmental justice. That order is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority communities and low-income communities access to public information on, and an opportunity for public participation in, matters relating to human health or the environment.

The purpose of this separate memorandum is to underscore certain provisions of existing law that can help ensure that all communities and persons across this Nation live in a safe and healthful environment. Environmental and civil rights statutes provide many opportunities to address environmental hazards in minority communities and low-income communities. Application of these existing statutory provisions is an important part of this Administration's efforts to prevent those minority communities and low-income communities from being subject to disproportionately high and adverse environmental effects.

I am therefore today directing that all department and agency heads take appropriate and necessary steps to ensure that the following specific directives are implemented immediately:

In accordance with Title VI of the Civil Rights Act of 1964, each Federal agency shall ensure that all programs or activities receiving Federal financial assistance that affect human health or the environment do not directly, or through contractual or other arrangements, use criteria, methods, or practices that discriminate on the basis of race, color, or national origin

Each Federal agency shall analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. section 4321 et seq. Mitigation measures outlined or analyzed in an environmental assessment, environmental impact statement, or record of decision, wherever feasible, should address significant and adverse environmental effects of proposed Federal actions on minority communities and low-income communities.

Each Federal agency shall provide opportunities for community input in the NEPA process, including identifying potential effects and mitigation measures in consultation with affected communities and improving the accessibility of meetings, crucial documents, and notices.

The Environmental Protection Agency, when reviewing environmental effects of proposed action of other Federal agencies under section 309 of the Clean Air Act, 42 U.S.C. section 7609, shall ensure that the involved agency has fully analyzed environmental effects on minority communities and low-income communities, including human health, social, and economic effects.

Each Federal agency shall ensure that the public, including minority communities and low-income communities, has adequate access to public information relating to human health or environmental planning, regulations, and enforcement when required under the Freedom of Information Act, 5 U.S.C. section 552, the Sunshine Act, 5 U.S.C. section 552b, and the Emergency Planning and Community Right-to-Know Act, 42 U.S.C. section 11044.

* * *

This memorandum is intended only to improve the internal management of the Executive Branch and is not intended to, nor does it create, any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any person.

William J. Clinton

RESPONSES TO WRITTEN COMMENTS ON THE DRAFT EIR/EIS

COUNTY OF LAKE PUBLIC WORKS DEPARTMENT LETTER OF JUNE 9, 1994

1. Construction management practices would be applied during construction to reduce impacts to acceptable levels. Appropriate mitigation measures will be applied to the affected roads and best management practices should be employed to avoid or minimize impacts. LACOSAN would be responsible for direct verifiable damages to roads from construction of the project. LACOSAN intends to document the pre-construction condition of all roads used for project construction. Where very heavy equipment would be needed, avoidance of roads that would be potentially damaged would be the chosen approach, if possible. As part of the construction strategy, LACOSAN and its contractors will have responsibility for complying with these mitigation requirements.

2. There would be no permanent road closures or loss of access during pipeline construction and no loss of access to residences, businesses or schools for emergency vehicles and postal deliveries. It will be necessary to have some lane closures and to redirect traffic around construction areas for short periods, which could cause delays, but roads would remain open to through traffic. It is possible that open trenches may be present for a period of about two weeks at a given location. In most cases, this would not impair access for vehicles, as steel plates can be used to bridge the trench. Appropriate mitigation (Mitigation 5.2.11.4 in the EIR/EIS), requiring advance notification of residents and businesses, would minimize the effect of the impact.

3. This comment is noted by the lead agencies. On page 1-81 of the Draft EIR/EIS, it is indicated that various permits would be required from the County. The review by the Public Works Department, while not specifically identified, would come under requirements for compliance with Lake County permits.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD CENTRAL VALLEY REGION LETTER OF 23 JUNE 1994

1. Because of the size of the pipeline and the operating pressure conditions, solids would not pose problems for the flow through the pipeline. The treated effluent itself will have insignificant suspended solids. Also, because of the depth of the intake for the lake diversion and screening, it is not likely that significant solids will be drawn into the system (see following letter of Tom Smythe, Lake County Public Works Department, June 24, 1994). It is possible, therefore, that it may not be necessary to shut down the lake diversion during the algae bloom in Clear Lake. However, if experience indicates that algae were being drawn into the system in substantial amounts, the lake water diversion system could be adjusted to incorporate a shut down of the pumps, as indicated in the project description.

   The chief concern regarding solids has come from the geothermal operators in relation to injection operations. As the proposed injection of combined lake water and effluent has never been done before in The Geysers, there is no prior empirical data from which to establish a level of anticipated problems. The industry operators do not anticipate a problem with clogging of pipelines or injection wells because the injected water would not vary substantially in solids content from surface water (rainfall or stream diversions) which has been used for injection for many years without problems. Additionally, if algae were entrained in the flow, it is assumed that as a combustible organism, it would be destroyed in the high temperatures (400 to 500 degrees F) of the reservoir. In sum, no specific level of

solids content in the injection water has been identified as a threshold beyond which "problems" are anticipated. The industry operators intend to carry out continuous careful monitoring of injection and steam production. If problems were to develop, it is anticipated that these would become evident in the monitored well data.

2. Filtration may be included as a precautionary measure to minimize the potential for solids to enter the system and thereby reduce optimal injection and return in steam production. Additionally, the effects of long-term injection of effluent are not known. As noted in the Draft EIR/EIS, it is not possible to predict an effect (or threshold) of organics, suspended and dissolved solids. However, the impact on the reservoir itself is probably not significant because of the fractured nature of the rock. At worst, there might be some clogging of fine fractures, but the effect is speculative and probably would be attenuated over a lengthy period of time. Clogging might affect a porous-medium reservoir such as sandstone more than a fractured reservoir such as The Geysers because the former consists almost exclusively of compact spaces, whereas the latter contains larger, open fractures. (See also response to Comment No. 9 of the Sierra Club regarding diatoms.) The use of filtration and the monitoring of well and reservoir behavior are considered reasonable approaches to prevent a potential problem, if it were to occur.

   The definition of an "acceptable level" of solids deposition is perhaps best established in terms of the optimization of steam production. This, in turn, is based on the overall modes and methods of operation, specifically the schedule for delivery of water to specific injection wells. Much of the proposed injection operation would be based on the judgment of the steamfield operators. Therefore, the threshold of acceptable level of solids or dissolved solids will depend on the individual well (or array of wells) behavior and the point at which less than optimum steam production results. This could vary geographically or over time, and would be determined as monitoring data are developed.

3. The comment is acknowledged. In the Draft EIR/EIS, page 2-2, paragraph 1, sentence 4 is revised to read:

   > "In fulfilling its delegated responsibility for wastewater treatment plant permitting under the *Porter-Cologne Water Quality Control Act*, the California Regional Water Quality Control Board issued a Cease and Desist Order in 1991 to LACOSAN, citing treatment and disposal deficiencies."

4. See response to Comment No. 2, above. It is important to note, in addition, that the steamfield operators submit monthly injection reports to the California Division of Oil, Gas and Geothermal Resources (CDOGGR). The CDOGGR reviews the data on volume, temperature, chemical constituents and other data included in the report.

5. In the Draft EIR/EIS, page 2-119, paragraph 2 is revised, adding the following statement:

   > *"Application of sludge to the reclamation property will be governed by the waste discharge requirements in conjunction with the Federal regulations 40 CFR part 503."*

COUNTY OF LAKE PUBLIC WORKS DEPARTMENT - MEMORANDUM OF TOM SMYTHE TO G.R. SHAUL JUNE 24, 1994

1. This issue was analyzed in earlier engineering feasibility studies, which determined that it could be cost-prohibitive to deal with the algae at this point. While effluent filtration is not considered a necessity, solids are of potential concern to the operators. Therefore, filtration has been proposed as part of the project as a precautionary measure.

2. The corrections identified in the comment are acknowledged. In the Draft EIR/EIS text references to mean lake level should be revised in all noted references to *1322.5* msl.

3. The comment is acknowledged. In the Draft EIR/EIS page 1-11, paragraph 5, sentence 5 is revised to read:

   "The water would be *obtained* from the Yolo County Flood Control and Water Conservation District, which *has the water rights to use* the upper part of the lake. *LACOSAN would seek to purchase the adjudicated rights to use the water for the proposed project.*"

4. The recommendation is noted by the lead agencies. It is possible, as the commentor notes, that algae may prove to be no problem for the lake diversion because of the depth at which the water would be diverted. The proposed project assumes a "worst-case" approach, i.e., the assumption is that algae blooms may create a potential operational problem that is best avoided through pre- and post-algae bloom pumping of the lake water at higher than average rates and shut down of the diversion during about a month of the maximum anticipated algae bloom. It is possible that these operating modes may prove unnecessary. A water sample will be taken during the algae bloom period in August or September 1994 to determine the extent of algae in the water at the intake.

5. Mitigation Measure 5.2.3.1.I on page 1-34 of the Draft EIR/EIS indicates that the banks of the stream would be replanted with the same native species present on the undisturbed banks upstream and downstream from the disturbance.

6. In the Draft EIR/EIS, page 1-82, it is noted that encroachment permits (unspecified) will be required from Lake County. However, to ensure that the requirement is specified, as requested, in the Draft EIR/EIS, pages 1-30 and 5-30, Mitigation Measure 5.2.2.4.C is created:

   "*5.2.2.4.C. LACOSAN shall obtain an encroachment permit from Lake County Lakebed Management.*"

7. The comment is acknowledged. Mitigation Measure 5.2.2.5 on pages 1-30 and 5-30 of the Draft EIR/EIS is revised as follows:

   "*The project sponsors must obtain a permit from Lake County Environmental Health before any well is abandoned.*"

   Similarly, "*well closure permit*" is added to the list of Lake County permits identified in Table 1.7-1, on page 1-83 of the Draft EIR/EIS.

8. The project sponsors considered the alternative mitigation measures and have agreed to carry out Mitigation Measures 5.2.2.7.A and 5.2.2.7.B instead of Mitigation 5.2.2.7.C. In the event that Mitigation Measure 5.2.2.7.C were selected, the measure would be revised as suggested in the comment; on pages 1-32 and 5-34 of the Draft EIR/EIS, the mitigation is revised to read:

   "5.2.2.7.C Conduct annual sampling of well water for *any* well within 100 feet of the pipeline alignment, and provide contractual assurances to the well-owner of a guaranteed supply of potable water at the expense of the project sponsors in the event a leak in the pipeline is identified as the source of groundwater contamination."

   In addition to the above revised mitigation measure, a new mitigation measure is also identified as follows:

   "5.2.2.7.D To avoid hazards of contamination for future wells, the County should not issue a permit for any new well within 100 feet of the effluent pipeline."

9. ESA's geotechnical engineering consultant, Michael J. Dwyer, indicates that in most cases, drainage toward the outside of the road, as indicated in the comment, is appropriate. However, there are site specific situations wherein sloping of the road to drain toward the inside would be more appropriate. Outsloping on some steep slopes has the potential to increase erosion cutting into the road surface which is aggravated by runoff in the road and wear by passing vehicles. In such situations, it is recommended that the road surface drain inward and then be directed into a drainage pipe under the road which would discharge into surface drainage systems. This mitigation measure also conforms with recommendations of the BLM. Recommendations in the comment regarding provision of adequate cross-drainage, energy dissipation at natural drainage crossings, and use of culverts or half-pipe flumes on fills are appropriate measures.

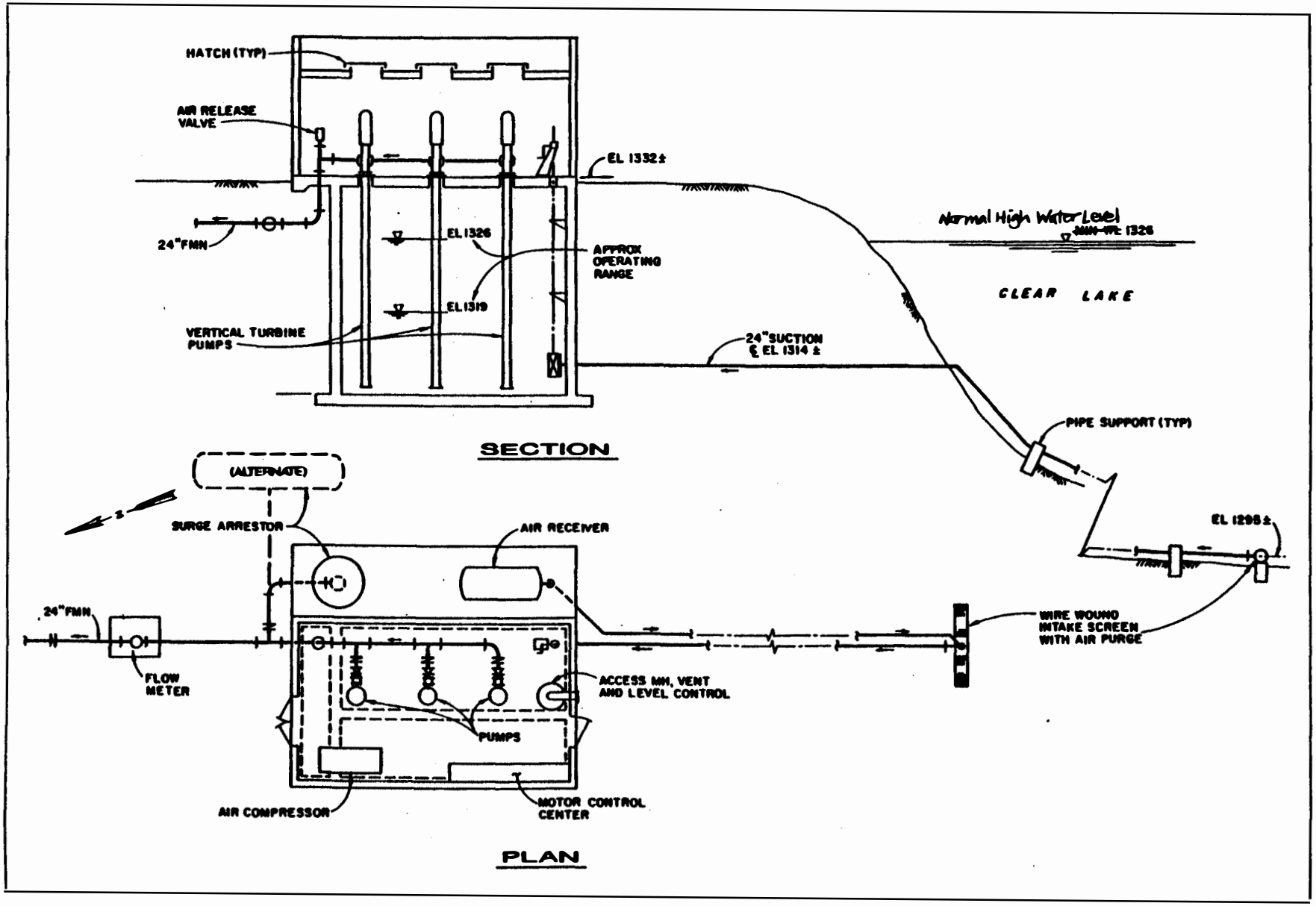
10. The comment is acknowledged. Figure 2.3.2-A on page 2-33 is revised to read: "*Normal high water level* 1,326 msl." The corrected figure is presented in this document.

11. The ability of the Lake Street Bridge to carry the pipeline with water is being analyzed in the final design engineering. This would be reviewed by the Lake County Public Works Department. The commentor is correct in noting that the pipeline would not hang below the bridge.

12. This comment is acknowledged and will be considered by the lead agencies. If this alternative is selected, in the final design, the pad for the pumps would be above the flood level.

13. This comment is noted and will be considered by the lead agencies in the final design.

14. In the final design, the project sponsors will consider utilizing "ball-joint" DIP for the lake water intake piping to reduce the need for underwater assembly and anchoring of the pipe and reduce local turbidity caused by construction.



SOURCE: Downie and Stowell Engineers

Figure 2.3.2-A
Lake Diversion Intake and Pump Station
Plan and Elevation

15. The comment is acknowledged. In the Draft EIR/EIS page 4-63, paragraph 1, sentence 4 is revised to read:

    "The cause and controls of the algae bloom are under investigation by the *University of California, Davis*."

16. The sentence referencing additional water quality information was a fragment from the earlier Draft EIR/EIS on the SERWTP Facilities Improvements Plan and has been deleted:

    "Additional information on water quality of Clear Lake is presented in Section 4.4.4."

17. The comment is acknowledged. In the Draft EIR/EIS, page 4-63, paragraph 2, sentence 5 is revised to read:

    "The contributing drainage area for the Lower Arm of Clear Lake is about *81* square miles."

18. This comment is acknowledged by the lead agencies.

19. The comment is acknowledged. In the Draft EIR/EIS page 4-63, paragraph 3, sentence 7 is revised to read:

    "The Rumsey Gauge established zero datum at elevation *1,318.65* feet above mean sea level *in reference to the 1929 NGVD. Resurvey by the U.S. Geological Survey in 1982 indicated that the revised datum equated zero Rumsey to 1,318.26 NGVD.*"

20. The text on page 4-70 of the Draft EIR/EIS only addressed "large" (i.e., wide) flood plains at the location that would be crossed by the pipeline or in which other project facilities would be located. In particular, the discussion was intended to identify floodplains with wide active channels. The comment is acknowledged and the information regarding designated floodplains for Burns Valley Creek, Miller Creek and Copsey Creek, as provided in the comment, is incorporated into the EIR/EIS to establish a specific record of FIRM designations.

    Coordination with the City of Clearlake and the Lake County Flood Control and Water Conservation District will be undertaken by the lead agencies in compliance with EO 11988. Compliance with this and other Executive Orders is identified in Section 9.2 of the Draft EIR/EIS.

COUNTY OF LAKE, LAKE COUNTY FLOOD CONTROL, MEMORANDUM OF SUE ARTERBURN TO G.R. SHAUL JUNE 30, 1994

1. As noted in the comment regarding limitations on pier length or depth, if this alternative design were to be chosen, it would be in conflict with the existing Lake County Code and would require an amendment to the code. Current plans do not envision use of a pier of this type.

2. The comment is acknowledged. In the Draft EIR/EIS, page 2-67, paragraph 1, new sentence, and on page 3-34, paragraph 1, new sentence should read:

   "*Screen size and intake flows are subject to review by the Lakebed Management staff and the California Department of Fish and Game. These final design features will be identified in the Lakebed Alteration Agreement.*"

3. The comment is acknowledged. In the Draft EIR.EIS, the following new mitigation measures are added to those on page 1-30 (impact summary table) and page 5-30:

   "*Mitigation 5.2.2.4.C. Construction specifications for the lake diversion intake and pipeline should require the contractor to comply with California Harbors and Navigation Code.*"

   "*Mitigation 5.2.2.4.D. Disturbed sediment at the excavation site in the lake for the lake diversion should be controlled by a siltation curtain if feasible.*"

   The use of a silt curtain at the depths required may partly help to minimize impacts. However, it is the opinion of the EIR/EIS preparers that temporary, significant, unavoidable impact likely will occur.

4. This comment regarding State Lands Commission mineral rights is acknowledged by the lead agencies.

5. No blasting in the lake is anticipated at this time, but if it is necessary, approvals would be obtained from the California Department of Fish and Game. However, in the event that it may be needed, the following text is added to the list of permits on page 1-82 of the Draft EIR/EIS:

   "*California Department of Fish and Game Blasting Permit in Clear Lake.*"

6. The comment is acknowledged. In the Draft EIR/EIS, page 9-5, paragraph 1, new sentence 2 is added:

   "*In addition, Lakebed Management would issue an administrative encroachment permit for the water intake structure.*"

7. The comment is acknowledged. In the Draft EIR/EIS, page 9-8, new section 9.2.9 should read:

   "*9.2.9 CLEAR LAKE SHORELINE ORDINANCE, LAKE COUNTY CODE CHAPTER 23, SECTION 23-4*

   Lake County Code Chapter 23, Section 23-4 requires an administrative encroachment permit from Lakebed Management."

FRIENDS OF COBB MOUNTAIN LETTER OF 5 JULY 1994

1. The referenced letter to Supervisor Mackey is included in Appendix B of this document. The project sponsors have undertaken careful consideration of the concerns of residents in the area with regard to induced seismicity and to the specific concerns raised by the Friends of Cobb Mountain in its letters of response to the Notice of Preparation/Notice of Intent. A brief summary of actions undertaken by the project sponsors in this regard is presented here.

   (a) Since construction of the first geothermal power plant in Lake County (1981), County staff have been aware of the issue of induced seismicity from geothermal injection and production. Since 1988, Lake County geothermal field permits have included conditions for seismic monitoring. The 1989 Lake County Geothermal Resource and Transmission Element Policy 43 codified the use of a monitoring network to analyze seismicity data and its relationship to resource extraction. The input of representatives of the Friends of Cobb Mountain and the Lake County Geothermal Advisory Board was received in developing this policy.

   (b) In 1991, Calpine Corporation first presented its ideas regarding injection in The Geysers. The participants acknowledged induced seismicity as a potential issue. Also in 1991, the County of Lake participated in the California Energy Commission Proceedings on the Geysers KGRA Generating Capacity and Steam Resources. Approximately $100,000 of County funds were provided to support the CEC proceedings. The funds were specifically targeted to characterizing the behavior of the geothermal reservoir.

   (c) At the time the Initial Study for the project was prepared, as well as the scope of work was issued for the present EIR/EIS, special emphasis was placed on the induced seismicity issue. Established and recognized expertise in evaluating seismicity was an important criterion for selection of the EIR/EIS contractor. A sizable portion of the effort and cost for preparing the EIR/EIS was given to analysis of this issue.

   (d) At the public scoping meeting for the EIR/EIS on 3/26/93, input regarding concerns of the Friends of Cobb Mountain with respect to induced seismicity and other concerns was received. Subsequently, at a public information workshop on 5/6/93, at the Guenoc Winery, information was presented about the proposed project, including issues of induced seismicity in the Southeast Geysers. Representatives of the Friends of Cobb Mountain were present, and their concerns were acknowledged by the project sponsors.

   (e) After work on the EIR/EIS was initiated, a coordination meeting on the induced seismicity issue was held on 6/21/93 that included the EIR/EIS seismic hazard analysts and geologists, representatives of the U.S. Geological Survey, representatives of LACOSAN and the industry partners. The meeting was focused on identifying meaningful approaches to the analysis using available monitoring data, limitations of the data, and identification of a strategy for further monitoring in the Southeast Geysers.

   (f) On 2/11/94, an interagency meeting was held at the U.S. Geological Survey in Menlo Park that focused on seismicity in The Geysers, ongoing and future monitoring programs, data requirements and uses, and other issues related to relationships between geothermal field operations and seismicity and microseismicity. The project sponsors, representatives of the

Friends of Cobb Mountain, and other parties involved with seismic monitoring attended this meeting.

In sum, the issue of induced seismicity has been the subject of considerable attention by the project sponsors, receiving both recognition as an issue of concern and effort in the attempts to address it in a meaningful manner.

2. This comment is noted and will be considered by the lead agencies. The EIR/EIS has attempted to make maximum use of available data on which to base the conclusions. The EIR/EIS authors of the induced seismicity analysis are aware of the data referred to in the comment and have considered the long term history of seismicity in The Geysers.

3. The commentor takes issue with the sixth sentence, first paragraph on page 5-129 of the Draft EIR/EIS. This sentence is revised as follows:

> "However, the frequency of earthquakes between M 3.0 and 4.2 is relatively small and assuredly many of these events are attributable to natural, regional *tectonic stress*."

The above text revision recognizes the accepted idea that some earthquakes are induced by injection of geothermal fluid. This revision also acknowledges that there has always been significant natural seismic activity in the region of The Geysers, even before injection began and continuing to the present, as a result of the regional stress field. However, there is no clear evidence that either the maximum magnitude of earthquakes at The Geysers is increasing, or that those earthquakes of maximum magnitude (e.g., greater than or equal to M 4) are the result of injection. The evidence does show that the number of small and very small magnitude earthquakes has increased since the onset of steam production and water injection activities in the 1960's, probably because of geothermal injection and production operations. Most of these are below the threshold at which they are felt by people, and almost all are below any threshold of causing damage.

Approximately 9,100 events of a magnitude greater than 1.4 have occurred in The Geysers field since 1975 (see Figure 4.5, Appendix B, Volume 2 of the Draft EIR/EIS). The majority of these events have been located outside the Southeast Geysers project area. During this same approximate period, about 200 events (of all magnitudes) have been located within the project area of the Southeast Geysers. Four events of magnitude greater than 3.0 have been located within the project area of the Southeast Geysers since 1975 (see Figure 4.4, Appendix B, Volume 2 of the Draft EIR/EIS). Within the wider Geysers region, the U.S. Geological Survey seismologists believe that some earthquakes of magnitude 3.0 or greater are tectonic in origin and unrelated to operations at The Geysers. The historical data indicate that some of the microearthquakes are locally triggered by injection, but the larger events (magnitude of 2.0 or greater) show little, if any, correlation to injection (personal communication of Mitchel Stark). Similar behavior has also been observed in the Lardarello steam field by Batini et al. (1985).

As the above data illustrate and as noted in the Draft EIR/EIS, there appears to be a need to distinguish the seismicity conditions of the Southeast Geysers project area from those of the larger geothermal field. Data from injection in the wider Geysers field indicate that microseismicity effects are limited to about a 2,000-foot radius from the wells. Therefore,

there is no basis in geophysics for concluding that induced microseismicity in the Southeast Geysers would result in a larger pattern of increased regional seismicity.

4. The commentor has suggested that the statistical analysis of earthquake probability is somehow invalid. The use of statistical and probabilistic analyses is one of the foundations of risk assessment. Such analyses of earthquake location, frequency and magnitude are among the most basic and frequently used methods of the U.S. Geological Survey for the assessment of location, size and probability of future earthquakes. Computer modeling using statistical analysis is used both to model past earthquakes and predict future ones. It is perhaps worth noting that such statistical analyses by the U.S. Geological Survey indicate that the number of large earthquakes (magnitude 5 and greater) has been increasing throughout California in recent decades ("Quake Rate Soaring Since 1980", San Francisco Chronicle, 1/23/94), causing the Survey to issue a recent reassessment of the likelihood of major earthquakes in Northern California in the near future.

5. The questions of responsibility for damages is a legal question beyond the scope of the EIR/EIS. The comments (11 specific questions) are based on the assumption that a significant impact of geothermal operations in the Southeast Geysers would have wide impact on property. The finding presented in this EIR/EIS is that significant impacts would not occur, and, therefore, CEQA/NEPA do not require mitigation. The Draft EIR/EIS presents the probable worst case prediction: it shows, at worst, potential for minor damage to poorly built or deteriorated structures. Setting aside the issue of responsibility for maintenance of structures in a deteriorated condition, the difficulty in establishing a legal responsibility of the project sponsors to damage of property is that there is no clear link between geothermal operations and an individual earthquake of a size sufficient to produce property damage. Most earthquakes are natural events, and the larger events that cause major damage to property are related to large-scale tectonic processes affecting the Pacific coastal region. Recent research even indicates that seismicity at The Geysers can be influenced by large earthquakes as distant as the Gulf of Alaska (EOS, April 20, 1993, Abstract T528B-2).

   In the case of an individual property damage claim against the project sponsors, it would be necessary to establish that an individual action or series of actions by geothermal injection and steam production in the Southeast Geysers project area was the proximate cause of the property damage. As noted above and in the Draft EIR/EIS, existing data do not establish a linkage between geothermal operations and individual earthquakes of a size sufficient to produce property damage. It is recognized, however, that by making data on seismicity available to the concerned residents of the area, they can assemble information that may be useful for mitigation planning on their own part, or, in the event that future data would reveal a linkage between Geysers operations and damaging earthquakes, devise appropriate responses, which might include individuals pursuing legal remedies.

6. The comment is noted and will be considered by the lead agencies. In earlier periods (e.g., 1986) the volume of condensate water injected into the geothermal field was approximately that proposed for the project (about 10 to 15 percent less), and was not accompanied by significant increases in seismicity. As noted by the California Energy Commission (1991, Geysers KGRA Generating and Steam Resources Committee Report), "optimum location and rates for injection must be determined through trial and error and may change over time." This does not suggest license to carry out irresponsible operations that could result in damaging earthquakes - which could be damaging to the industry's facilities in The Geysers and property of residents. What it does suggest, however, is that ongoing monitoring (as

proposed as part of the project) will be a critical element of future injection operations and will be useful in early identification of any future adverse activity and, thereby, allow the establishment of a strategy to minimize any adverse effects. The BLM and California Department of Conservation, Division of Oil, Gas and Geothermal Resources have ultimate responsibility for proper and effective reservoir management and have oversight authority for compliance with their requirements.

7. The project sponsors have agreed to participate in a meeting with the Friends of Cobb Mountain. The County intends to address the need for ongoing monitoring of project area reservoir activities. The approach to this will be developed in the Monitoring and Mitigation Plan. The objective will be regular public distribution and review of seismic activity and injection data to identify changes in reservoir behavior that may be related to project activities.

CALTRANS LETTER OF JULY 11, 1994

1. The comment is noted by LACOSAN.

2. The comment is noted by LACOSAN.

3. This comment is noted by LACOSAN. Final engineering design will be undertaken if the project is approved by the LACOSAN Board of Directors and the BLM. It is understood that, if longitudinal encroachment in Caltrans right-of-way is needed, the alternatives analysis must include a financial analysis, cross-sections for each longitudinal encroachment location, and reasons why placement within the Caltrans right-of-way would not be reasonably avoidable.

BRUCE ARNDT LETTER OF JULY 11, 1994

1. This comment is noted and will be considered by the lead agency. The Planning Commission and the Board of Supervisors (LACOSAN Board of Directors) are the decision makers who consider the public's input in this process.

STATE WATER RESOURCES CONTROL BOARD LETTER OF JULY 12, 1994

1. The comment is noted by the lead agencies.

2. The comment is noted by the lead agencies. Upon certification of the final EIR/EIS, mitigation measures will be recommended by the Planning Commission to the LACOSAN Board of Directors. In permitting the project, the LACOSAN Board of Directors will specify required mitigation. Details of the mitigation program included in the Monitoring and Mitigation Plan adopted by LACOSAN will be presented at the EIR/EIS certification hearing.

3. As is required by law, excavated soil containing asbestos, such as serpentine, should be tested to determine the relative amount of asbestos content. If tests reveal concentrations of one percent or greater, the California Environmental Protection Agency Department of Toxic

Substances Control may require disposal in a Class 1 hazardous waste facility or other facility designated for accepting asbestos waste. The Department possibly could grant a variance if it is determined that there is no threat to public health by other methods of use or disposal.

4. The I/I (infiltration and inflow) reduction is part of the normal operations at the SERWTP facility, and has been analyzed in the Improvement Facilities Plan Engineering Report 1994 Update, prepared by Eco:Logic Engineers. This analysis was required for the SWRCB revolving loan. A program of inspection and rehabilitation has already been initiated by LACOSAN. A detailed investigation of I/I sources and control methods was completed for the Southeast Regional /System in January 1994. A cost benefit analysis was completed as part of that study. Potential savings in project costs to expand the SERWTP that might result from system I/I reduction were developed and compared with system rehabilitation costs to effect that I/I reduction. It was concluded that costs to reduce I/I in the system by a significant amount exceed the benefits of the reduction in overall project costs. However, the recommendation was made to use manhole grout sealing in specific areas and flood-proofing of system components subject to inflow from high levels in Clear Lake as a desirable component of a regular District maintenance program. A reduction in sewage flows of 1.0 - 2.0 million gallons per day (mgd) appears to be attainable by identification and correction of major inflow sources subject to lake flooding. The current District pipeline maintenance program is expected to achieve this objective over several years. LACOSAN intends to continue its program of I/I reduction as part of the ongoing and long term maintenance activities at the SERWTP and collection system. The goal of this program is to reduce I/I by 25 to 30 percent by the year 2000.

   In addition, LACOSAN will implement water conservation programs which are consistent with existing local water conservation ordinances and the State Water Resources Control Board. Both the County of Lake and the City of Clearlake have adopted water conservation ordinances. Provisions of these ordinances apply to new connections only and require new single family houses to install water-saving shower heads, water-saving aerators on kitchen sinks and lavatories, water-saving toilets, and pressure reducing valves, when appropriate, to maintain 60 pounds per square inch (psi) or less in the system.

5. The comment is acknowledged by the lead agencies. Through its Memorandum of Understanding, it is understood by the lead agencies that studies will be required to provide additional information for Section 106 compliance. LACOSAN is working with the SWRCB in developing the details of a mitigation plan and monitoring program.

6. The comment is acknowledged by the lead agencies.

RESOURCES AGENCY OF CALIFORNIA, DEPARTMENT OF CONSERVATION, OFFICE OF GOVERNMENTAL AND ENVIRONMENTAL RELATIONS, LETTER OF JULY 7, 1994

1. The comment is acknowledged. All references cited as The California Division of Oil and Gas and Geothermal Resources (CDOG&GR) in the Draft EIR/EIS should be understood to refer to the corrected title of California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR).

2. The comment is acknowledged. In the Draft EIR/EIS, pages 1-30 and 5-30, Mitigation 5.2.2.5, the text is revised to read:

> "The project sponsors shall comply with all requirements of the *Lake County Department of Environmental Health* for *irrigation/domestic well* closure. An inspector *from this agency* shall certify that the well has been properly sealed and capped."

3. The comment is acknowledged. In the Draft EIR/EIS, page 1-83, Table 1.7-1 is revised to read:

Action Requiring Permit/Consultation	Agency	Permit or Approval	Statutory Authority
Fluid Injection	California Division of Oil, Gas & Geothermal Resources	*Project Approval*	CA Code Title 14, Division 2
Injection Well Drilling	"	*Geothermal Drilling Permit, Permit to Rework*	"

4. Please see the response to Comment No. 3 of this letter, above.

5. In the Draft EIR/EIS, page 2-105, paragraph 3, sentence 2 is revised to read:

> "There have been 25 years of augmented injection in The Geysers, *and of the 40 approved injection wells, an average of 29 wells are in operation each month.*"

6. The comment is acknowledged by the lead agencies. It is understood that DOGGR and BLM will require the industry partners to periodically demonstrate the mechanical integrity of the wells.

7. The comment is acknowledged. In the Draft EIR/EIS, page 4-71, paragraph 1, sentence 1 and new sentence 2 are revised to read:

> "Groundwater resources in the Southeast Geysers are regulated by the *BLM* and the County of Lake and the County of Sonoma. *DOGGR is mandated to prevent damage to underground and surface waters suitable for irrigation or domestic purposes by reason of the drilling, operation, maintenance, and abandonment of geothermal resource wells.*"

8. The Lake County Air Quality Management District reports that few wells have been drilled in recent years and sumpless drilling was used in most cases. Permits to conduct sumpless drilling are issued by the County Planning Department with the review of the State Water Resources Control Board.

9. In response to the suggested text edits, in the Draft EIR/EIS page 5-140, paragraph 5, sentence 4 the text deletions are acceptable and the text is revised to read:

> "*Besides the biennial tests, a Division inspector will make periodic visits to the well site.*"

SIERRA CLUB - REDWOOD CHAPTER LETTER OF JULY 4, 1994

1. It has been widely recognized for some time that the geothermal steam resources at The Geysers are being depleted much faster than originally anticipated. Reviewers are directed to the report by the California Energy Commission (1991) Geysers KGRA Generating and Steam Resources Committee Report. The information in the Draft EIR/EIS does not conflict with the findings of the Commission. The Geysers reservoir is essentially a closed system, and the decline in steam pressure is caused by overdrawing of the resource at a rate in excess of recharge. The California Energy Commission (CEC) report indicates that "The Geysers resource has been seriously over built by numerous competing interests". The report goes on to note that "policy makers should remember that generation from The Geysers has been a major source of economic, clean electricity for over 30 years, having saved California the equivalent of almost 200 million barrels of oil. With proper management, The Geysers will continue to provide a significant amount of generation as well as environmental and other benefits for decades to come. Moreover, proper management will further the state's long-standing policies, recently reaffirmed by the CEC's draft Biennial Report, supporting development of the geothermal resources and efficient utilization of existing resources."

   In the above referenced CEC document, the Interim Coordinated Resources Management Plan is described. As set forth in the Management Plan, Element 2 contains the recommendation of water injection to support the reservoir pressure. Treated wastewater from Lake County is specifically identified as a potential, dependable source of water to meet this goal.

   The Sierra Club Depletion and Geology Discourse provided with the comment letter is included in this response to comments document.

2. Impacts to the aquatic environment are discussed in the Draft EIR/EIS in Section 5.2.1, Geology, Seismicity and Soils, specifically with regard to erosion of stream banks and stream channels, in Section 5.2.2 Hydrology and Water Quality, with respect to effects on water quality of construction at all stream crossings and within Clear Lake, and in Section 5.2.3, Biological Resources with respect to habitats and species in riparian zones, wetlands, Clear Lake, and water bodies containing species of concern.

   All known cumulative projects within the study area have been identified in the Draft EIR/EIS and are indicated in Table 7.4.1-1 and Table 7.4.2-1. As indicated in these tables, by far most of these projects are residential subdivisions and commercial property developments. Only one of the projects, Park Place in Clearlake is classified as industrial. Except for the residential project at Cobb and four residential and two commercial projects in Middletown, all of the projects are within the drainage of Clear Lake. These projects, taken cumulatively may significantly affect aquatic habitat through the increase in silt loads, which is especially of concern in Clear Lake, and the addition of nutrients and urban pollutants entrained in runoff. The frequent blooms of blue-green algae in Clear Lake are attributed to silt loading and phosphorus inflow because of development in this watershed since the late 1930's. This information is presented in the detailed report "The Causes and Control of Algal Blooms in Clear Lake, by Peter J. Richerson, Thomas H. Suchanek, Stephen J. Why and the University of California - Davis, Division of Environmental Studies and Institute of Ecology, 1994".

The control strategy for the Clear Lake water quality problem contributing to algae blooms is effective control of creek channel erosion, and use of best management practices in construction of roads, cuts and fills and other sources of erosion is one of the recommended strategies for control of aquatic habitat degradation in water courses and Clear Lake. Permits for cumulative development projects contain or will contain conditions specifically directed to minimizing direct and indirect impacts on the aquatic environment through best management practices. Additionally, any project over 5 acres must obtain a National Pollutant Discharge Elimination Permit for Stormwater Runoff, which must be supported by detailed mitigation to effectively reduce untreated runoff into surface waters. The current EIR/EIS contains these requirements as well. The project itself will result in a combined total of about 0.28 acre of aquatic habitat impact. These would all be temporary impacts, as all stream and lake bed crossings would be buried, and recovered with native streambed and lakebed materials. Of the total 0.28 acres, 0.1 acre is disturbance related to the placement of the lake diversion intake and pipeline (noted in the EIR/EIS as a significant, although temporary impact on the Clear Lake aquatic environment), and a combined 750 square feet of stream environment would be located in intermittent and ephemeral streams that drain into the Clear Lake Outlet Channel. Given these figures, and assuming the mitigation included in this EIR/EIS, the contribution of the project to the cumulative impact on aquatic habitat in Clear Lake is considered insignificant.

Almost all pipeline crossings are in intermittent or ephemeral streams, and construction likely would occur when they are dry, minimizing any impact on seasonal aquatic habitat. The perennial streams with aquatic environments (Copsey Creek, Harbin Creek, Big Canyon Creek and Putah Creek) are also subject to extreme variations in flow, and in the dry summer period are reduced to small channels with flows of an inch or two at most. The location of the pipeline crossing in each of these streams is an area in which the streams have very coarse substrate of cobbles and gravel, with little aquatic vegetation and no habitat deemed suitable for fish. Some of these areas do support amphibians, as noted in the EIR/EIS. Because of the small summertime flows that can be diverted, minimal disturbance to downstream aquatic habitat is anticipated. The natural substrate materials would be replaced as cover for the buried pipeline. The EIR/EIS addresses appropriate additional mitigation measures for construction in those water courses as well as in tributary intermittent streams. The principal concern with regard to stream course ecosystem impacts is related to the Geysers Effluent Pipeline Project construction in Sweet Springs Creek and an unnamed tributary of Big Canyon Creek south of Childers Peak. The EIR/EIS addresses impacts in these watercourses, and appropriate mitigation in detail. There are no other cumulative development projects in either of those watersheds.

The six projects on the cumulative list located in Middletown are all located well downstream of the Geysers Effluent Pipeline crossing of Putah Creek. One Middletown project is already under construction and would be completed before the Geysers Pipeline would be constructed. The five remaining projects, if constructed, have the potential to have cumulative impacts of construction on aquatic ecosystems, primarily effects of silt loading. As noted above, the project impacts would be minimal in the Putah Creek watershed, assuming all mitigation identified in the EIR/EIS is applied. Expansion of the Middletown Treatment Plant is not proposed and there is no moratorium on development in that area. Therefore, the Geysers Effluent Pipeline Project would have no growth inducing impact in that portion of the county.

There are no cumulative projects identified for the Big Sulphur Creek watershed. Impacts of the Unocal pipeline are addressed in the EIR/EIS.

The project, by increasing the amount of geothermal steamfield use above existing levels and extending the life of operations in the Southeast Geysers, would contribute to the long-term cumulative risk of accidental spills and releases of hazardous substances into the watercourses of The Geysers. The likelihood of additional accidental spills is speculative. Were spills of effluent or condensate to occur in the future, they could adversely and significantly affect aquatic life in the watercourses, possibly including fish kills in some streams. In the past, geothermal operators have been required to carry out extensive stream remediation efforts in addition to paying fines for accidental spills.

Lake County requires aquatic monitoring in The Geysers. The Aquatic Resources Monitoring (ARM) program, which includes monitoring of a variety of aquatic parameters is oriented to identifying aquatic resource conditions.

3. The project does not include any discharge of wastewater to water sources. The nature of the geothermal reservoir, as described in Section 4.4.1.4 of the Draft EIR/EIS, indicates that the deep injection area of the Southeast Geysers is isolated from the groundwater system of the area. Wastewater injected into the reservoir would not become a groundwater resource.

   The various alternatives for disposal of the SERWTP wastewater were analyzed in detail and are summarized in Section 3.2 of the Draft EIR/EIS. The stand-alone alternative of disposal into Cache Creek was the subject of considerable investigation and determined to be less feasible than disposal at The Geysers. It was found that this disposal method, besides requiring advanced treatment levels, would result in several years of delay in order to conduct impact studies likely costing over one million dollars. Because of the prior threat of litigation by Yolo County, there was no guarantee that a permit could be received for this disposal method. For this reason, the proposed Cache Creek disposal alternative was dropped. Land irrigation was found to cost more because of higher land value for other forms of development. Also, reservoir sites needed for this alternative were constrained by geologic instability problems. The proposed project (Geysers disposal) was determined to be the only alternative that provided sustainability for continuous disposal of effluent, as well as sustainability for the geothermal operations. Finally, funding would not be made available from public or private sources if the project were not cost effective.

   LACOSAN is required to meet all regulatory requirements for wastewater discharge established by the Central Valley Regional Water Quality Control Board (CVRWQCB). The current and proposed level of treatment is secondary, which is the current level required by the CVRWQCB. LACOSAN independently investigated the feasibility of tertiary treatment. Continued pursuit of this approach would have resulted in substantial delays created by the need for detailed investigations, and, therefore, in resolving the problem and lifting the Cease and Desist Order. The likelihood of this delay is confirmed by the experience of the Clear Lake Oaks County Water District, which investigated effluent discharge into a tributary of Cache Creek, and was unsuccessful in obtaining a permit from the CVRWQCB. Preliminary investigations by LACOSAN of advanced treatment systems (tertiary) indicated that a problem of induced algae growth in the Clear Lake Outlet Channel (CLOC) was possible. The use of extremely costly reverse osmosis systems appeared prohibitive. Even with tertiary treatment, a potential consideration for disposal alternative into the CLOC or Cache Creek was constrained by current state policy and county ordinance prohibiting a discharge

into the lake and the possibility that downstream users in Yolo County would not find the disposal method acceptable. Under the proposed project, as there is no proposed discharge into waters that would be used as resources for other beneficial uses, there is no inherent reason or requirement to treat the water to a tertiary level.

4. This project would not discharge wastewater into Big Sulphur Creek or any other creek. To the contrary, the project, if implemented, would solve the problem of occasional overflows into Burns Valley Creek and ultimate discharge into Clear Lake.

   If the pipeline were significantly damaged by earthquake or landslide, effluent could leak into the creeks in the project area. The watersheds are described in the EIR/EIS, and it may be assumed that a break of the pipeline would follow the general course of flow in those watersheds. A map of the drainage systems which the pipeline would cross is included in Appendix A of this document. The flow from a broken or leaking pipeline would not necessarily run directly into watercourses, as it may run in streets in developed areas or over land in rural areas. Neither would the entire pipeline drain at one location because of the topographic configuration, the placement of isolation valves, and the flow control system. The analysis of pipe drain flow from any and all points along a pipeline of this length is essentially impossible to assess because an almost infinite combination of possibilities exist, taking into account the size and location of the rupture, slope inclination, pressure conditions and head, response time, lag time for shutting off pumps and other factors. It is not in the experience of the EIR/EIS preparers that such an analysis has ever been required for a wastewater pipeline. The EIR/EIS attempted to illustrate the impact using a simple worst-case rupture and drain down.

   It is possible that the drain down following a rupture of the pipeline would discharge some toxins, metals and salts, such as those identified in the comment. However, these would be in highly diluted concentrations because of the wastewater itself and the very large dilution from the raw lake water diversion. A drain down likely would require some clean-up, primarily because of the mud deposition created by a break. Such a failure would be an extremely rare event, and could lead to some changes in the design in the affected area to avoid another similar rupture. However, the low risk of pipeline rupture does not justify the cost of treating the effluent to tertiary levels. There is no precedent in California of tertiary treatment being a requirement because of the risk of rupture of the pipeline. LACOSAN is developing response plans, operational practices, and inspection procedures to follow in the possible, although unlikely, event of a catastrophic failure of the pipeline to prevent this from occurring.

5. The "runoff potential" (drain down of a ruptured tank) from the Childers Peak Regulating Tank and the Y-Pad Tank would both vary according to the amount of water in the tank at the time. The volume of water will vary depending on operations of the pumps. As a worst case, the entire contents of the tanks might drain in a catastrophic failure. In both cases, some, if not most, of the flow would discharge through the pipeline. For Childers Peak tank the flow would be toward the Middletown WTP in the pipe. For the Y-Pad tank, the flow would be to the distribution lines. Water draining from a leak in the Childers Peak tank would drain into the unnamed tributary of Big Canyon Creek and eventually into Putah Creek. Water draining from a leak in the Y-Pad tank probably would flow into unnamed watercourses that drain into Big Sulphur Creek.

   See the response to Comment No. 4 regarding pipeline rupture.

An investigation of the location of mines and mining prospects was undertaken for an area of several miles on either side of the pipeline corridor. Mining claims were also identified from existing databases. An interpretation of aerial photographs also was carried out. The findings of this investigation indicate that there are no mines or mine tailings observed within or near the pipeline corridor. This is further supported by field investigations undertaken by the study team in preparing the EIR/EIS. The closest mercury mines to the pipeline are one-half mile or more distant. These are located north of the Bear Canyon power plant. The most significant of these are the Big Injun, Big Chief, and Thorn mines. None have been actively mined for decades and all were relatively small procedures.

The U.S. Geological Survey (USGS) topographic quadrangles, and special California Division of Mines and Geology geologic studies of the Lower Lake Quadrangle (e.g., James Brice, 1953) were used as the information base for the maps in the Draft EIR/EIS. These USGS topographic quadrangles are the best available maps that cover the entire project area.

6. The removal of water from its watershed of origin is supported by existing California law. The California Legislature in 1980 declared that the facilitation of voluntary water transfers is state policy (Water Code, Sections 109, 475 and 480). In 1992, Governor Wilson signed into law AB2897, Chapter 481 of the Statues of 1992, which allows water suppliers to transfer water out of their service area without making a finding that the water is surplus to their needs provided that it is a beneficial use of the water. The same bill also limits the transfer of water from a water supplier to 20 percent of the supplier's water supplies for the year of the transfer, unless the supplier holds a public hearing. Out of basin water transfers have further been encouraged through the State Water Bank program, founded in 1991. Yolo County has participated in the Water Bank Program through water transfers out of the county (approved by the Board of Supervisors through a Memorandum of Understanding and contract with a large water user), and, for example, in 1992, sold over 41,000 acre-feet of water to the Program (State of California, The Resources Agency, Department of Water Resources, 1993, Draft Program Environmental Impact Report State Drought Water Bank). Additionally, water marketing has been the subject of a number of bills considered by the Legislature in recent years, and the concept appears to be gaining widespread support among water users, water suppliers, holders of water rights, and state and federal agencies.

7. The commentor's suggested relationships between seismicity and pressure are theoretical at best. That such a relationship exists in the Southeast Geysers is not supported by data. As the data in the EIR/EIS indicate, there is a well defined low pressure area in the Southeast Geysers, while the occurrence of seismic events is low compared to other parts of The Geysers. The relationships between fluid injection, steam production, and seismicity are not well understood at present. If a relationship between low pressure and seismicity does exist, then, conceptually, the project would reduce the occurrence of seismic events, because it would result in increased pressure in the field.

   There is no "critical level" of microearthquakes at which the project would be halted. A finding of the EIR/EIS is that induced microseismicity is not likely to have a significant impact. See also response to comments of the Friends of Cobb Mountain.

8. Typical conditions of the Lake Couty Geothermal Use Permit and those of Sonoma County do not allow water diversion for project facilities until appropriate permits are acquired from the Department of Water Resources, Division of Water Rights (DWR). There are no

diversions for the project in Lake County that require a permit from DWR. There is no diversion proposed for the project in Sonoma County.

9. Diatoms are microscopic organisms which secrete a shell (or "test") composed of opaline silica. Silica is any substance made only of silicon and oxygen atoms bound together. The general chemical formula is SiO_2 (silicon dioxide), because overall there are two oxygen atoms for each silicon atom. The most common form is the crystalline mineral quartz. In a crystalline mineral, the different constituent atoms are positioned in a regularly repeating 3-dimensional array. Amorphous silica is a non-crystalline form in which there is no regular structure; common window glass is an example of an amorphous mixture of silica and minor amounts of other elements. Opaline silica is an amorphous combination of silica with water, written as $SiO_2 \cdot nH_2O$, where "n" indicates the number of water molecules per SiO_2 unit. The value of "n" varies among different examples, up to about 0.1 (10% water).

   The solubility of diatoms in heated water has not been reported in the publicly available literature known to the EIR/EIS authors. However, diatom solubility is likely to be close to that of pure amorphous silica, which is well-known, and which exceeds the solubilities of all the crystalline forms of silica (quartz and several other less common minerals). Amorphous silica solubility increases with temperature in roughly linear fashion, from about 100 milligrams of SiO_2 per kilogram of water at 63°F, to 360 mg/kg at 212°F, to 1,200 mg/kg at 460°F (240°C), the approximate temperature of The Geysers steam reservoir. In contrast, the solubility of quartz is less than 10 mg/kg at 63°F, 50 mg/kg at 212°F, and 440 mg/kg at 460°F (240°C).

   The potential effect of injecting diatoms into the reservoir can be evaluated in the context of "Effects on Permeability," which starts on p. 5-108 of the Draft EIR/EIS. This includes a description of calculations done by Crecraft and Koenig ("Geochemical consequences of treated wastewater injection at The Geysers, USA geothermal field", Geothermics, Vol. 18, No. 1/2, pp. 65-72, 1989), to predict the chemical reactions caused by heating injection water to 240°C. If extended to consider the present question, this model would show that 1,200 mg/kg of SiO_2 in diatom tests will dissolve as the water is heated to 240°C, but any SiO_2 dissolved in excess of 440 mg/kg will re-deposit as quartz. That is, if diatoms are present in the injected water at less than about 440 mg/kg, some quartz will still dissolve, and there still will occur a net increase of porosity. If diatoms are present in the injected water at more than about 400 mg/kg, quartz will form from dissolved diatoms, and there will occur a net decrease of porosity.

   As noted on p. 5-111 of the Draft EIR/EIS, the Crecraft and Koenig (1989) calculation is a simple equilibrium heating model which does not consider chemical disequilibria, flow rates, heating rates, reaction rates and boiling. For example, amorphous silica tends to dissolve much more quickly than quartz will deposit, so there is the potential that dissolved diatoms will form a solution which is to some degree super-saturated with quartz. Additionally, the formation of quartz from dissolved diatoms would not be expected to occur because of kinetic factors in the reservoir, such as heat.

   Crecraft and Koenig (1989) also presented a conceptual model of injection, which is described starting on p. 5-111 and on Figure 5.3.1-C of the Draft EIR/EIS. Even though the mechanisms in this model are too complex and uncertain to allow any meaningful calculation

of the net quantitative effect of diatoms on reservoir injectivity or permeability, the following points are noted.

> (1) Low to moderate concentrations of diatoms should have no effect on the injection wellbore. (2) The zone of carbonate precipitation and quartz dissolution or precipitation (depending upon diatom concentration) will still tend to migrate outward from the injection well over time, decreasing the likelihood of an effect. (3) At the interface of the water plume and reservoir steam, the presence of an intermediate zone of quartz dissolution, or the presence of quartz deposition, will depend upon the initial diatom concentration. (4) At the outer zone of complete evaporation and deposition of all solutes, all of the silica contributed by diatoms will deposit. Some of this may re-dissolve later if the concentrations of silica in the injected water swings from high to low.

It is known that diatoms are present in Clear Lake water, with abundance varying seasonally and in different parts of the Lake (Bradbury, J.P., 1988, "Diatom biostratigraphy and the paleolimnology of Clear Lake, Lake County, California", *in* Late Quaternary Climate, Tectonism, and Sedimentation in Clear Lake, Northern California Coast Ranges, U.S. Geological Survey Special Paper 214, J.D. Sims, Ed., pp. 97-130). The concentration of diatoms per unit volume or mass of water apparently has not been measured. However, considering that the diameter of a diatom test is on the order of 10 microns, and with the conservation assumption that each diatom is a solid sphere of opal with a radius of 10 microns, the population of diatoms required to yield a silica concentration of 440 mg/kg (the concentration of reference for dissolution or formation of quartz in the reservoir) would have to be about 5 billion per liter. A consistent, widespread population of this density seems very unlikely.

If the diatom concentration consistently greatly exceeds 500-600 mg/kg, then there is some precedence in geothermal experience to say that it <u>may</u> effect injection well performance. This is because at some geothermal installations the injection well performance has been found to decrease when injected water contains elevated silica. However, in these cases the silica is already dissolved <u>before</u> entering the injection well, so it tends to deposit in or very close to the well. Such deposits are treated by mechanical clean-outs of the injection wells, by re-drilling, and/or by using acid treatments to dissolve the silica which has formed. The Southeast Geysers project EIR/EIS case is different, however, because the diatoms would only dissolve <u>after</u> entering the formation, at some distance from the well, and silica deposition would only happen also at some distance. Considering this, the conclusion is that an effect is not likely to occur. If an effect were to occur, any approach to treatment would be experimental.

With respect to some particular aspects of the Sierra Club comments, we note in addition the following.

In Comment 23, the reference to "analyses of water besides diatoms . . . Page 1-10" is unclear, since analyses are not discussed on that page. This comment also asks about injection of diatoms into compact mineral spaces. As noted above, heated diatoms are likely to dissolve. In the cold part of the injection plume, undissolved diatoms could perhaps clog fine fractures and rock pores, but the extent of this effect is speculative. Clogging would presumably affect a porous-medium reservoir such as a sandstone more than a fractured

reservoir such as is present at The Geysers, since the former consists almost exclusively of compact spaces, whereas the latter contains larger, open fractures.

Comment 95 asks about conclusions concerning significance in the next to last paragraph on p. 5-114. It is hoped that the discussion above clarifies the EIR/EIS conclusion regarding diatoms that "An evaluation probably would be highly speculative and difficult to rank...." Regarding biological growth downhole fed by effluent organics and nutrients, there are no data. The EIR/EIS authors are not aware of any experience in the geothermal industry which suggests that this has happened at injection wells elsewhere, but the typical injection well is fed hot water, not cold, and the typical injection water is saline, but lacks the nitrogen and phosphorous nutrients which may be present in the Clear Lake injectate.

10. The criteria for selecting the injection points were largely determined by the industry partners to obtain the maximum recovery of geothermal energy from the reservoir. In order to make the project a worthwhile investment, the industry wants to generate the greatest amount of steam as a result of injected fluids. Studies determined that the maximum amount of steam would be produced if the wastewater is injected in the proposed wells and at the rates indicated in the EIR/EIS. The project proposes using only existing wells, although some would be converted from production to injection wells. Injection into Cobb Mountain or the Collayomi Fault would require drilling of new wells and would potentially create additional environmental impacts. Evidence of connection between the Collayomi Fault and the steam fields is not proven.

11. Currently there are bonds for spills, mishaps and reclamation for geothermal permits by the Division of Oil, Gas and Geothermal Resources (DOGGR), as well as the BLM and County. Bonds also exist for reclamation for abandonment of the geothermal resource. There are statutory limitations imposed on the DOGGR for bonding requirements for restoration and reclamation. Lake County does not require bonding for public agencies, that is, for the publicly owned portion of the project.

12. Lands owned by the Bureau of Land Management fall under BLM jurisdiction. The Lake County Planning Department and Sonoma County Planning Department oversee project lands that occur in their respective counties. It has been recognized by the California Energy Commission in its 1991 Committee Report on the Geysers KGRA Generating and Steam Resources that a "fragmented approach" to regulatory oversight responsibilities exists and has contributed to the problems of resource depletion in The Geysers. However, this project may provide an opportunity for all agencies to coordinate responsibilities with the goal of The Southeast Geysers becoming a sustanable resource. It is beyond the scope of the EIR/EIS to resolve this situation. The EIR/EIS indicates which permits and regulations will apply to this project.

    Primary responsibility for monitoring of mitigation rests with the BLM on lands under federal jurisdiction and with the County of Lake and County of Sonoma for the remainder of the project area.

    No new wells will be drilled for the project. If new wells would be proposed at some future date, appropriate permits would be required from the agencies with jurisdiction and entail further environmental review pursuant to CEQA.

The County would have possession of the pipeline up to the Bear Canyon Pump Station No. 1. At that point, the effluent would be owned by the industry operators. The project sponsors are regulated by federal and state agencies, as is described in the EIR/EIS.

13. LACOSAN and the industry partners are completing negotiations on the terms of the operating agreement. Present language in the agreement will replace the two-year noticing requirement with a long-term commitment for the industry to take the water. Alternatives for disposal of LACOSAN's effluent are listed in section 3.3, Possible Future System Modifications Alternative, on page 3-49 of the Draft EIR/EIS. Federal, state and local law prohibits unauthorized discharge of wastewater to surface waters and groundwater. Although no County ordinance prohibiting wastewater discharge into waterways is planned, the Mitigation Monitoring Program for the project is a functional equivalent of a use permit. Under this permit, the project must meet the same requirements as other developments.

14. This comment is noted and will be considered by the lead agencies. The materials included with the comment have been included in this document.

15. See Response to Comment No. 5, above. Currently there are no plans for measuring or monitoring mercury or other toxins in the effluent, because no discharge to waterways would occur. The Central Valley Regional Water Quality Control Board establishes the constituent types and concentrations as part of its Waste Discharge Requirement permit.

16. See Response to Comment No. 1, above. Implementation of the project would supply new water to the resource area rather than deplete the resource. The Geysers is essentially a closed system, and the decline in steam pressure is caused by overdrawing of the resource. The augmented injection program proposed in this EIR/EIS would provide an additional source of water, which could be converted to steam by the heat from the reservoir rock and thereby help to reduce the decline rate in steam pressure. The rate of pressure decline has been analyzed by the operators and by other entities. The location of injection wells reflects this prior analysis. The monitoring of injection results will be continuous. If advisable, injection sites and quantities can be changed.

17. The Cache Creek wastewater disposal option was determined to be politically unfeasible based on comments that were received when this was first presented as an alternative. This alternative would have been challenged in court and would require significant policy changes with regard to discharges into Clear Lake, as noted in the Draft EIR/EIS. Furthermore, the Cache Creek alternative would require extensive supplemental environmental studies, including in-depth hydrological studies, that are estimated to cost $950,000 to $1,000,000. Completion of these studies, and the possibility of a drawn-out permitting and/or legal process would create substantial delays in the lifting of the Cease and Desist Order. See also the response to Comment No. 3, above. The proposed project would be funded by federal and state grants that would lower LACOSAN's costs and prevent high increases in ratepayers' charges.

18. This project does not involve drilling new wells. Since no drilling would occur, no adverse impacts to aquatic life would occur from that type of action. The Aquatic Resources Monitoring (ARM) program, which has been in place for a number of years, is specifically designed to obtain a data base on the aquatic resources and water quality of creeks in The Geysers, including the project area.

The cause of a potential fish kill would be the possibly high turbidity of the creek water in a large spill. Because of the sudden increase in flow volume from a drain down of a broken pipe, the water would be expected to entrain considerable silt. The high silt loading potentially could clog fish gills, resulting in fish kills.

Turbidity impairing fish respiration is the cause of potential concern addressed in the discussion on page 5-59 of the Draft EIR/EIS. With the mitigation measures proposed, sediment in the tributary of Big Sulphur Creek would not likely result in kills of Rainbow Trout.

19. The California Environmental Quality Act Guidelines, Section 15146, addresses the level of specificity needed for an EIR. The Guidelines indicate that the "level of analysis provided in an EIR is subject to the rule of reason."...The level of analysis must be "specific enough to permit informed decision making and public participation". The analysis provided in the EIR/EIS is considered by the lead agencies to sufficiently encompass the potential impacts of the project. If the final design results in changes to the project that would reveal substantially new potential impacts, these revisions to the project would be required to undergo supplemental environmental review pursuant to CEQA.

20. The types of pipe being considered for this project (cement-lined and tape coated steel pipe, cement lined and bare exterior Type A606 weathering steel, or high density polyethylene pipe; see page 2-38 of the Draft EIR/EIS) have been commonly used throughout California, including areas that have experienced more severe earthquakes than those measured in The Geysers. Pipe selection will be part of the final engineering and design and the criteria for selection are cited in the Preliminary Engineering Report.

21. Damage to the Childers Peak Regulating Tank is considered unlikely, but if it did occur, could result in a release of water into the nearby unnamed tributary of Big Canyon Creek. The type of tank proposed by the project is used extensively throughout California and has few instances of failure. The amount of water release would depend on the nature of the break, which could vary between a small leak and a sizable draining. A rapid loss of water in the tank would be revealed by the float monitor, which would trigger an alarm to shut off the pumping system. Most of the tank water probably would drain through the pipeline without impact to surface streams. The amount of water draining to the surface environment would depend on the size of the rupture and its height above the ground level. The downhill environment that would receive the water is open woodland and rangeland lacking any houses or other developments. A rough road currently winds up the valley to the tank site. The stream that would receive the water from the tank is a small, intermittent water course. Regular inspection of the tank would identify a small leak. A concrete containment basin could be constructed to capture small releases, if deemed necessary. Since tank failure is unlikely, construction of a large containment structure probably is unnecessary and would create additional environmental disturbance.

22. The primary impacts are topographic alteration related to grading of the pad and cutting back the hillside, visual alteration created by the cut and the tank itself, and a loss of chaparral vegetation cover in the graded area. None of the impacts are considered significant. Revegetation of the exposed cut and fill slopes is recommended to reduce erosion. Mitigation 5.2.7.4 also recommended appropriate revegetation and paint color selection to minimize visual impact.

23. No other analysis of the water constituents is anticipated. See response to Comment No. 9, above.

24. No facilities have been planned for treating the make up water. There is no reason to treat the lake water.

25. There are several instances in which lake water would have to be shut off. Maintenance of the pipeline, problems with the operation of the pipeline, etc. The project would not necessarily draw the amount of water agreed on; this amount is the maximum the project may remove from the lake. If lake diversion flow is stopped for a significant amount of time, the SERWTP has storage capacity to maintain steady flow rates. Severe drought conditions in Clear Lake also could limit the amount of water withdrawn for the project. Significant toxic spills into the lake are not likely. Because of the proposed use of the water and the mixing of it with treated effluent, a toxic spill likely would not affect operations and, therefore, would not necessitate a shut-down of the diversion.

26. The flow is regulated by the system of pumps. The Childers Peak Regulating tank is the primary tank in the system for this purpose.

27. Pipeline pressure loss could be the result of several things, such as a leak or a pump that has stopped. Specific mitigation measures would vary depending on the cause of the pressure loss. Standard procedures are followed which involve first identifying the problem, characterizing its origin, responding quickly, and implementing the appropriate corrective measures. In most cases, loss of pressure will be primarily a systems operation concern rather than an environmental problem. Full containment of pipeline drain down is provided in the project within the reservoirs at the Middletown Wastewater Treatment Plant and Southeast Regional Wastewater Treatment Plant.

28. The total anticipated water removal over the anticipated 25 year life of the project is 165,621 acre-feet per year, based on the withdrawal rates projected in Table 2.1.4-1 on page 2-16 of the Draft EIR/EIS. No cumulative effect on Clear Lake is anticipated (see response to Comment No. 11 of the Environmental Protection Agency).

29. There would be absolute redundancy in all control systems. Back-up diesel generators also would provide back-up power for the monitoring systems. If the DCS fails, operation and maintenance of the pipeline could be controlled manually.

30. A telemetry connection would provide redundancy for the emergency control system.

31. The alarm would be triggered by a pressure loss. Once the alarm is sounded, the problem would be identified by visual inspection. Because of the potential danger of spills, operators are required to respond quickly to locate and repair the leak. The average flow rate would be 5,400 gpm.

    As noted in response to Comment No. 4, above, an assessment of the potential flow rate and path of discharge at all points in a system of this size is beyond the level of analysis of an EIR/EIS required by CEQA and NEPA. The proposed system design would minimize the risk to life and property though use of isolation valves, flow controls and other preventative measures described in the EIR/EIS. Emergency response planning will be developed by the project sponsors as part of the Monitoring and Mitigation Plan and in conjunction with final

design. The EIR/EIS (page 5-30 - 5-32) provides an illustration of the effects of a catastrophic break in the pipeline. The information provided is considered by the EIR/EIS preparers to be sufficient disclosure of potential risk of upset hazards on which the decision makers can base their determinations.

32. This project is Unocal's only on-going proposal in the Southeast Geysers. Therefore, no cumulative impact would occur. There are currently no plans to expand the project; however, if an expansion is proposed, a review of the impacts associated with such an expansion would be required.

33. No separate permit process would be required if NCPA adds other sources of water for injection. NCPA already is permitted to use captured rainfall as an injection water source.

34. Aluminum sulfate and chlorine may react with mineral constituents of the reservoir rocks when heated, to form secondary replacement minerals, and/or may go into solution into the reservoir fluid. The water in most geothermal fields contains abundant sulfate and chloride in solution, whereas aluminum is very poorly soluble and usually present only in trace amounts except where pH is very high or very low. These do not appear to have effects upon either the reservoir or the ability of wells to produce geothermal fluids.

    The comment refers to proposed facilities at the SERWTP. There is no plan to heat or superheat chlorine at the SERWTP. The use and storage of chlorine at the SERWTP was addressed in the EIR/EIS. Dechlorination would be provided before the water is discharged to the SERWTP reservoir. Chlorination of the effluent in the pipeline is not specifically proposed as part of the project, because there is no strong basis for requiring it. It would be considered if a problem with bacteria growth inside the pipeline were to occur, which event is considered unlikely because of the flow pressures in the pipeline. It might also be considered if a problem with odor were to occur. Heating of these substances in highly diluted form and at great depth in the geothermal reservoir is not anticipated to result in environmental impacts or pose health and safety concerns.

35. If the oxidation ditch process is not operating normally, the biological reactions have somehow been inhibited. Oxidation and pollutant breakdown would not happen as completely. This problem could be alleviated by funneling wastewater to another ditch.

36. "Open space" as used on page 1-19 of the Draft EIR/EIS refers to undeveloped grassland and trees.

37. Surges of flow in the pipeline impair the efficiency of pipeline operation, and severe surges are potentially damaging to pumps and possibly to the pipeline. The proposed pipeline will be of a design and materials sufficient to accommodate the effects of large surges without risk of rupture. The proposed surge tank is one of the preventative measures designed to prevent damaging surges from occurring.

38. If wastewater is cut off, the volume of water for injection would be reduced. Some injection may continue using other sources already permitted, e.g., power plant condensate, collected rainwater, and diverted stream water. This is not expected to affect the integrity of the well or have any adverse impacts other than reduction in resource use.

39. If Clear Lake were to become contaminated, pumps and valves to the pipeline could be shut off. If this were to occur, flows to the injection wells would remain steady because the SERWTP would have a backup supply. There is no apparent reason to believe that lakewater would be contaminated to such a degree that this would be necessary.

40. There are no points in this alternative where the pipeline would be above ground and there would be public access. Therefore, hazards caused by vehicles would not occur.

41. The information requested cannot be provided because quantitative data on the extent of the affected habitats and the size of the species populations are not available. The species of concern are designated so because of apparent regional destruction of habitat. The project would contribute in small degree to that habitat loss, roughly estimated at about 7.6 acres of Mixed Chaparral, and about 50 acres of woodlands. It would add cumulatively to region-wide reduction in habitat. Some of these losses probably would not be permanent, as a certain amount of revegetation with the native plants would occur in the right of way.

42. Previous study on water availability in 1991 by Criterion indicated that within a 50 mile radius of The Geysers, the only water source of sufficient size to meet the needs of the Geysers was in Lake County, and specifically the wastewater from the Clear Lake Basin. The City of Santa Rosa has considered disposal of wastewater at The Geysers for some time. Earlier studies indicated that construction of a pipeline to The Geysers would be expensive because of the required distance and lift (one of the highest in the world). Other considerations in reaching an agreement also presented problems, and a specificaly define project was not advanced. The City of Santa Rosa continues at present to consider disposal of wastewater at The Geysers. However, given the previous experience and the lack of a defined project, disposal of Santa Rosa wastewater at The Geysers is regarded as very speculative, and, therefore, is not considered in the cumulative impact assessment of this EIR/EIS. It may be worth noting that, in the event that the City of Santa Rosa does progress to development of a Geysers disposal project, it would be required to consider the cumulative impacts of the Southeast Geysers Effluent Pipeline Project, if it is approved by LACOSAN.

43. Alternative F includes a segment of pipeline running overland over steep terrain. It would not have an access road adjacent to the pipeline. As a result, if some form of problem, such as a leak, were to occur in that segment, access to the problem site would have to be on foot or from helicopters. Because rapid vehicle access would not be possible for part of that route, a delay in getting to the site and effecting repairs would occur.

44. Responsible Agency and Cooperating Agency are designations given to public agencies relative to CEQA and NEPA. The designations are not necessarily exclusive. The same agency can be both with regard to a specific project for which that agency may have permitting or oversight authority, or as the comment suggests, a role in mitigation monitoring. The roles of Responsible Agencies are established by statutory authority. Cooperating Agency designation (which is specific to NEPA) is discretionary depending on the role which an agency has for a given action, for example, the agency may have a role in funding the proposed action.

45. CEQA Guidelines Sections 15131 and 15358 do not require cost analysis unless they result in physical environmental impacts. NEPA (Section 1502.14) does not require a cost analysis, but does allow them if the federal agency chooses to use cost/benefit considerations in making its decision. However, in the facilities plan for the SERWTP, a cost analysis was

done and has been made available as a back-up study. Tertiary treatment of the wastewater would require reverse osmosis, which is a very expensive process and would result in marginal benefits and increasing costs to service area ratepayers.

46. Final agreements occur between industry participants and LACOSAN. Two such agreements are the construction financing agreement and the operating agreements. These agreements cover the financing of the project construction, operations and maintenance, and obligations, including obligations for system modifications. Currently LACOSAN and the industry participants are in the advanced stages of negotiating the terms of these agreements. Provision of funds for system modification will be required.

47. If the industry terminates the project or seeks a reduction of the demand for water, an adjustment to the program or an alternative disposal method would be required. It is possible that a partner might withdraw, thereby reducing the demand for water, and effecting a reduction in lake water withdrawal. Other industry partners may choose to purchase the water. If all industry partners were to withdraw or reduce the demand for water below the projected wastewater volumes, then an alternate method of disposal would have to be found. The terms of the agreement addressing that possibility are still in negotiation between LACOSAN and the industry parters. The industry partners might be required to pay part of the cost of a back-up disposal alternative. The intention is to cost-share system modifications, if they are needed.

48. In the Draft EIR/EIS, Figure 2.1.4-a on page 2-19 is not to equivalent scale on the two axes. The vertical axis measures elevation in feet, while the horizontal axis measures distance in thousands of feet. As a result, the horizontal axis label should be revised to read: "Distance (thousands of feet)."

49. A comminutor is a shredding device that grinds solids passing through bar screens to about 1/4 to 3/8 inch in size and removes foreign objects. It is installed directly in the wastewater flow channel and is provided with a bypass, which allows the length containing the unit to be isolated and drained for machine maintenance.

50. The wastewater will be treated to a secondary level. Secondary treatment is common in plants throughout California.

51. The choice of which pad(s) to use for laydown will be based on the relative ease of access of the pads to the construction sites. As all three pads are cleared dirt surface areas, no environmental disturbance from laydown is likely to occur at any of them.

52. The emergency spill response plan will be included with the final Mitigation and Monitoring Plan and will contain emergency response procedures. Spill bonding and oversight authority is addressed in Comment No. 11, above.

53. Table 2.3.5-1, Southeast Geysers Effluent Pipeline Project Construction Disturbance Area Estimates, on page 2-77 of the Draft EIR/EIS, provides the total disturbed area, the total disturbance of existing roads, and total duration of disturbance.

54. The comment references pressure testing. This would not be carried out using waste water. The release of the test water would occur by opening a valve. The water could be drained

into a tanker truck or possibly drained onto the ground. If the latter approach were used, a permit would be required because the water probably would contain small amounts of silt.

55. If drawn from Clear Lake, the use of the water would entail purchase from the Yolo County Flood Control and Water Conservation District. The volume of water used for dust suppression is highly speculative since it will depend on the relative need for dust control under various weather conditions. Construction during hot and windy summer days would require more frequent watering, and consequently greater volumes,than that occurring in the cooler, wet portions of the year. On the whole, one may anticipate on the order of 10 truck trips per day during the summer season. Assuming use of 2,000 gallon trucks, this would entail roughly 20,000 gallons per day.

56. Slopes with a 67 percent inclination are within the range of accessibility of four-wheel drive and all terrain vehicles. There are only short stretches of the pipeline route that would encounter slopes of this type. A 67 *percent* inclination should not be confused with a 67 *degree* inclination; the latter would be prohibitive for vehicles.

57. The exact behavior of fluid injected into the geothermal reservoir is governed by a large number of parameters, such as fluid mobility, porosity, fracture length and width, liquid saturation of the rock, etc. These parameters, and their impact on fluid behavior, are estimated within a degree of uncertainty, reflecting the current state of observation of the results of injection at The Geysers and other geothermal fields. If the injected fluid behaves in unexpected ways in the reservoir, changes can be made in the quantity, location and timing of injection to mitigate the unexpected behavior. Nothing at the present time indicates that this will be necessary. There will be continuous monitoring of the injection process and results.

58. The amount of power generated is dictated by the amount of steam that can be extracted from the reservoir at commercially useful pressures. The amount of steam produced from each production well is controlled mainly by the permeability around the well (the ability to move fluid through rock), and by the steam pressure. The proposed project provides additional water for injection. This is expected to help reduce the rate at which pressure is declining. However, pressure is expected to continue to decline, albeit at a lower rate, because the net extraction of fluid from the reservoir will still exceed the net injection. Therefore, the steam production rate also can be expected to continue to decline. The project would help to prolong the life of the reservoir, but may not serve to restore pressure to earlier levels. Approximately 500 megaWatts of plant capacity exist at The Geysers.

59. It is planned that existing injection and production wells will be used for the proposed injection; therefore, no new injection wells are anticipated for this project.

60. Unocal has an existing permit to divert water from a tributary of Big Sulphur Creek. This water would be used with the proposed project wastewater for injection. Mixing in this case simply means that the flow of the two water sources in the two pipelines would be joined into a single flow in one line through a valve. There is no spill potential unless the line were to break.

61. Enthalpy is the heat energy in a substance available for conversion to mechanical energy and then to electrical energy. At each of the conversion stages, a portion of the energy is lost

because of various factors. The enthalpy of water is relatively low when it is in a liquid state; it becomes progressively higher as water is heated to become two-phase (a mixture of liquid and vapor), fully vapor, and then superheated steam. Enthalpy monitoring is a standard practice in any geothermal operation, involving measurements of temperature, pressure and mass flow rate at the wellhead. Through the monitoring process one can make an assessment of the effects of injection and the interaction between the injected and the produced fluid.

62. No new wells are planned for this project. If new wells were to be drilled, they would be required to obtain the appropriate permits and undergo environmental review.

63. The reservoir is a body of rock, containing pores between grains comprising the rock and fractures that pass through the rocks, which together form probably less than 10% of total volume. The resource is the fluid that occupies those fractures and pores. Induced seismicity is not expected to reduce the overall porosity or permeability of the reservoir, although individual rock pores and/or fractures possibly may be enlarged or diminished in volume. This is not expected to damage the reservoir or alter the fluid flow pattern, based on prior injection experience at The Geysers and other geothermal fields. There is no documented case of a geothermal resource being destroyed by induced seismic activity.

64. There is no evidence to suggest that the project would lead to an increase of spills in the Southeast Geysers. Beyond the basic fact that the project would prolong the life of operations in the area, there is no element of the proposed project plan that necessarily would increase hazards of spills or result in degradation of waterways in the area. Once constructed, the project is essentially a closed system of pipes. Spill hazards relative to the project would primarily be the result of a pipeline failure, which is unlikely, or the accidental opening of a valve that is not connected to an injection line. Existing geothermal use permits in Lake and Sonoma counties require monitoring of fish and water quality in the local waterways of the Southeast Geysers. A spill of the effluent in the distribution lines to the injection points would have similar effect in kind to that of a spill from the main effluent pipeline. The chief difference is that it would entail a smaller volume of water because of the smaller pipe sizes. The potential impact on waterways and aquatic habitat would be the creation of high silt loads if the flows were continued unabated for some time. Continuous monitoring of the system by the operators and the ease of access to the distribution lines would reduce the risk of a lengthy response time to a spill. The silt loads could be harmful to fish and other aquatic species, such as amphibians that require clear water.

65. A specific abandonment plan for the pipeline and facilities has not been prepared because of the long design life of the facility. It is possible that the pipeline could be put to effective reuses, for example, to supply potable water from Clear Lake to Middletown and other growing parts of the County, to supply water for agriculture. The pump stations may obtain reuse in the same way. The Mitigation and Monitoring Plan will provide for abandonment if it becomes necessary.

    If the pipeline does not obtain reuse, pipeline segments would be removed and pumps likely would be salvaged and reused elsewhere or sold. The abandonment could require regrading and revegetating of disturbed right-of-way, unless regrading were itself to result in greater slope stability and erosion hazards. Regrading could entail importing fill material to backfill the trench and recontouring to create more natural slopes with drainage that would not result in erosion. Revegetation would be carried out to provide control of soil loss on slopes and to

promote the reestablishment of the natural vegetation cover. All roads probably would be left in place. These would be maintained or regraded, depending on the need to be determined at that time.

66. LACOSAN has investigated additional sources of funds and has identified at least three or four other federal agencies that might provide more money for the project. Before construction of the pipeline can begin, the Board of Supervisors and the industry participants must be assured that sufficient funds are available. At present, sources of equity and debt financing have been identified in excess of project requirements. The selection of the final funding sources will occur during the final agreement negotiation.

67. Mitigation requirements and oversight responsibilities would not be eliminated even if a government reorganization were to occur. The reorganization noted in the comment is speculation.

68. The injection into The Geysers is governed by DOGGR or the BLM, depending on where federal or state jurisdictions apply. Injection volumes and other information are reported to the agencies. These agencies must undertake enforcement action if any regulation and permit requirements were violated. If no violations occur, they may provide to the operators specific recommendations which might correct an existing or potential problem.

69. Alternative G in the earlier EIR on the Southeast Regional Wastewater Treatment Plant Facilities Improvement Plan has evolved to become the preferred project considered in the current EIR/EIS. The original concept, disposal of wastewater in The Geysers, remains the same, but more detailed information aoubt the design has evolved.

70. This information is included with this document in the Appendix.

71. Clearlake Oaks County Water District (CLOCWD) and Hidden Valley Water Districts have not indicated any firm interest in participating in the project. The CLOCWD prepared an EIR for their preferred disposal plan to discharge to a tributary of Cache Creek. The CLOCWD permit for this form of disposal was denied by the CVRWQCB. However, the CLOCWD has initiated an engineering feasibility study to determine if it is in their interst to be a part of the proposed project. If they were to change their position and propose to build a pipeline connecting to the SERWTP pipeline, they would have to go through the appropriate permitting process, including environmental review pursuant to CEQA. The result of their inclusion in the project would be a decrease in the amount of lakewater diverted to the pipeline. As noted in Comment 42, disposal of Santa Rosa wastewater in The Geysers is one of six alternatives being considered by the City of Santa Rosa. This alternative is very speculative at this point.

72. The Sulfur Bank Hazardous Waste Site is an old mercury mine located in the Oaks Arm at the eastern end of Clear Lake. Initially, the preparers of previous Draft EIR on the SERWTP Facilities Improvements suggested that the fluid be pumped out of the tailings pond and shipped to The Geysers for injection. However, this alternative was rejected because the industry participants were not interested in receiving water with mercury contamination. The EPA has been conducting site remediation at the site for approximately two years.

73. At present, LACOSAN is pursuing both programs. The one program is not being sacrificed to the other. Ongoing I/I reduction for the SERWTP collection system is required by the

Central Valley Regional Water Quality Control Board. Both I/I improvements and disposal in the Geysers were evaluated in the earlier alternatives analysis. Water conservation is a requirement throughout California. The City of Clearlake will be required to agree to water conservation measures both to reduce water consumption and wastewater. See response to Comment No. 4 of the Resources Agency, Department of Conservation.

74. Information in Table 3.2-7 is presented to show the historic process that has led to the current project. Since the original table was created, more detailed information has been developed. This EIR/EIS presents the most up to date information on water resources and other environmental consideration in Chapter 4 and related impacts in Chapters 5 and 6.

75. Public funding requirements are not different from that of the original proposal (Cache Creek disposal). The difference in estimated costs to construct the proposed project is made up by funding by industry and grant programs promoted by public policy from agencies that support environmentally superior wastewater projects or geothermal energy development projects. Most of these funding sources would not be available for the original (Cache Creek) disposal project.

    One of the primary reasons that the preferred project has been carried forward is that the other alternatives had a high probability of greater environmental impact, and for some, substantially higher costs for construction and operation in addition. A range of possible alternatives were considered, and costs for construction and operation were considered at that time. Evaluation of the Cache Creek effluent disposal alternative indicated substantial difficulties for resolving water quality issues. A reevaluation of costs of the alternatives would not alter the potentially significant, and possibly unsolvable problems associated with them. Timely resolution of the problem of the Cease and Desist Order currently in effect is an additional consideration. The proposed project would achieve this objective in the shortest time.

76. Careful field investigation, interpretation of recent aerial photography and review of the geologic literature by a professional engineering geologist have identified a few areas of significant or potentially significant landslide hazard along the proposed project alignment. A geologic map, which indicates landslides, has been included in this submission. Some small landslides are not mapped because of the limitations of the map scale. It is important to note that a very large amount of the proposed route is located in existing roads, most of which have been in place for many years and have performed satisfactorily. There are identified segments of the route where slope instability requires further investigation, as documented in the EIR/EIS. Landslide hazard and appropriate mitigation are presented in the EIR/EIS. An important task of final engineering design will be further geologic conditions surveys that will include geotechnical engineering mitigation to minimize all slope instability hazards. With these measures, slope instability hazards should be reduced to an acceptable level.

77. Severe erosion areas have been identified in the EIR/EIS as well as mitigation to reduce the hazard to acceptable levels. Most of the route crosses watercourses which are seasonally dry and do not have fish populations. The concern about erosion control stems from the seasonal drainage in which water is entrained in the flow and carries the sediment to lower reaches of the waterways The sediment has the potential to increase turbidity, affecting aquatic life directly as well as lead to silt deposition that may affect bottom conditions of rivers with fish and amphibian populations. Alteration of bottom conditions in this manner could affect

spawning areas, aquatic vegetation and local flow conditions. The proposed mitigation measures, if implemented would reduce the impacts to less than significant levels in the streams.

78. Fish count data are not available for these streams in the vicinity of the proposed crossings. It is likely that no fish exist in many of these streams since they are mostly intermittent or ephemeral streams. The proposed construction would be carried out during the dry season, when flows are very low in the watercourses. This, in combination with other erosion control measures, would reduce the impacts on fishes in downstream areas to a less than significant level.

79. See response to Comment No. 8.

80. No diversions from Big Sulphur Creek have been proposed for the project; therefore, no impact would occur. Unocal already holds permits for diversions from this creek and has not requested additional diversions as a part of the proposed project.

81. Monitoring of fish populations and mitigation of identified impacts are covered under Geothermal Use Permit conditions of Lake County. These are a continuation of the ARM program identified in the EIR/EIS.

82. Spills of effluent would be rare events, if they occur at all. Toxin loads would depend on the nature of the effluent at the time of the spill, the amount of water discharged and the amount of water and flow conditions in the receiving water body. Toxin loads likely would be low because of the substantial dilution created by the wastewater and the addition of lake water. In a worst case spill into a creek during a low flow period, the toxicity levels possibly could be harmful to some aquatic species, highly sensitive amphibians that could not escape, juveniles of fish and other aquatic animals, and invertebrates.

83. Monitoring and mitigation will be conducted in the same manner as under all Geothrmal Use Permits of the counties and the BLM. Periodic inspections will occur to ensure compliance. Lake County has considerable experience in working with revegetation of serpentine soils, for example, the County has developed serpentine grass seed mixes. The County has an inspection program and the project would be required to comply with inspection requirements.

84. The injection wells are located on pads largely devoid of vegetation and providing little useful habitat for wildlife. As injection at the pads is entirely in a closed piping system, there is little at the site to disturb wildlife.

85. The comment is noted by the lead agencies. Growth inducement is analyzed in Section 7.2 of the Draft EIR/EIS.

86. Asbestos could become entrained in runoff of sites disturbed by construction grading activities, such as serpentinite. Most of these areas lack perennial streams. Construction would be confined largely to the dry season as required by the County. Therefore, there would be limited opportunity for asbestos soil to be washed into water courses. Most asbestos, if deposited in the streams, would be deposited in the sediment and, thereby, be relatively harmless. However, if asbestos were deposited in flowing watercourses, the fibers possibly could become lodged in the gills of fish and amphibians or ingested by them. This

would be potentially hazardous to them. One of the most effective means to prevent asbestos from becoming deposited in stream courses is effective dust control. Regular watering of construction sites has proven effect in suppressing dust, and, therefore, the potential for the fibers to blow away from the construction site and into water courses.

87. See response to Comment No. 5.

88. In all probability, additional injection cannot restore full production (see Response to Comment 58). There probably are a sufficient number of wells that could be used for injection in The Geysers. However, the project probably would not provide sufficient water to restore full production.

89. Reasons for the returns are given on page 4-206 of the Draft EIR/EIS. These are:

    1. Higher permeability - evidenced by wells of higher initial deliverability;
    2. Higher reservoir superheat - indicating "dried out" conditions which promote efficient boiling; and
    3. Lower reservoir pressure - indicating a higher degree of depletion and promoting boiling of the injectate.

    The results of injection will be monitored continuously. This will help to determine if injection quantity or location should be modified with time. Monitoring will include pressure and temperature responses at various production wells, changes in calculated fluid enthalpy, and changes in other production parameters, such as mass flow rate.

90. The criteria for injection well selection is the same as that for all the operators. The intention is to select wells that will optimize steam production.

91. The release of hydrogen sulfide is not expected to increase with additional steam production resulting from injection of the project effluent. Experience to date has shown that injection tends to dilute the gases at adjacent wells. In part, this is because the injected fluid does not contain measurable hydrogen sulfide. In addition, hydrogen sulfide abatement controls and ongoing air quality testing will remain in effect.

    Radon is a product of radioactive decay of trace amounts of radium which are trapped in the rocks of the earth's crust, including those at The Geysers. The radon measured at geothermal wells is the isotope ^{222}Rn, which has a half-life of 3.8 days. The extent of radon production from a geothermal reservoir depends upon several factors, including the distribution of radium in the rock formation, the surface area exposed for escape of radon atoms formed during decay of the radium, and the time required for transport of the radon from sites of production in the reservoir rocks to the well. For example, it has been shown at one Geysers well that radon production declined when the flow rate was cut back, presumably due to decay of the radon isotope in the reservoir at the lower flow rate (Kruger, P., Stoker, A. and Umaña, A., 1977, "Radon in geothermal reservoir engineering", Geothermics, vol. 5, pp. 13-19). No comprehensive long-term data regarding releases of radon from Geysers well are available with which to fully evaluate the possible effect of the proposed additional injection. Injection of cold water into the reservoir may initially cause an increase of surface area exposed for escape of radon atoms (due to possible cooling and micro-fracturing of the rocks), and an increase of radon emissions, at least temporarily, due to an increased transport rate. However, if the increased transport rate affects only a limited volume of the reservoir

between the boiling front and the well, then the tendency of injectate to dilute the radon produced in that area may overcome the effect of increased rate, resulting in a decline of emissions. Note also that Kruger and others (1977, cited above) determined that the emissions of radon from a 55 MWe power plant at The Geysers was about equivalent to the natural release of radon from soils in less than 2.5 square miles of the surrounding land area.

Radon has been studied in The Geysers. The Bear Canyon and West Ford Flat Geothermal Use Permits required testing for Radon for the past five years. Both projects are located near the proposed project area in the Southeast Geysers. The results indicate insignificant levels of radon.

92. See response to Comment No. 63 of this letter.

93. Analysis of the landslides identified in the EIR/EIS does not indicate that rerouting is necessary. Further geotechnical investigation was suggested as a mitigation measure and will be carried out for the final design phase.

94. The impacts are described in the EIR/EIS (page 5-9, 5-22, 5-23, 5-39, and 5-59. No impact on fish is anticipated, if the recommended mitigation measures are implemented. This watercourse is typically dry in summer in the segment where the road and pipeline would cross the stream channel. Therefore, construction in the summer and late dry season likely would not affect fish in doenstream segments directly.

95. See response to Comment No. 9 of this letter.

96. See response to Comment No. 7 of this letter.

97. Viral release into the atmosphere is considered unlikely because of the high temperatures in the geothermal reservoir and the attenuated pathways back to the surface environment. The recommended proposed mitigation measure is intended to be a limited check to determine if any problem might exist because of the uncertainties about virus and bacteria survivability. Because some of the condensate could be reused again in cooling towers, it was felt that it would be important to know whether the issue merits further consideration. It should be recognized that this is not a matter of a significant potential health hazard because any concentrations would be extremely small, if the virus and bacteria are present at all. If virus or bacteria are found, a determination would be made by the Lake Air Quality Management District and the Environmental Health Department (or the Northern Sonoma Count Air Pollution Control District) whether a potential health risk is present. Control strategies may be identified at that time.

The proposed disposal method would be significantly superior to spray irrigation or discharge into surface waterways with regard to pathogens.

98. See response to Comment No. 11.

99. See response to Comment No. 3. When discussing pollutant removal, disposal of those pollutants must also be considered. Clearly the value of wastewater will increase over time and at some point it will be reasonable to treat it for drinking water use. Currently, however, even tertiary treatment would not eliminate environmental impacts, and ratepayers cannot afford to pay for tertiary treatment, which in this case probably would also ential the use of

reverse osmosis. Tertiary treatment would almost double the costs of secondary treatment. Furthermore, it currently is illegal to discharge wastewater into a potable water system regardless of the treatment used. Therefore, secondary treatment is the preferred method of treatment.

100. No discharge to surface waterways is proposed. Therefore, no impacts of the type indicated in the comment are expected to occur.

ELIO GIUSTI LETTER OF JULY 13, 1994

1. A geologic map compiled by Michael J. Dwyer, Consulting Engineering Geologist, is included in Appendix A of this document.

2. Preliminary geologic evaluations were made of the alternate route identified in the comment. There were a number of reasons that this route was dropped from consideration, including geotechnical constraint. The principal problems were related to the fact that Caltrans would not allow encroachment in the highway right of way which occupies the area with the least constraining terrain. Because of the terrain along portions of the route, this would require the pipeline alignment to be located in steep hills. It was determined that potential slope instability hazards in this terrain were significant. Additionally, construction in the steep hills raised the prospect of potentially significant erosion hazards.

3. The fibrous mineral asbestos (asbestos is more formally referred to as the mineral chrysotile) is often associated with serpentinite deposits. The approximate boundaries of serpentinite in the project area are indicated on the geologic map in the study area. For more detail, geologic maps with scales of 1:24,000 or 1:62,500 prepared by the U.S. Geological Survey and the California Division of Mines and Geology (CDMG) should be reviewed by interested parties. According to older publications of the CDMG, the large northwest-trending serpentinite body located west of Childers Peak was briefly mined for its asbestos decades ago. Production was not large. The mine sites are located between 0.5 and 1.5 miles westerly of the alignment and not within an area of potential effect of the project. The proposed pipeline alignment does cross the serpentinite body approximately 2 to 2.5 miles south of Childers Peak. Asbestos mineralization could be present at this location. Further information on the crossing of serpentinite is presented in the Draft EIR/EIS.

   The serpentinite bodies located in the project steam field along the county line possibly contain asbestos mineralization. However, no specific reference to this is made in the available literature.

   There appears to be an old quarry or closely spaced quarries along the northernmost part of the pipeline. It is located easterly of Huntington Road along Arrowhead Road (SW1/4 Section 16 and NW1/4 Section 21, T. 13 N, R. 7W). According to older publications of the CDMG, this is the location from which rock (Clearlake Volcanics) were extracted many years ago for construction of residential foundations.

   See Response to Sierra Club Comment No. 5 regarding mercury mines.

   In sum, there are no known mines or tailings deposits from mercury or asbestos mines and prospects along or near the alignment. Some fibrous asbestos is associated with the

serpentinite bodies along the alignment, particularly in the vicinity of Childers Peak, as was reported in the EIR/EIS. Effective sprinkling for dust supression is one of the best methods of controlling the spread of asbestos fibers from a construction site to water courses and other areas.

4. Landslides are indicated on the geologic map included in Appendix A of this document.

5. Concern for slope stability along the alignment was a consideration from the inception of the EIR/EIS investigations. Areas of both larger and smaller instability are discussed in the EIR/EIS. The difficult areas of construction near Childers Peak have been carefully considered in the EIR/EIS. It is the opinion of the geotechnical consultant for the EIR/EIS that the potential slope instability and erosion hazards can be mitigated in this area to acceptable levels. Additional geotechnical evaluation to prepare specific grading and slope stabilization plans will be conducted for the final design of the pipeline and Childers Peak Regulating Tank.

6. The comment is correct in noting that if a pipeline break were to occur under very wet conditions in the Childers Peak area, delays in effecting repairs could occur. A draining of the entire storage capacity of the Childers Peak Regulating Tank would be an absolute worst case catastrophe. The first action to be taken in such an event would be to cut off the water supply to the pipeline including both the diversion from Clear Lake and the wastewater effluent from the SERWTP, and shutting down flow in the pipeline by closing isolation valves.

   It is the intention of LACOSAN to carry out periodic inspections of the pipeline to identify any problems that might occur. During periods of intense and sustained rainfall, inspections would be an expected activity to ensure that hazards of the type envisioned in the comment can be identified and corrective action taken to avoid a catastrophe.

7. The SERWTP storage reservoir has sufficient capacity to hold the wastewater for at least 25 days. It is believed that this would provide sufficient time to make repairs in the pipeline.

BONNY J. HANCHETT LETTER OF JUNE 13, 1994

1. There is no evidence to support the contention in the comment that Clear Lake is "extremely marginal". Hydrologic data indicate that Clear Lake has a relatively regular regime.

2. See response to Comment No. 11 of the U. S. Environmental Protection Agency. LACOSAN intends to enter into a water purchase agreement with Yolo County Flood Control and Water Conservation District (YCFCWCD). Therefore, the agreement would be purely a matter of YCFCWCD treating Lake County as one of its "customers". At this time, Lake County does not feel it is necessary to amend the Solano Decree. LACOSAN currently is negotiating the terms of the agreement with YCFCWCD.

MIGNON PERRY LETTER OF JULY 12, 1994

1. Current state policy and county ordinance (see page 4-69 of the Draft EIR/EIS) prohibit discharge of wastewater into Clear Lake.

2 Effluent currently is disposed through spray irrigation near the SERWTP. This approach was one of the alternatives evaluated in previous studies described in the EIR/EIS. The problem with this approach is that the volume of wastewater would increase as growth occurs in the service area. This means that a substantially larger amount of land area is needed for spray irrigation. The costs for land for the spray fields, as well as reservoirs, are currently prohibitive and would consume land which has higher value for residential, agricultural, commercial or recreational uses.

3. Lake County would purchase the water from Yolo County, as administered by the Yolo County Flood Control and Water Conservation District.

4. Benefits of the project are described in the EIR/EIS. The main benefits include: (1) removal of an existing Cease and Desist Order and associated moratorium on sewer connections of the Central Valley Regional Water Quality Control Board and the possibility of substantial financial penalties that would have to be paid by the existing rate payers; (2) elimination of overflows into Burns Valley Creek and discharge of wastes into Clear Lake, which conditions create a public health hazard; (3) increased growth and jobs opportunity for the Clearlake and Lower Lake areas; (4) construction jobs for the local work force; (5) continued employment for about 112 workers in the Southeast Geysers; (6) substantial electric energy production which is not dependent on environmentally damaging use of nonrenewable fuels; and (7) revenues and tax benefits from the geothermal industry.

5. Measurements of the noise from pumps similar to those envisioned for the project indicate a sound level of 64 dBA at 50 feet. This is substantially above existing background noise levels near the pump station sites. Mitigation would be required, e.g., enclosing the pumps within a structure and other measures. These measures will be incorporated into the final design to bring noise down to an acceptable level.

6. Slope instability and erosion hazards are addressed in detail in Chapters 4.3, 5.2.1 and 5.4.1 of the Draft EIR/EIS.

7. The comment is noted by the lead agencies.

8. The comment is noted by the lead agencies. The project would not be the longest or largest sewer line in California.

9. The uses of "short-term" and "long-term" are applied in the context of requirements of the California Environmental Quality Act.

10. The comment is noted by the lead agencies.

11. The Initial Study is a check list of possible environmental issues and concerns. It is used to identify questions that need to be evaluated in the EIR/EIS. Where doubt existed about the potential significance of an issue, LACOSAN indicated that an impact maybe could occur, and, therefore, added that to the list of issues addressed in the EIR/EIS. The EIR/EIS addresses all issues indicated with a "yes" or "maybe" in the Initial Study checklist.

U.S. DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE LETTER OF JULY 20, 1994

1. The EIR/EIS contains an estimate of the total diversion from Clear Lake that would be project-related wastewater and diverted raw make-up lake water. The wastewater component was assumed to be derived entirely from Clear Lake since this is by far the greatest source of the potable water supply in the SERWTP service area (as noted, some of the water from the Lower Lake area is derived from groundwater, but as groundwater was assumed to have a possible connection to Clear Lake, it was included within the total calculated diversion).

   Using the population estimates of growth for the service area, and an assumed use of 350 gpd per single family household, the total withdrawal for water supply in the area would vary between 3.22 mgd in the year 2000 and 7.04 mgd in the year 2020. An assumed 20 percent reduction for required water conservation would reduce these figures to 2.58 mgd and 5.63 mgd for the years 2000 and 2020, respectively.

2. The recommendations in the comment will be considered by the lead agencies. Screening criteria will be developed with input from the California Department of Fish and Game, which will issue a Lake Alteration Agreement for the project.

   The proposed intake would be located at depth of about 30 feet. Current information from Lakebed Management indicates that this depth probably could be reached by placing the intake between about 100 and 300 feet offshore. By drawing in water at this depth of the lake bottom, most fish species in Clear Lake would not be affected. Some of the fish species that might commonly use the deeper waters as habitat include catfish, bullhead and crappie. None of the fish species using the deep lake are considered species of concern, although they have recreational sport-fishing value.

3. The recommended measures will be incorporated into the Mitigation and Monitoring Plan.

4. Current plans would not place the pipeline directly on the ground surface.

5. The following losses of habitat are calculated based on a 50 foot wide disturbance corridor in off road areas. This is a conservative assumption, as it may be possible to reduce the width of the disturbance area in places. This is based on the fact that materials, workers and vehicles will have to be brought into the remote sites and removed when work is complete, and in certain areas the pipeline will remain above ground on vertical supports. In areas off highways on existing dirt and jeep roads an area of twenty feet disturbance outside of the dirt track was calculated. Habitat consisting of irrigated grassland consisting of planted species with short reproductive cycles were not counted. When habitat with already disturbed vegetation or habitat consisting of vegetation cover that is restorable such as Annual Grassland, Urban/ Agricultural, it was counted as a loss, but may be replaced except where structures prevent restoration. In areas with shrubs and trees the disturbance corridor would take longer to be restored and because of the size of the trees, avoidance of the individual organisms is planned but the habitat value of the 50 foot wide corridor will be lost, at least for the short-term. Perennial streams such as Big Canyon Creek and Putah Creek will not sustain permanent loss because after the excavation and placement of the pipeline, the substrate will return to its pre-construction condition of gravel stream bed and water flowing over the gravel.

ESA calculates that 12 acres of Annual Grassland, 4.6 acres of Urban / Agricultural land, 0.4 acres of Wet Meadow and approximately 0.4 acres of stream bed and aquatic habitats will be lost along with 1.5 acres of Valley and Foothill Riparian. Seven and six-tenths acres of Mixed Chaparral, and 1.8 acres of Serpentine Barrens and Seeps will be lost at least temporarily as habitat. In woodland habitats 3.5 acres of Blue Oak Woodland, 2.7 acres of Blue Oak-Foothill Pine Woodland, 5.4 acres of Valley Oak Woodland will be lost as habitat; 3.5 acres of Montane Hardwood, 5.7 acres of Montane Hardwood-Conifer and 1.1 acres of Closed Cone Pine-Cypress Forest. Total project losses of habitat would be approximately of 50 acres.

Alternatives to the project would entail the following impacts on habitat:

Alternative A: 1.7 acres of Mixed Chaparral

Alternative B: 0.3 acre of Valley and Foothill Riparian

Alternative C: none - (alternative was created to spare large trees)

Alternative D: 0.7 acre of Mixed Chaparral

Alternative E: none - (alternative is in-road location)

Alternative F: 1.4 acres of Montane Hardwood, 1.4 acres of Mixed Chaparral, 0.7 acre of Montane Hardwood-Conifer

Alternative G: 0.6 acre of Closed Cone Pine-Cypress Forest

Childers Peak Tank Alternative: 0.5 acre of Serpentine Barrens and Seep

6. Red-legged frog surveys of the type indicated in the comment would be completed after a final design is completed and prior to construction. The survey protocol included with the comment will be used for these studies. The Draft EIR/EIS indicates that there is potential habitat for these species along the alignment, and the impact statement is directed to an assumed presence.

7. The mitigation measures of the EIR/EIS are non-specific because three separate botanical surveys conducted for the EIR/EIS were not successful in consistently identifying the presence of most of the plant species.

   To elaborate on the mitigation in the EIR/EIS, it is recommended that a pre-construction survey of these species be carried out prior to construction. After final design and the final alignment are determined, the location of the proposed pipeline and access roads should be staked in the field in these areas. The botanical survey should entail an investigation at that time and at the potential sites identified in the EIR/EIS to determine if any of the plant species of concern are present in the area of potential effect. Consultation with the project engineers should occur at that time to determine if options are available for final adjustment of the pipeline location. If avoidance is possible, the plant sites would be staked and clearly identified for avoidance. If avoidance is not possible, then the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG) should be notified at least ten days in advance of construction that the plants are potentially in danger of being destroyed. The USFWS and CDFG may choose to collect seeds in the disturbed area and/or propose mitigation. Additionally, if possible, individuals of the listed plants should be

moved and replanted. It is recommended that a specific salvaging and replanting plan be prepared indicating suitable relocation sites, specific measures to promote establishment of the plants (substrate preparation, watering, fertilization, etc.) and a monitoring program. This plan would be coordinated with the USFWS and the California Department of Fish and Game. In the event that adequate replanting and mitigation could not be achieved, the project sponsors would meet with the USFWS and CDFG to address appropriate compensatory mitigation for habitat loss. Of the approximately 50 acres of disturbed habitat, about 24.9 acres are habitat which are more important for wildlife use and/or rare plant habitat (including riparian, serpentine barren, and oak/hardwood/conifer). The approach would include evaluation of the degree to which these habitats could be restored through mitigation measures identified in the EIR/EIS and the degree to which permanent losses would occur.

8. The recommendation will be considered by the lead agencies. The commitment to removal of pipelines spanning creeks is acceptable to LACOSAN, provided that other reuse of the pipeline is not available at the time of abandonment.

9 The release of hydrogen sulfide of treated wastewater is not expected to increase with additional steam production resulting from injection of the project effluent. Experience to date has shown that injection tends to dilute the gases at adjacent wells. In part, this is attributable to low level (non-measurable) hydrogen sulfide content of wastewater. Additionally, hydrogen sulfide abatement control required by the Lake County Air Quality Management District will remain in effect in the Southeast Geysers.

GOVERNOR'S OFFICE OF PLANNING AND RESEARCH, LETTER OF JULY 11, 1994

See letter and responses to the comments of the Resources Agency, Department of Conservation Division of Oil, Gas and Geothermal Resources.

UNITED STATES DEPARTMENT OF THE INTERIOR, NATIONAL PARK SERVICE LETTER OF JULY 26, 1994

1. The information presented in the EIR/EIS is a summary of detailed reports prepared for the project by the Sonoma State University Academic Foundation, Inc., Cultural Resources Facility. These studies included an archival literature search, a phase 1 (walk over) survey, evaluation of ethnography and history, and assessment of the potential for significant cultural resources and sensitive sites. In conducting the survey, it was recognized that a very high potential for extensive significant sites would be encountered along the proposed pipeline right of way and facilities sites. It was additionally recognized that detailed investigations would be required in order to achieve compliance with the National Historic Preservation Act and other federal and state laws with regard to cultural resources. The report was subsequently reviewed by an independent cultural resources consultant.

   It was reported by the investigators that some sites are of very high archaeological and historic value and sensitivity. This has been confirmed by recent cultural resources work for the Lower Lake Water District pipeline along a part of the alignment which encountered a burial. Additionally, some of the sites are vulnerable to disturbance from intentional or incidental activities, and there has been plundering of some sites. For these reasons, on the

advice of the cultural resources investigators, it was determined that the EIR/EIS should not include maps of identified sites or detailed descriptions about the specific resources that may lead to their further degradation. The specific kinds of requested information identified in the comment is available in the reports prepared by Sonoma State University Cultural Resources Facility, Cultural Resources Study for the Southeast Geysers Effluent Pipeline and Injection Project Lake and Sonoma Counties, California, 6 June 1993. These reports may be reviewed on a "need-to-know" basis. LACOSAN should be contacted for a copy of the report.

In sum, the relative brevity of the cultural resources section in the EIR/EIS should not be misinterpreted as a cursory treatment of the issues or impacts. To the contrary, the potential impacts on cultural resources are recognized in the EIR/EIS as one of the primary concerns with respect to the project. The EIR/EIS authors approach was to identify the potential significance of the impacts and mitigation requirements without providing details in a public document that might lead to further damage to the resources.

The EIR/EIS indicates only the identified sites from the survey that would potentially be disturbed by project construction. As noted in the EIR/EIS trenching for the pipeline itself would destroy the resources. Surface activities, such as movement of heavy equipment and vehicles could additionally damage the resources. The supporting reports do contain additional information of sites in the vicinity of the of the project that were deemed by the investigators to be located out of the area of potential impact.

2. It is the stated finding of the EIR/EIS that the identified sites have potentially significant cultural resources, and as a result, further investigation and mitigation are warranted. In consequence of this finding, LACOSAN and BLM have entered into a Memorandum of Agreement with the State Historic Preservation Officer and State Water Resources Control Board (SWRCB), that it will carry out the necessary investigations and mitigation requirements pursuant to Section 106 compliance requirements (see letter of State Water Resources Control Board, Joe L. Pope, Cultural Resources Officer). The SWRCB has agreed to continue these investigations independent of the EIR/EIS process. The determinations of the EIR/EIS are not in dispute by the project sponsors or concerned agencies. What is important is that the necessary information was developed and evaluated in preparing the findings of the EIR/EIS and is available to those who need to know the details, such as the National Park Service. The need to present further detailed information in the EIR/EIS appears to the authors to be unnecessary and would not alter the findings of potentially significant impact.

3. The locations are all within Lake County in the Clear Lake Basin. The identified sites potentially would be affected by construction of the proposed pipeline, including potential loss of cultural materials. The sites are described in the ethnographic literature and identified as Southeastern Pomo, Lake Miwok, and Wappo. The historic villages that are "Native American" are sites that were occupied in historic times (Nineteenth and early Twentieth Century) by indigenous Native American people, as opposed to historic villages occupied by people of European descent. The village sites were named Kulai (Southeastern Pomo, location presently unclear), Kuubdai (Southeastern Pomo, location presently unclear), Ciccapukut (Lake Miwok), Tuleyomi (Lake Miwok), Killiyo-kepukut (Lake Miwok), Sisiyome (Lake Miwok) and Petinoma (Lake Miwok or Wappo). Hut mutul, a Wappo summer camp, also may be in the area of potential affect of the project. As noted, two of the village sites have uncertain locations.

4. Some of the identified cultural resource sites have been previously investigated. All are considered potentially significant, and therefore, possibly eligible for the National Register. Further investigation of these sites will be required.

5. The impact significance criteria presented in the EIR/EIS on pages 5-69 through 5-71 are developed from the cited CEQA Guidelines Appendices G, and K, the latter specifically directed to cultural resource evaluations. Requirements of the National Historic Preservation Act are embodied in the impact criteria, and compliance with Section 106 of the National Historic Preservation Act is specifically identified as a requirement in Section 9 of the EIR/EIS. Citation of the Native American graves Protection and Repatriation Act is mentioned in the EIR/EIS because there is a potential for encountering burials, a possibility that has since been proven real by recent excavations in Lower Lake on the pipeline route.

6. See Response to Comment No. 1.

7. The comment is noted by the lead agencies.

DAN BROWN, U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT LETTER OF JULY 25, 1994

1. The comment is acknowledged. The following mitigation measure is added to the EIR/EIS, page 1-30:

   "Mitigation Measure 5.2.2.3.F. Construction, seeding and fertilizer shall be completed by October to protect disturbed soils, reduce rainfall impacts and possible sediment load dispersal into the unnamed stream."

2. The comment is acknowledged. The following mitigation measure is added to the EIR/EIS, page 1-30:

   "Mitigation Measure 5.2.2.3.G. Within the 150 feet stream buffer, straight line measurement, of the unnamed stream, use an excavator (back-hoe) to extract road soils/materials and haul material to disposal site, not on BLM land. Cut banks within the 150 foot buffer shall be hydromulched using rates A and B below. There should be no fill material down slope from the new road within 50 feet of the stream buffer.

   A. Seed Rate: 50 lbs./acre of California certified wymmera ryegrass
   B. Fertilizer: 400 lbs./acre of 12-16-16
   C. Rice Mulch: 1,000 lbs./acre applied evenly overfill slope."

3. The comment is acknowledged. The following mitigation measure is added to the EIR/EIS, page 1-30:

   "Mitigation Measure 5.2.2.3.H. Fill slopes out of the 150 foot buffer shall be seeded, fertilized and mulched to achieve a 75 percent vegetative cover using mulch rate C in Mitigation Measure 5.2.2.3.G."

4. The comment is acknowledged. The following mitigation measure is added to the EIR/EIS, page 1-30:

   "Mitigation Measure 5.2.2.3.I. Water shall not be taken from the unnamed stream for construction purposes."

5. The comment is acknowledged. The following mitigation measure is added to the EIR/EIS, page 1-30:

   "Mitigation Measure 5.2.2.3.J. Fuel materials shall not be stored within the 150 foot stream buffer."

6. The comment is acknowledged. The following mitigation measure is added to the EIR/EIS, page 1-30:

   "Mitigation Measure 5.2.2.3.K. Any hazardous spill(s) of fuels, chemicals, or unknown fluids shall be immediately reported to the appropriate state, county and federal hazardous materials specialist. In case of a hazardous spill on BLM land, contact Dave Fatch, Hazardous Materials Specialist, at (707)468-4053 or Renee Snyder, Clear Lake Area Manager, at (707)468-4070, BLM office in Ukiah."

7. The comment is acknowledged. The following mitigation measure is added to the EIR/EIS, page 1-30:

   "Mitigation Measure 5.2.2.3.L. All trash, cans, debris shall be disposed of in an authorized refuge site."

8. The comment is acknowledged. The following mitigation measure is added to the EIR/EIS, page 1-30:

   ""Mitigation Measure 5.2.2.3.M. BLM shall have a project coordinator occasionally visit the work site when work is performed on BLM land."

9. The comment is acknowledged. The following mitigation measure is added to the EIR/EIS, page 1-30:

   "Mitigation Measure 5.2.2.3.N. A BLM employee shall be notified before work on BLM land commences.
   Renee Snyder (707)468-4070
   Greg Managan (707)468-4078
   Rich Estabrook (707)468-4052 or
   Dan Brown (707)468-4049"

10. The comment is acknowledged. The following mitigation measure is added to the EIR/EIS, page 1-30:

    "Mitigation Measure 5.2.3.14.E. BLM shall monitor protective vegetative prescriptions approximately 1 year after project completion."

11. The comment is acknowledged. The following mitigation measure is added to the EIR/EIS, page 1-30:

    "Mitigation Measure 5.2.1.6.G. In the event of any road or construction failure on BLM land, corrective measures shall be undertaken."

    The memorandum of Greg Mangan regarding fishery resources and sediment control is herein incorporated into the EIR/EIS record.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY LETTER OF JULY 26, 1994

1. LACOSAN currently is carrying out system wide improvements in infiltration and inflow (I/I) in the SERWTP service area. Similarly, water conservation programs are a required element of LACOSAN planning in its service area. See Response to Comment No. 4 of the State Water Resources Control Board.

2. The comment is noted by the lead agencies. Consultation with the Corps of Engineers will be required, as indicated in the EIR/EIS.

3. The mitigation measures identified in the Draft EIR/EIS, if implemented, would achieve the compliance with Section 401(b) of the Clean Water Act. Consultation with the Corps of Engineers will be carried out to ensure that these measures adequately satisfy all requirements of the Act. The Mitigation and Monitoring Plan will specify all measures that must be implemented as conditions on the Use Permit for the project.

4. The comment is noted by the lead agencies.

5. The use of silt curtains and other means to reduce turbidity during construction have been identified as a mitigation measure. See Response to Comment No. 3 of the Lake County Flood Control, Memorandum of Sue Arterburn to G.R. Shaul.

    As recommended by the EPA, the following mitigation measures are added to the EIR/EIS:

    "Mitigation 5.2.2.4.C. Bottom sediments should be sampled for contaminants prior to construction of the lake intake structure and pipeline. Results of the samples should be conveyed to the California Department of Fish and Game, Lakebed Management, and Lake County Department of Environmental Health. In the event that levels of contamination are sufficient to be of concern to public health or to wildlife, LACOSAN should meet with these agencies to identify appropriate mitigation to minimize risks."

    "Mitigation 5.2.3.9.B. As part of the Lakebed Alteration Agreement, LACOSAN should consult with Lakebed Management and the California Department of Fish and Game to determine the appropriate scope and schedule for carrying out a survey of fishery habitat at the site of the proposed intake and pipeline structure in Clear Lake."

As stated in Mitigation Measure 5.2.3.9, installation of the Clear Lake intake pipeline would not occur during the adult spawning season. In addition, the intake would draw water from 28 feet below the surface of the lake, which would not affect fishery habitat.

The Mitigation and Monitoring Plan will contain an emergency response plan that addresses appropriate clean-up and restoration requirements in the event of a spill.

6. See response to Comment No. 1 of the U.S. Fish and Wildlife Service.

There are no current requests for appropriations or allocations from Clear Lake. Future requests for same are speculative. The water drawn from the lake as make-up water would decrease over time as wastewater increases in the service area. At the same time, water conservation programs are anticipated to reduce water demand per unit household.

LACOSAN is in the process of negotiation for purchase of use water for which Yolo County has adjudicated rights. An agreement has not yet been signed.

Yolo County Flood Control and Water Conservation District (YCFCWCD) sells water primarily to agricultural and municipal customers. It has participated in the State Drought Water Bank. In most years, YCFCWCD does not use all the Clear Lake water to which it has rights. In years of drought, the Solano Decree establishes priorities for curtailment of water supplied by the YCFCWCD. Highest priority is assigned to domestic water users, followed by agriculture and then by industrial users. The proposed project use would be considered an industrial use, and therfore, would be among the first of YCFCWCD's customers to have its supply reduced. In the history of the YCFCWCD, there has been no instance in which domestic water supply was curtailed. In general, planning studies for the project indicate that the project might receive some curtailment of supply about once in every 12 years. Present indications from Yolo County are that this is a preferable coarse of action to the prospect of having treated wastewater discharged into Cache Creek. In sum, current arrangements would prevent the project withdrawal from affecting the supplies of domestic or agricultural users.

7. Increases in emissions in the Southeast Geysers are not anticipated to occur because of the project. The BLM will consult with the Lake County Air Quality Management District and Northern Sonoma County Air Pollution Control District to determine if the need exists to demonstrate conformity with Section 176 (c) of the Clean Air Act.

As discussed in the Draft EIR/EIS, the project would accommodate an increase in residential and commercial development in the LACOSAN SERWTP service area. New residents and workers would generate additional emissions within the Lake County Air Basin primarily through additional vehicle trips and vehicle miles traveled (VMT); however this increase would be more than offset by the decrease in emissions per vehicle-mile expected to occur into the future. The reasons for the decrease in emissions per vehicle mile are the natural rate of vehicle turnover which has the effect of replacing older, more polluting vehicles with newer vehicle manufactured to meet more stringent emissions standards and the change in gasoline composition beginning in 1996 (i.e. California Phase II gasoline).

Between 1993 and 2005, composite motor vehicle emissions (per vehicle mile traveled) are expected to decrease by 63% for CO, 67% for HC, and 41% for NOx based on ARB's EMFAC7F emissions factors. SOx emissions from motor vehicles would be negligible with

the conversion to Phase II (low-sulfur) gasoline. PM10 emissions from motor vehicle use would increase between 1993 and 2005 since dust entrainment is the major component of motor vehicle PM10 (rather than exhaust). However, the increase in motor-vehicle-related PM10 would not be expected to cause violations of state PM10 standards given the low background concentrations in the Basin (see Table 4.6.1.1). Thus, while the cumulative impact on PM10 would be adverse, it would not be significantly adverse.

8. Considerable comment has been received by the lead agencies about the very large size of the EIR/EIS. For this reason, in compliance with NEPA and CEQA, much information has had to be presented in abridged form with appropriate referencing. It is recognized that this creates an inconvenience for reviewers. However, it is believed that additional detail in the current EIR/EIS on other designs and alternatives that have been dropped from consideration would not substantially enhance the ability of decision-makers to evaluate the current proposal which has evolved from a very lengthy and costly planning and review process.

9. The comment is noted by the lead agencies.

10. A commitment by the project sponsors to continued monitoring of seismicity in the Southeast Geysers is included as part of the proposed project.

11. As noted in the EIR/EIS, the two inches of water taken from the lake in a given year represents a theoretical equivalent intended to illustrate the magnitude of the diversion. The diversion, however, would not mean that the water level of Clear Lake would drop two inches at any point in time or over an extended period. This is because water level in the lake is constantly fluctuating because of the balance of inflow (from surface runoff, rainfall directly into the lake, and groundwater supply) and outflow (from evapotranspiration, diversions, and spills over the dam). It is estimated, for example, that evaporation alone accounts for a theoretical loss of 36 - 40 inches of water off the lake each year.

    Cumulative impacts on Clear Lake probably would be negligible. It is difficult to quantitatively assess the cumulative impact of the diversion because of the above considerations about fluctuations of the lake level. If one were to assume, as a theoretical case, a steady state (inflow and outflow in exact balance) in which the two-inches of diversion were an observable drop in lake level from 0 Rumsey, the effect on the water level of the lake itself would be negligible. As a rule of thumb, the volume of water represented by a two-inch drop in lake level would equate to about 85 acres reduction in lake surface area. This represents about 0.002 percent of the 39,600-acre surface of the lake when it is at 0 Rumsey. There is no available mapping at a scale (horizontal or vertical scale) that can accurately depict a two-inch drop in the lake level. It is assumed that most of the observable 85-acre reduction would be expressed in low-lying areas of the lake perimeter such as wet lands. Under this scenario, there possibly could be some drying-out of the edges of the wetlands affecting shallow-rooted plants, but sufficient saturation of the soils in those areas probably would remain to maintain the wetland and riparian vegetation which has rooting depths greater than two inches. Some surface ponding of water would be lost in those areas and the habitat for invertebrates and fish that may occupy them.

    The above scenario, however, is purely artificial because inflow/outflow balance in Clear Lake occurs only on a transitory basis. There are continuous cycles of water fluctuation in the lake on a long-term, seasonal and daily basis. These fluxes substantially influence the factors which support the lake, shore and wetland environments of Clear Lake. The worst

case scenario would be the possibility of an extended drought that would tip the balance of these hydrologic processes toward outflow far in excess of inflow. However, the impact of the proposed project diversion under such conditions would not occur because of the contractual limitation that would be placed on the diversion by YCFCWCD. YCFCWCD could not exceed a diversion beyond its adjudicated water rights under any circumstance. The project diversion is contained within these limitations of that water right.

12. The recommendation will be considered by the lead agencies.

13. Currently there is no plan to provide additional chlorine treatment to the effluent. It is possible that chlorine may be added in the future, although the Lake County Air Quality Management District does not anticipate any odorous emissions problems. If a chlorine additive were to be used, potential impacts to fish and wildlife would be minimal. The effluent pipeline would be above ground at three creek crossings, Clayton Creek, Copsey Creek, and an unnamed tributary to Sweet Springs Creek. A break in the pipeline at one of these crossings would allow the chlorine-treated effluent to discharge into the creek and possibly affect fish and wildlife. The amount of chlorine that would be applied is not known at this time, but only a small amount would be needed to diminish odorous emissions. A break would have to occur at one of these three locations and discharge effluent for a substantial amount of time before the chlorine would be at levels high enough to affect fish.

14. The recommendation will be considered by the lead agencies.

15. The recommendation will be considered by the lead agencies.

16. There are no hydrologic data available on flood flow near any of the locations where the pipeline would cross streams. As noted in the EIR/EIS, most of the stream crossings are small ephemeral or intermittent streams with small channels. None of these streams is likely to have sufficient erosive energy to uncover a pipeline buried to a depth of three to five feet or to break the pipeline.

    The larger watercourses, including Clayton Creek, Copsey Creek, Big Canyon Creek, Cockerell Creek, and Putah Creek have substantially greater flood hazards and in flood have significant erosive power. These watercourses display either incised channels (Clayton, Copsey, and Cockerell Creeks), or wide cobble-bedded channels (Big Canyon and Putah Creeks) at the locations of the proposed pipeline crossings. Both conditions are indicative of flood flows of large volumes,

    The Clayton Creek crossing would be a span crossing at the bridge. The bridge stands about 20 feet above the channel bottom and has no evidence of being undermined by channel erosion. The primary threat during a flood would be the potential for large debris entrained in the water to pile up against the pipe and bridge.

    Copsey Creek also is a span crossing for the northerly crossing at a height of about 25 feet above the channel bottom. In flood, this likely would be well above the water height. The chief concern would be related to undermining of the steep channel banks that would bear the pipeline and supports. During final engineering, an appropriated depth and form of anchoring may be needed.

In the upper (southerly) crossing of Copsey Creek, the pipeline would be buried. The channel is somewhat broader, is less incised here an has a fairly gentle gradient, therefore, and the erosive energy would be more distributed than at the northerly crossing. In flood the hazard would be uncovering of the pipeline cover soil.

The Big Canyon Creek crossing occurs in a wide area of the channel that is partly vegetated with willows and trees. A cobble and sand bed is present. The gradient is gentle. In flood, the water appears to reach a height of about four or five feet. The chief hazard would be erosion of the cover, exposing the pipeline to damage of cobbles. To accomplish erosion to a depth of several feet, this would have to be a flood of great size. The proposed plan would include trenching the creek, possibly to a depth greater than three feet. Concrete protection of the pipeline also may be used to anchor it and protect it from damage by moving bedload. The sand and cobble cover would be replaced over the top. The cobbles would protect the crossing in most flood flows.

Cockerell Creek would have a buried crossing. The incised creek has a cobble bottom and a moderate gradient (the site is just above the confluence with Putah Creek). The concern would be that flood waters would erode the channel bottom, exposing the pipeline.

Putah Creek has a very wide, sand and cobble bed. The gradient is gentle. Flood levels likely would reach four or five feet. This creek probably has the greatest erosive energy, but the width of the channel would distribute the erosive energy. Exposure of the buried pipeline would be the concern. Design for the crossing would be similar to that at Big Canyon Creek.

The EIR/EIS describes the general nature of emergency identification through an alarm system that indicates that a loss of pressure in the pipeline is occurring or a loss of water from the Childers Peak Regulating Tank. Specifics of an emergency response plan are a required part of the Mitigation and Monitoring Plan. It is worth noting that a break of the pipeline at a large stream crossing during a major flood of a size sufficient to break the pipe would not lead to a substantial increase in flood hazard or to a water quality problem. The diameter of the pipeline would limit the rate at which it would drain, and this likely would be small in comparison to the large flood flow. The dilution of the effluent in such a flood flow would result in insignificant water quality impact.

17. EO 12898 is identified in the EIR/EIS. The proposed project would pass only through the communities of Clearlake and Lower Lake. Neither community is predominantly characterized as minority. While data are not available, parts of the pipeline in the eastern part of Clearlake would pass through areas with many low-income residents. The service area of the SERWTP is the most economically depressed part of the county. The project would lower the debt service in this area. It is because of these socioeconomic conditions that some sources of grants would be made available to fund the project, e.g., from the Rural Development Administration.

    The impacts on these communities would be temporary, primarily related to construction disturbance in the City streets (which are largely unpaved and in poor condition). The primary impacts would be construction traffic and dust, similar to that which would occur elsewhere in the area during construction. There are no commercial enterprises in this area. In the long-term, it is likely that the community would benefit from the project because it would remove an obstacle to growth and, thereby, provide future job opportunities which are currently limited in the area.

The EIR/EIS has been made available at public facilities in Clearlake. Middletown, Lower Lake, and elsewhere in the county, as well as Sonoma, Mendocino and Yolo counties. There have been 12 workshops with presentations about the project at public forums, service groups and organizations. Notifications of hearings on the project have been made in local newspapers. There has been considerable coverage in the local new media about the project for a number of years. There appears to be a high amount of support throughout the area served by this project.

18. The following table presents information that is available on water quality standards.

TABLE 4.4.4-4
(Revised)

SERWTP Effluent Wastewater Quality and Applicable Water Quality Standards

Parameter	Effluent Quality in Reservoir	Water Quality Standard
Total Hardness	172 mg/L	--[a]
Calcium	32 mg/L	--[a]
Magnesium	22 mg/L	--[a]
Sodium	109 mg/L	--[a]
Potassium	13 mg/L	--[a]
Total Cations	8.49 meq/L	--[a]
Total Alkalinity (as $CaCO_3$)	187 mg/L	--[a]
Bicarbonate (HCO_3)	228 mg/L	--[a]
Sulfate	101 mg/L	--[a]
Chloride	64 mg/L	--[a]
Nitrate	10 mg/L	45 mg/L (NO_3)
Total Anions	7.80meq/L	--[a]
pH	8.1 units	Between 6.5 and 8.5 units
Specific Conductance	696 umho/cm	--[a]
Total Filterable Residue	348 mg/L	--[a]
Apparent Color	22 units	--[a]
Odor Threshold @ 60°C	3.3 ton	No limit; DO must be >1 mg/L
Turbidity	4.0 NTU	--[a]
MBAS	<0.05 mg/L	--[a]
Arsenic	<10 µg/L	5 µg/L
Barium	<100 µg/L	--[a]
Cadmium	<1 µg/L	10 µg/L
Chromium	<10 µg/L	33,000 µg/L (Chromium III); 50 µg/L (Chromium IV)
Copper	<50 µg/L	1,000 µg/L
Iron	150 µg/L	--[a]
Lead	<5 µg/L	50 µg/L
Manganese	100 µg/L	--[a]
Mercury	<1 µg/L	0.012 µg/L
Selenium	<5 µg/L	10 µg/L
Silver	<10 µg/L	50 µg/L
Zinc	<50 µg/L	5,000 µg/L
Endrin	<0.02 µg/L	0.02 µg/L
Lindane	<0.4 µg/L	0.4 µg/L
Methoxychlor	<10 µg/L	10 µg/L
Toxaphene	<0.5 µg/L	0.5 µg/L
2,4-D	<10 µg/L	100 µg/L
2,4,5-TP Silvex	<1 µg/L	1 µg/L
BOD_5	8 µg/L	40,000 µg/L (30 day average); 80,000 µg/L (daily maximum)

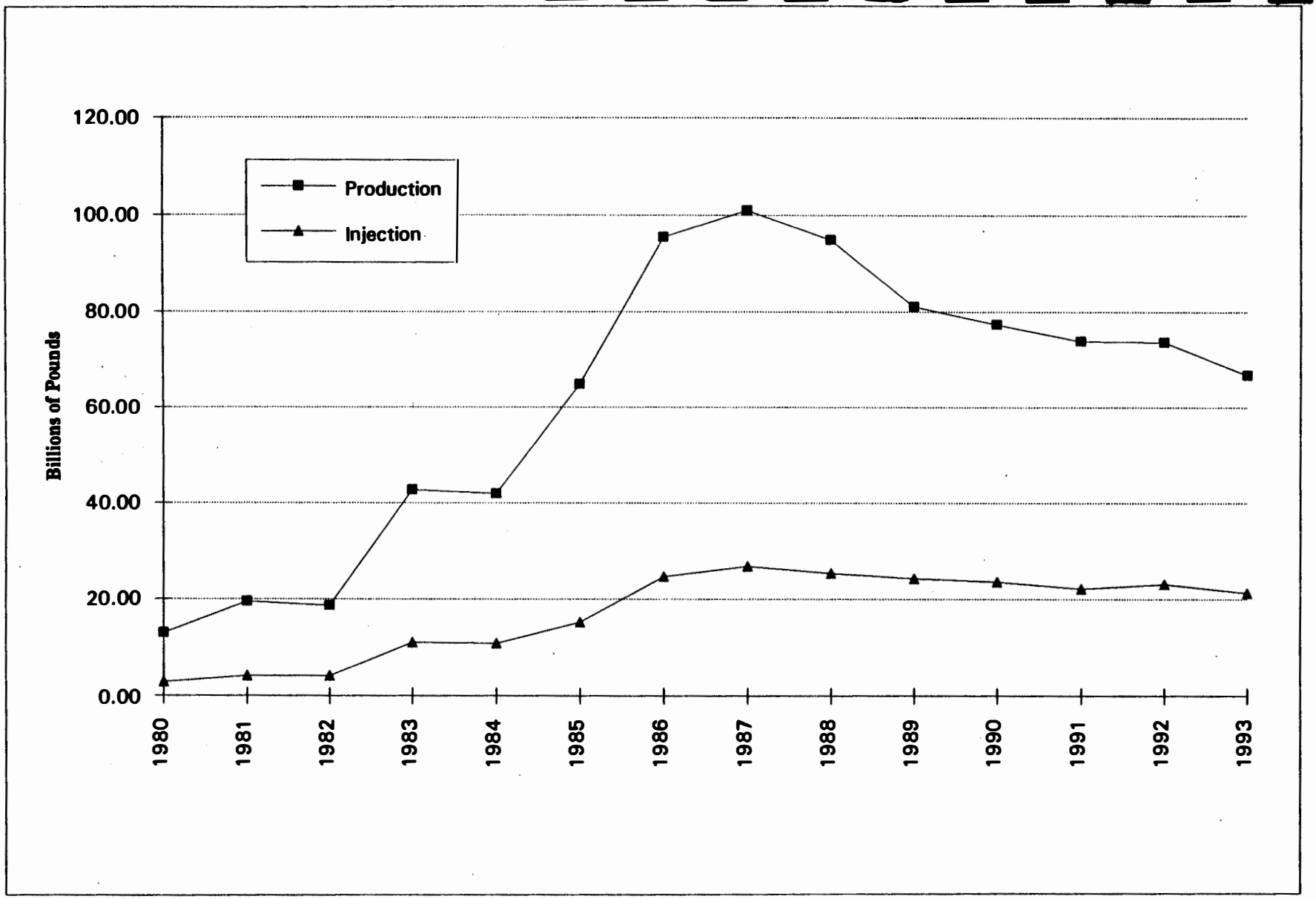
[a] According to the Central Valley Regional Water Quality Control Board, there is no set standard for this parameter for wastewater. However, a limit may be established if unusually high levels are detected.

19. EPA's General Conformity Rule (i.e., conformity to the applicable federal air quality plan) applies to areas designated "nonattainment" or "maintenance" with respect to federal ambient air quality standards. As discussed on page 4-139 of the Draft EIR/EIS, Lake County and northern Sonoma County are designated as "attainment" or "Unclassified" with respect to federal ambient air quality standards. As such, no federal air quality plan has been developed for either of these areas. Therefore, a conformity determination is not likely to be required.

EDIT TO THE EIR/EIS REQUESTED BY THE LEAD AGENCIES

Figure 4.15.1-A and 5.3.1-A of the Draft EIR/EIS contained incorrect information about injection and production. The totals indicated on the previous charts included Unocal's total production in The Geysers rather than that specifically for Units 18 and 20. The attached figures are the revised graphs with the corrected information specific to the project area.

The intermittent stream course on the south side of Childers Peak was incorrectly identified as an unnamed tributary of Big Canyon Creek. This was identified in the Draft EIR/EIS in Table 4.4.2-1 (page 4-73) and Table 5.2.2-1 (page 5-27) as the crossings of the Geysers Effluent Pipeline at Stations 68-72 and 72.5. The unnamed stream is, in fact, a tributary of Putah Creek. This tributary joins Putah Creek a little downstream of the confluence of Putah Creek and Big Canyon Creek.

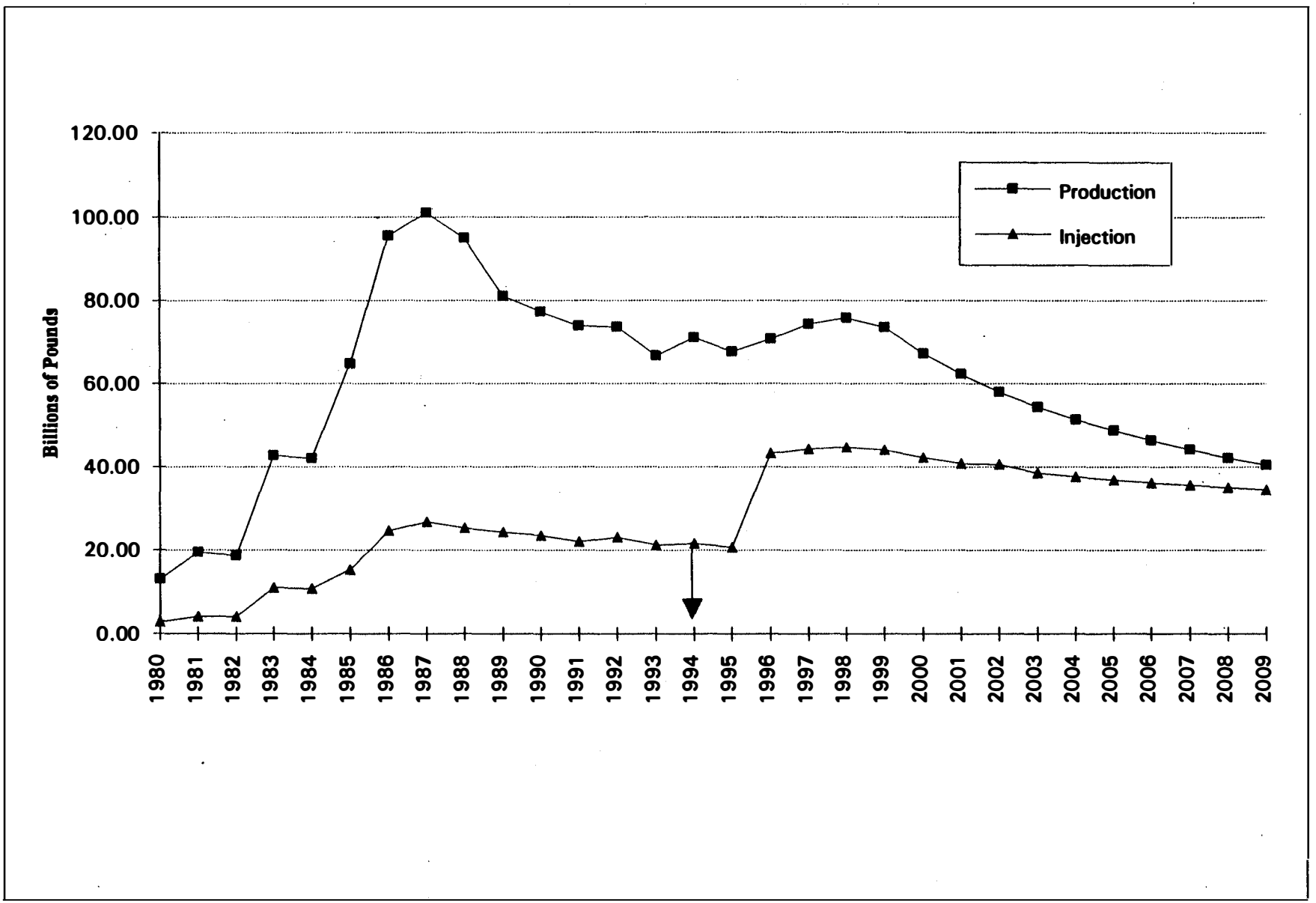


Southeast Geysers Effluent / 920586 ■

SOURCE: Unocal

Figure 4.15.1-A

Combined Annual Totals of NCPA, Calpine and Unocal Operations
in the Southeast Geysers for NCPA Plants #1 and 2 and PG&E Units 13, 16, 18 and 20

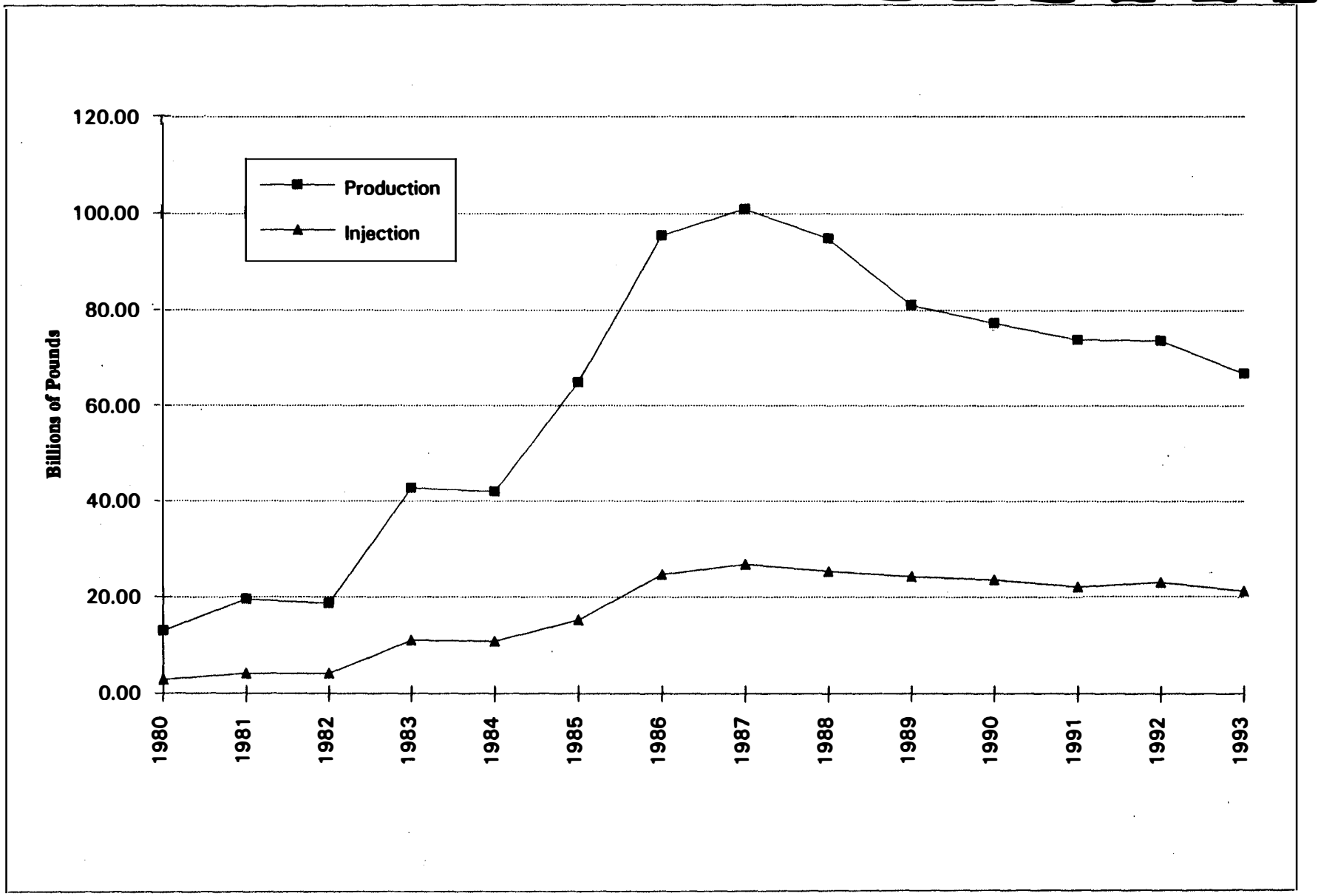


Southeast Geysers Effluent / 920586 ■

SOURCE: Unocal

Figure 5.3.1-A

Combined Annual Totals of NCPA, Calpine and Unocal Operations in the Southeast Geysers for NCPA Plants #1 and 2 and PG&E Units 13, 16, 18 and 20



Southeast Geysers Effluent / 920586 ■

SOURCE: Unocal

Figure 4.15.1-A

Combined Annual Totals of NCPA, Calpine and Unocal Operations
in the Southeast Geysers for NCPA Plants #1 and 2 and PG&E Units 13, 16, 18 and 20

COMMENTS RECEIVED AT THE PUBLIC HEARINGS AND RESPONSES

COMMENTS RECEIVED AT THE PUBLIC HEARINGS AND RESPONSES

Most comments and questions presented at the public hearings are the same as those presented in the preceding portion of this report, and many were offered by the same individuals who submitted written comments. These comments and responses to them will not be repeated here. The following are specific comments not covered by the preceding discussions. All comments are paraphrased.

PUBLIC HEARING OF JUNE 30, 1994

Commissioner Louise Talley

Comments: There is concern about affecting business operations. There should be mitigation to minimize these impacts on commercial businesses. Can construction avoid peak business periods? Would there be delays in construction due to encountering cultural resources? Is Clear Lake Oaks County Water District interested in joining the project? Will there be a local hire program? Will bald eagles be affected?

Response: As a general rule, one may expect minimal disturbance of businesses. There are relatively few businesses along the route and most have alternate access. There will be nuisance dust and noise. It is possible that an open trench may exist in streets for about two weeks. This would not cut off access to businesses as steel plates can be placed over the trench. The only substantial limitation might be that heavy trucks could not drive across the plate for deliveries. This can be handled with proper advance notification of businesses, as is suggested as mitigation in the EIR/EIS.

The following mitigation measure is added to the EIR/EIS, page 1-49:

"*Mitigation Measure 5.2.11.4.A. Construction activities should be designed to minimize obstruction to the access to commercial businesses.*"

Cultural resources are present on the proposed pipeline route. Some of these are important resources, and the process of determining their nature and significance can be very time consuming and costly.

Originally the Clear Lake Oaks County Water District (CLOCWD) declined participation in the project. This remains true at present. Recently, LACOSAN staff were invited to a meeting of CLOCWD to discuss the project. CLOCWD is conducting engineering feasibility studies of their own to deal with their wastewater disposal problem. They have indicated that they would consider joining the project if another feasible solution is not found. Participation by CLOCWD would reduce the needed volume of lake water withdrawal.

There will be a local hire program.

The EIR/EIS indicates that there will be no impact on bald eagles.

Commissioner Jim McMurray

Comment: Will local roads and bridges be affected and left in good repair?

Response: The EIR/EIS contains mitigation requirements that will repair roads to equal or better condition than prior to construction. A survey of bridges will be conducted to ensure that they will not undergo damage from heavy loads.

Commissioner Al Schulz

Comments: Who is responsible for proper construction and meeting of specifications? Will there be a rate increase?

Response: There is an Oversight Committee which is responsible for the project construction. Boyle Engineering Corporation would be retained by the Committee to provide design and construction oversight.

There will be a rate increase to cover LACOSAN's funding responsibilities. The remainder of the costs will be from industry and grants.

Representative of the Middletown Press Democrat

Comment: Are burials expected to be encountered?

Response: Yes. Since the public hearing, a burial was encountered in Lower Lake in a road along the proposed pipeline alignment.

PUBLIC HEARING OF JULY 14, 1994

Bob Miller, Operating Engineers of Santa Rosa

Comments: The proposed project is a logical, straightforward solution to a difficult problem. It will provide jobs and economic benefits. It will create 150 construction jobs. The Santa Rosa effluent pipeline (to The Geysers) is cost prohibitive and offers many disadvantages.

Response: The comment is noted by the lead agencies.

Eileen Diener, Lake County Rancher

Comments: The project area has underground springs and rivers and is a vital resource. Injecting wastewater into groundwater will endanger the resource. There is concern about bacteria survival in the water and groundwater. Would you drink this water?

Responses The project would not discharge wastewater to surface or groundwaters. The water would not be used for drinking water.

Robert Stark, Friends of Cobb Mountain

Comments: There has to be a seismicity effect. David Oppenheimer of the U.S. Geological Survey showed local residents how seismicity has increased. A PG&E report once indicated that energy development in The Geysers should be regarded as having a 30-year life and should not be reused. The day will come when the lake water will have to go back to the groundwater system and eventually used for drinking water. I have received many phone calls from concerned citizens about the project. I do not want to stop the project, but I believe it needs to be the best possible. It is not likely that wastewater will reach Clear Lake. Water quality probably would not be a problem. The chief concern is with the pipeline and lift stations. Commitment to the Geysers will limit other uses.

Responses: Induced seismicity is analyzed in the EIR/EIS. The analysis indicates that there is an effect of geothermal operations on microseismicity. However, no significant impact is expected with regard to potentially damaging seismic events.

Ann Hackett, Resident

Comment: Who is liable in the event earthquakes do occur?

Response: See response to Comment No. 5 of the Friends of Cobb Mountain letter.

Commissioner Al Schulz

Comments: Many of my concerns about control of the project have been resolved after a meeting with Dean Cooley (of PG&E), specifically the agreements of the participating parties will help to control overruns. We cannot afford to let Lower Lake and Clearlake stagnate. There is no concrete evidence that there will be increased seismicity.

Response: The comments is noted by the lead agencies.

Commissioner Jim Murray

Comment: Will the existing wastewater spray irrigation systems be retained?

Response: At this time LACOSAN would prefer to retain the spray system as a back-up system to maintain flexibility in the system. Most of the current wastewater disposed through spray irrigation will be used in the Geysers Effluent Pipeline.

Commissioner Ed Robey, Jr.

Comment: Has this type of project ever been done before?

Response: Wastewater injection has been carried out in a number of locations across the United States. This is the first project in the United States to use treated wastewater in a geothermal environment for energy production. The total amount of water used in previous injection operations in The Geysers was substantial and included larger flow rates for individual injection wells. That water was primarily power plant condensate, the volume of which has declined to its current level. The total project water volume would restore that historic level of injection and

increase it to a somewhat greater level (see revised Figures 4.15.1-A and 5.3.1-A, included with this submission).

APPENDICES

APPENDIX A: Geologic and Hydrologic Maps

APPENDIX B: Letter to Supervisor Mackey and Response; Calpine Financial Assessment

APPENDIX A

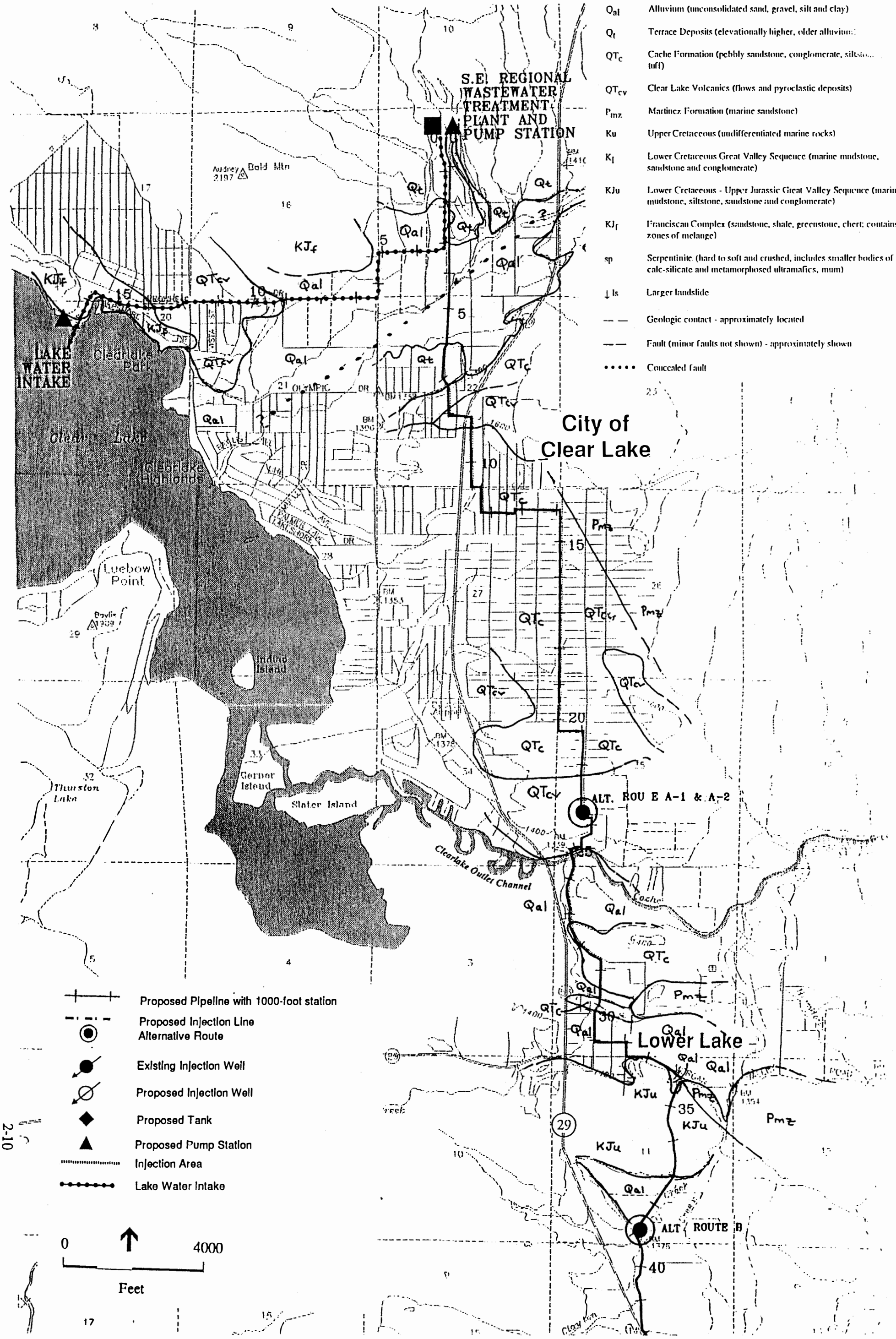


Figure 4.3.1-A
Geologic Map
Stations 0 to 40 and Lake Diversion Pipeline

SOURCE: Criterion

LEGEND

Q_{al}	Alluvium (unconsolidated sand, gravel, silt and clay)
Q_t	Terrace Deposits (elevationally higher, older alluvium)
QT_c	Cache Formation (pebbly sandstone, conglomerate, siltstone and tuff)
QT_{cv}	Clear Lake Volcanics (flows and pyroclastic deposits)
P_{mz}	Martinez Formation (marine sandstone)
Ku	Upper Cretaceous (undifferentiated marine rocks)
K_l	Lower Cretaceous Great Valley Sequence (marine mudstone, sandstone and conglomerate)
KJu	Lower Cretaceous - Upper Jurassic Great Valley Sequence (marine mudstone, siltstone, sandstone and conglomerate)
KJ_f	Franciscan Complex (sandstone, shale, greenstone, chert; contains zones of melange)
sp	Serpentinite (hard to soft and crushed, includes smaller bodies of calc-silicate and metamorphosed ultramafics, mum)
↓ ls	Larger landslide
— —	Geologic contact - approximately located
— —	Fault (minor faults not shown) - approximately shown
• • • • •	Concealed fault

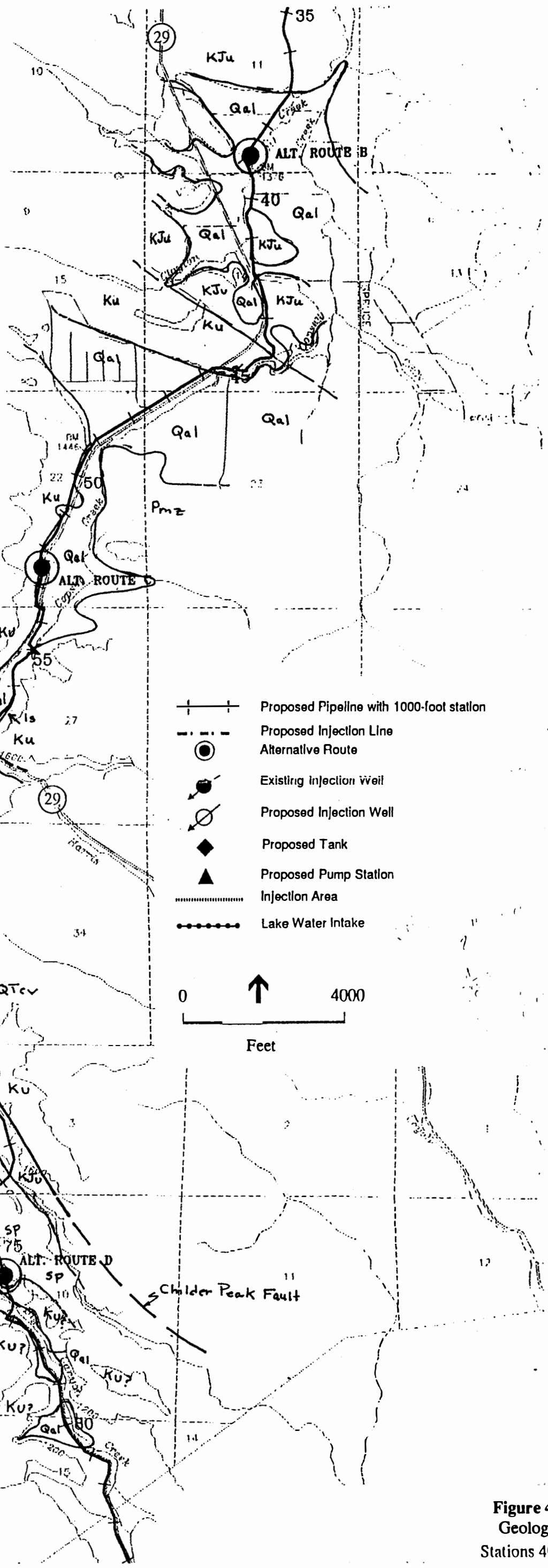


Figure 4.3.1-B
Geologic Map
Stations 40 to 80

SOURCE: Criterion

LEGEND

Q_{al}	Alluvium (unconsolidated sand, gravel, silt and clay)
Q_t	Terrace Deposits (elevationally higher, older alluvium)
QT_c	Cache Formation (pebbly sandstone, conglomerate, siltstone and tuff)
QT_{cv}	Clear Lake Volcanics (flows and pyroclastic deposits)
P_{mz}	Martinez Formation (marine sandstone)
Ku	Upper Cretaceous (undifferentiated marine rocks)
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sp	Serpentinite (hard to soft and crushed, includes smaller bodies of calc-silicate and metamorphosed ultramafics, mum)
↓ ls	Larger landslide
— —	Geologic contact - approximately located
— —	Fault (minor faults not shown) - approximately shown
• • • • •	Concealed fault
—+—+—	Proposed Pipeline with 1000-foot station
—·—·—	Proposed Injection Line
◉	Alternative Route
⬈●	Existing Injection Well
⬈⊘	Proposed Injection Well
◆	Proposed Tank
▲	Proposed Pump Station
·····	Injection Area
●●●●●●	Lake Water Intake

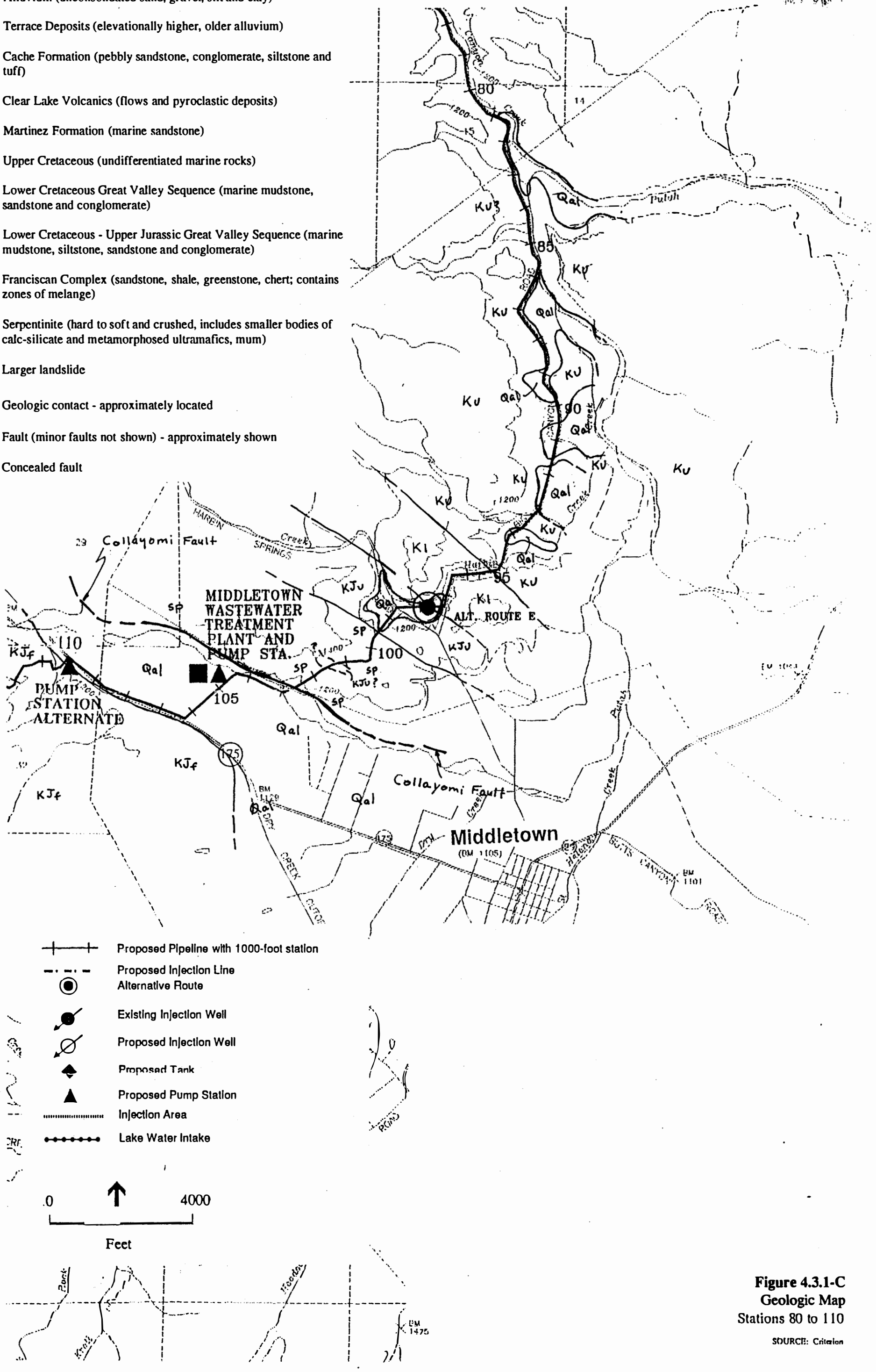
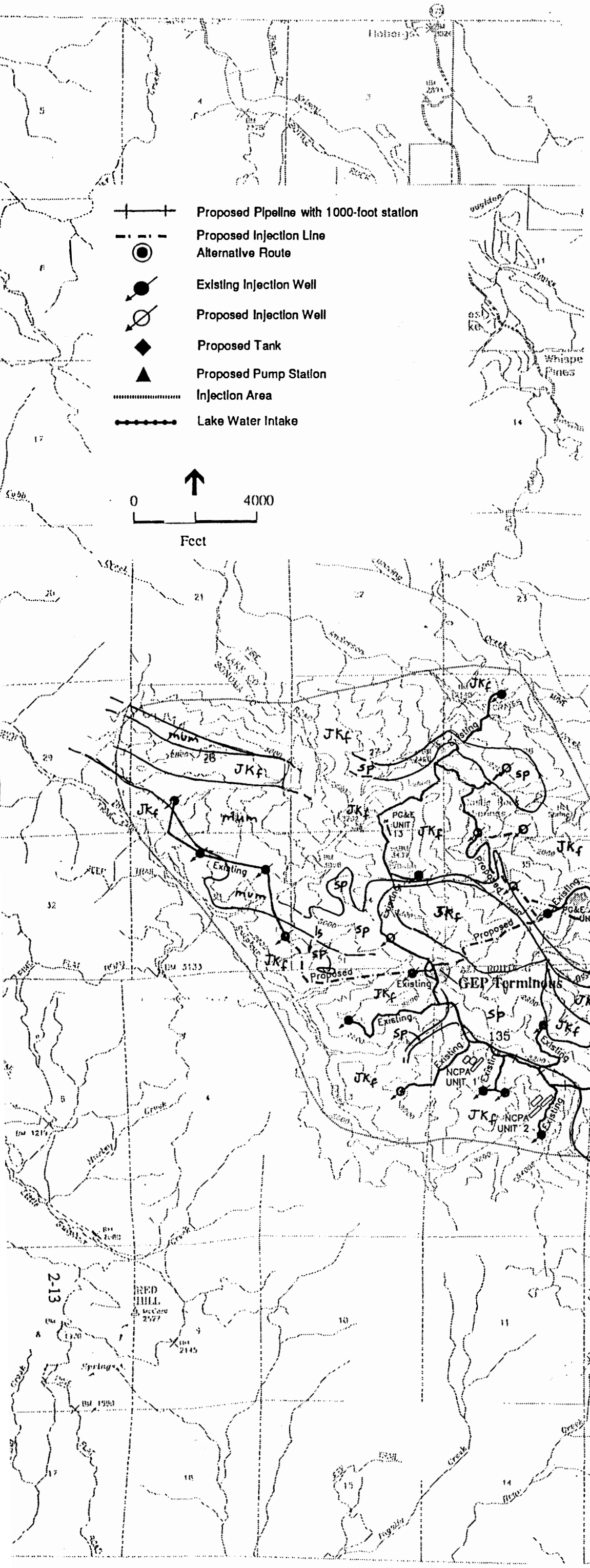


Figure 4.3.1-C
Geologic Map
Stations 80 to 110

SOURCE: Criterion



LEGEND

Q_{al}	Alluvium (unconsolidated sand, gravel, silt and clay)
Q_t	Terrace Deposits (elevationally higher, older alluvium)
QT_c	Cache Formation (pebbly sandstone, conglomerate, siltstone and tuff)
QT_{cv}	Clear Lake Volcanics (flows and pyroclastic deposits)
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KJu	Lower Cretaceous - Upper Jurassic Great Valley Sequence (marine mudstone, siltstone, sandstone and conglomerate)
KJ_f	Franciscan Complex (sandstone, shale, greenstone, chert; contains zones of melange)
sp	Serpentinite (hard to soft and crushed, includes smaller bodies of calc-silicate and metamorphosed ultramafics, mum)
↓ ls	Larger landslide
— —	Geologic contact - approximately located
——	Fault (minor faults not shown) - approximately shown
•••••	Concealed fault

Figure 4.3.1-D
Geologic Map
Stations 110 to 138.5 and End Distribution System

SOURCE: Criterion

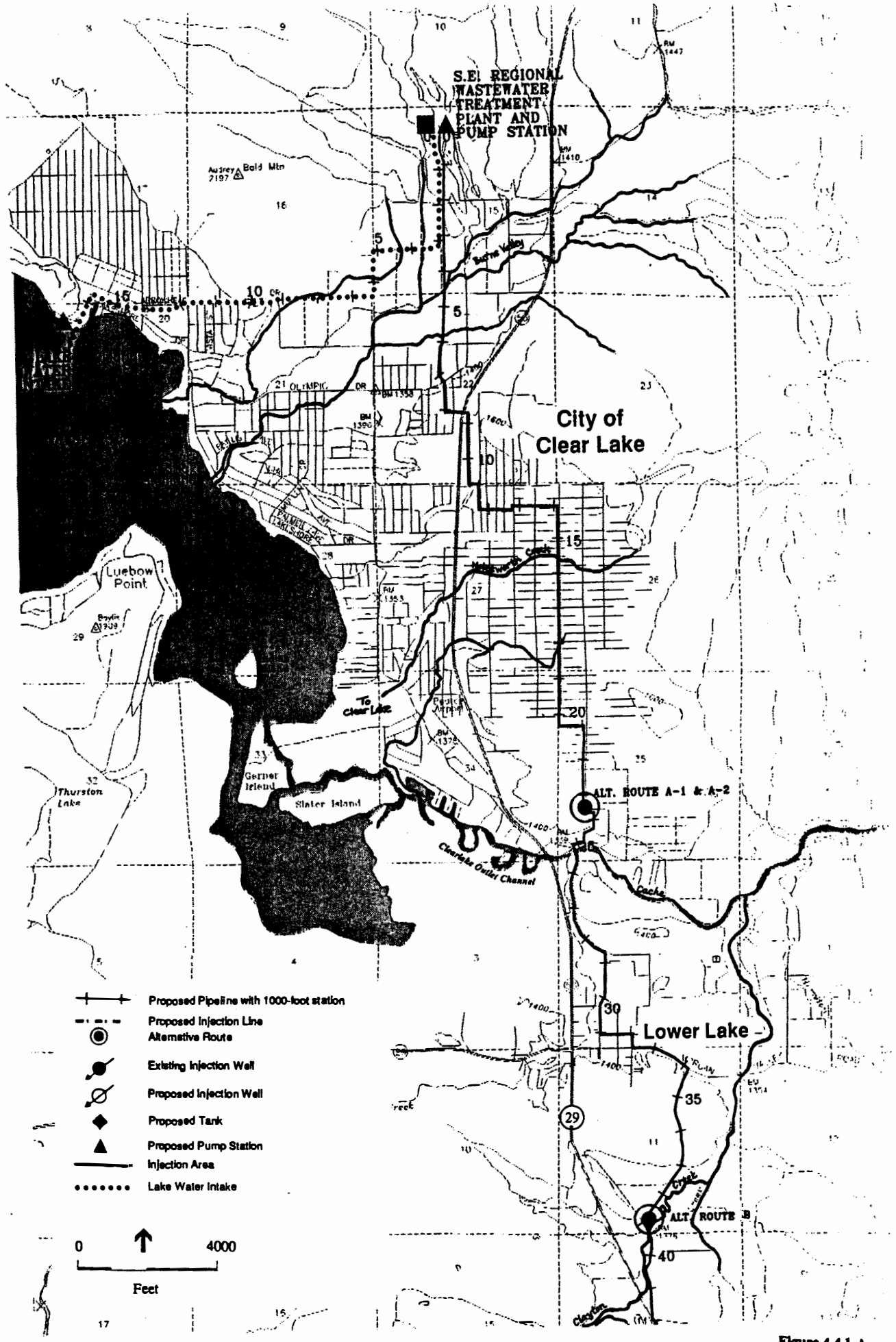


Figure 4.4.1-A
Stream Courses

SOURCE: Criterion

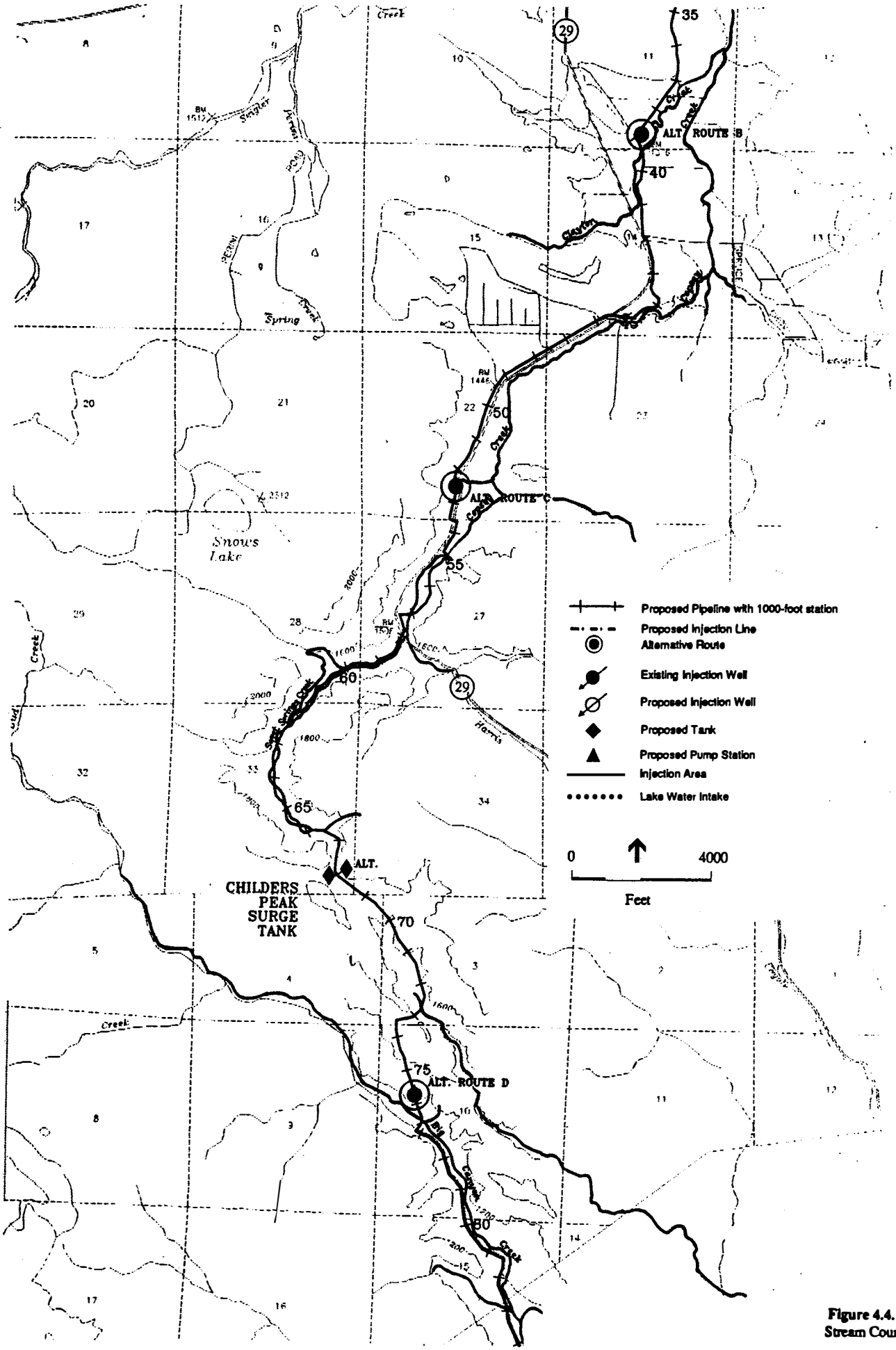


Figure 4.4.1-B
Stream Courses

SOURCE: Criterion

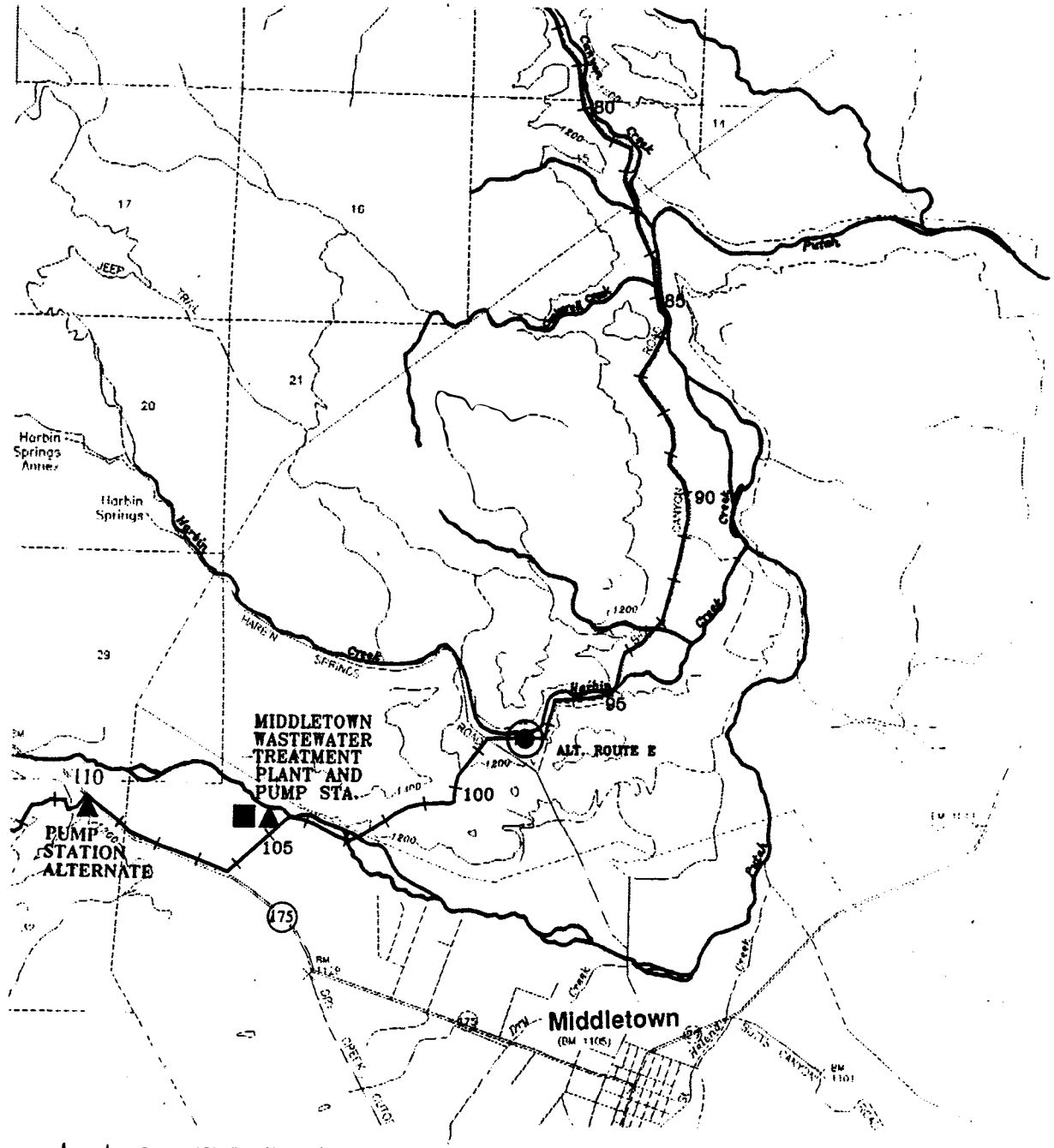


Figure 4.4.1-C
Stream Courses

SOURCE: Criterion

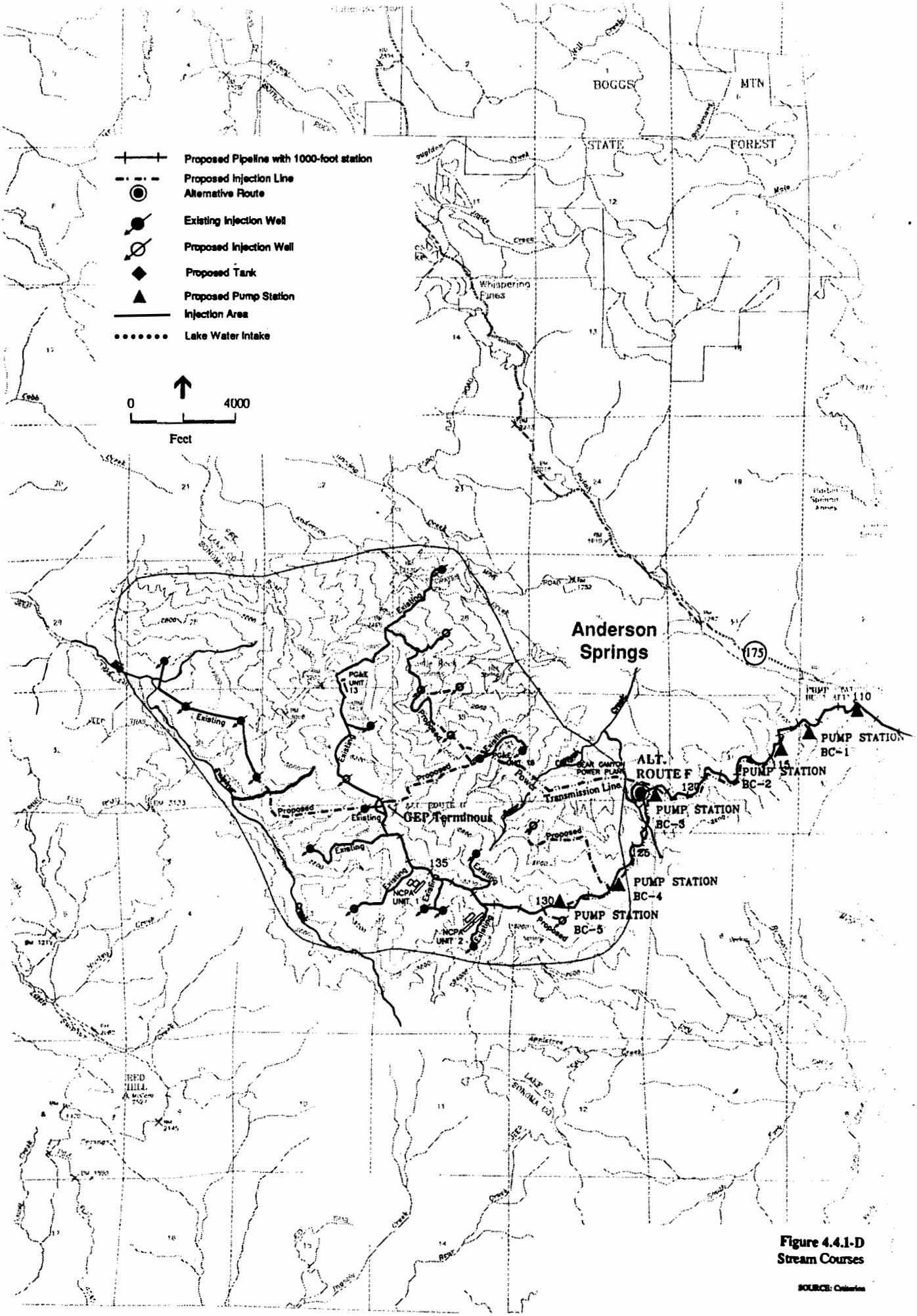
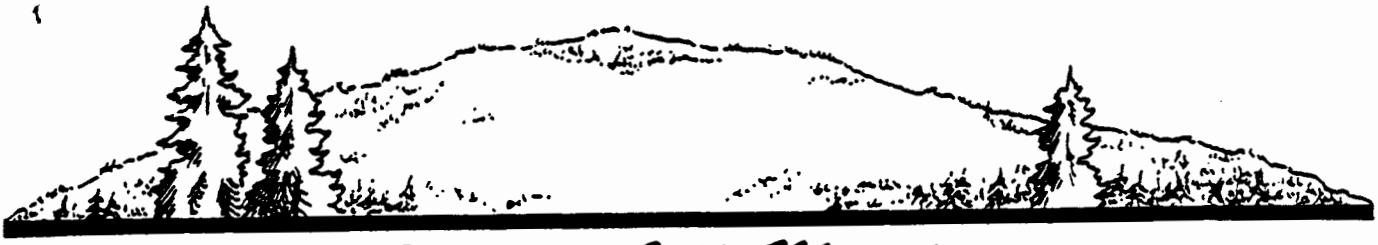


Figure 4.4.1-D
Stream Courses

SOURCE: Cnitarius

APPENDIX B



Friends of Cobb Mountain

May 11, 1993

Mrs. Karan Mackey, Chair
Board of Supervisors
County of Lake
Court House
Lakeport, CA 95453

Dear Supervisor Mackey:

I wish to express my appreciation for your very effective chairing of last Thursday's workshop at the Guenoc Ranch. You forthrightly called for all issues to be presented and for a cooperative spirit to be displayed by all parties in facing those issues.

Unfortunately, that cooperative spirit was not shared by the geothermal industry. We were appalled, and not a little disappointed, by their unwillingness to acknowledge any responsibility in the matter of local earthquakes and by their apparent intent to circumvent the issue entirely. This was most unfortunate. In the view of Cobb Valley and Anderson Springs residents, earthquakes induced by geothermal fluid extraction and by the injection of fluids into the reservoir is one of the two most important environmental issues relating to the proposed sewage effluent injection plan. The other is spring water pollution, but it is the issue of earthquakes that I am addressing here.

We have thus far generally supported the effluent injection proposal under conditions that are being presently pursued by Mark Dellinger. These are:

1. an expanded study of Geysers seismicity for a better understanding of the phenomenon,
   *
2. the development of reservoir management techniques to prevent an increase of the frequency or intensity of the quakes,

3. a provision for compensation of homeowners for damage to structures by quakes caused by geothermal operations.

POST OFFICE BOX 47 • COBB, CALIFORNIA 95426 • (707) 928-5376

Meeting these conditions obviously depends on industry acknowledgement of responsibility and willingness to cooperate. Our present support for the injection proposal is absolutely dependent on these conditions, and we will regretfully be forced to oppose the project if they are not effectively realized.

We are aware that the local Geysers earthquake issue has been almost systematically ignored in political circles, but we ask the Lake County Board of Supervisors to regard it as a serious matter in need of attention. We live with the quakes, and we are tired of them. Perceptible quakes occur two to three times per week, and heavier ones (magnitude 3.0 and above) occur on an averege of two to three times per month. They rattle our china, knock things off shelves, cause momentary anxiety when they happen, and frighten our guests. They have caused minor structural damage already, and will likely cause further damage in the future. The industry cannot afford to avoid this issue. It is fully acknowledged in the scientific community that geothermal operations in The Geysers field -- both fluid extraction and fluid injection -- are the major cause of the quakes which we experience.

I enclose for your information three professional papers and a list of the Geysers quakes over magnitude 3.0 which have occurred since March 1984. The recorded latitude and longitude places the epicenters of all but thirteen of the one hundred and twenty-eight listed quakes within The Geysers operational area. These thirteen are placed in brackets. I have highlighted the quakes of magnitude 3.5 and above. While the strongest quake listed was 4.9, it is significant to note that the 3.6 quake at 4:29 pm on January 18th, 1993 (listed as Jan 19, 1993, 2429 Greenwich Mean Time) was felt as the strongest to date by most Cobb Valley residents.

Anything that you and the Board can do to support our concern and to ensure industrial cooperation with the conditions which we have requested will be greatly appreciated.

Sincerely yours,

Hamilton Hess
Vice Chairman

cc: Members of the Board
Mark Dellinger
Calpine Corporation
Northern California Power Agency
Pacific Gas and Electric Company
California Energy Commission

COUNTY OF LAKE
PLANNING DEPARTMENT
Resource Management Division
Courthouse - 255 N. Forbes Street
Lakeport, California 95453
Telephone 707/263-2221

June 22, 1993

Mr. Hamilton Hess
Friends of Cobb Mountain
P.O. Box 47
Cobb, CA 95426

Dear Hamilton:

Karan Mackey has referred your May 11, 1993 letter to me for inclusion in the public scoping comments on the Southeast Geysers Effluent Pipeline EIR/EIS.

As you know, the EIR/EIS team is treating seismicity as an important issue. The team recently held a working session with USGS representatives to ensure that all relevant prior research is taken into consideration, and that the team's analytical approach is as sound as possible. Preliminary planning for a long-term monitoring network was also discussed.

Because of the issue's importance, the team agreed that as soon as the public draft EIR/EIS is issued, a special public meeting devoted exclusively to seismicity will be held near Anderson Springs or to allow interested persons an opportunity for discussing the draft impact analysis with its authors.

Again, we appreciate your interest and participation, and look forward to working with you.

Sincerely,

Mark

Mark Dellinger
Energy and Resource Manager

MD:dls

CALPINE CORPORATION

PRELIMINARY ASSESSMENT

LAKE COUNTY EFFLUENT

DISPOSAL AT THE GEYSERS

Presented to: Lake County Board of Supervisors
May 28, 1991

P.O. Box 11279, Santa Rosa, California 95406-1279

A FINANCING CONCEPT
LAKE COUNTY WASTE WATER DISPOSAL

1. TAX-FREE FINANCING

1.1 Potential Ownership/Financing Structures

In choosing the non-profit structure, we will achieve the following goals:

- Achieve the lowest cost method of disposing of Lake County's waste water
- Achieve lowest cost, most secure financing
- Utilize tax-exempt debt
- Avoid direct debt issuance by Lake County
- Provide financing flexibility
- Provide that the County will maintain ownership of the facility

1.2 Solution

- With the sponsorship of the County, form a non-profit Special Purpose Corporation ("SPC") to act as the financing entity and the nominal owner of the waste water transportation system.
- The SPC would issue tax-exempt non-recourse debt to finance the project. The SPC would contract with Calpine or another party for equipment, design, construction and operation of the project.
- The SPC would transport the County's waste water to the Water Customers for reinjection in their geothermal fields. The price of the transportation would be set to repay the bonds plus a debt service margin.
- Once the bonds were repaid, legal title to the water transportation system would automatically pass to Lake County.

This structure involves stand-alone, non-recourse, tax-exempt financing, no payments by the County for the disposal of its waste water, and limited construction and operation risks.

1.3 Project Financing Structure

The project financing structure is identified in the organization chart on the following page.

This structure is based on achieving the above goals. If the County prefers to issue the debt directly, the only change to our recommended structure would be to bypass the SPC. In this case the County would sell the water directly to the Water Customers. Our intent is to work with the County to find a structure which achieves all party's goals.

LAKE COUNTY WASTE WATER PROJECT

FINANCING STRUCTURE

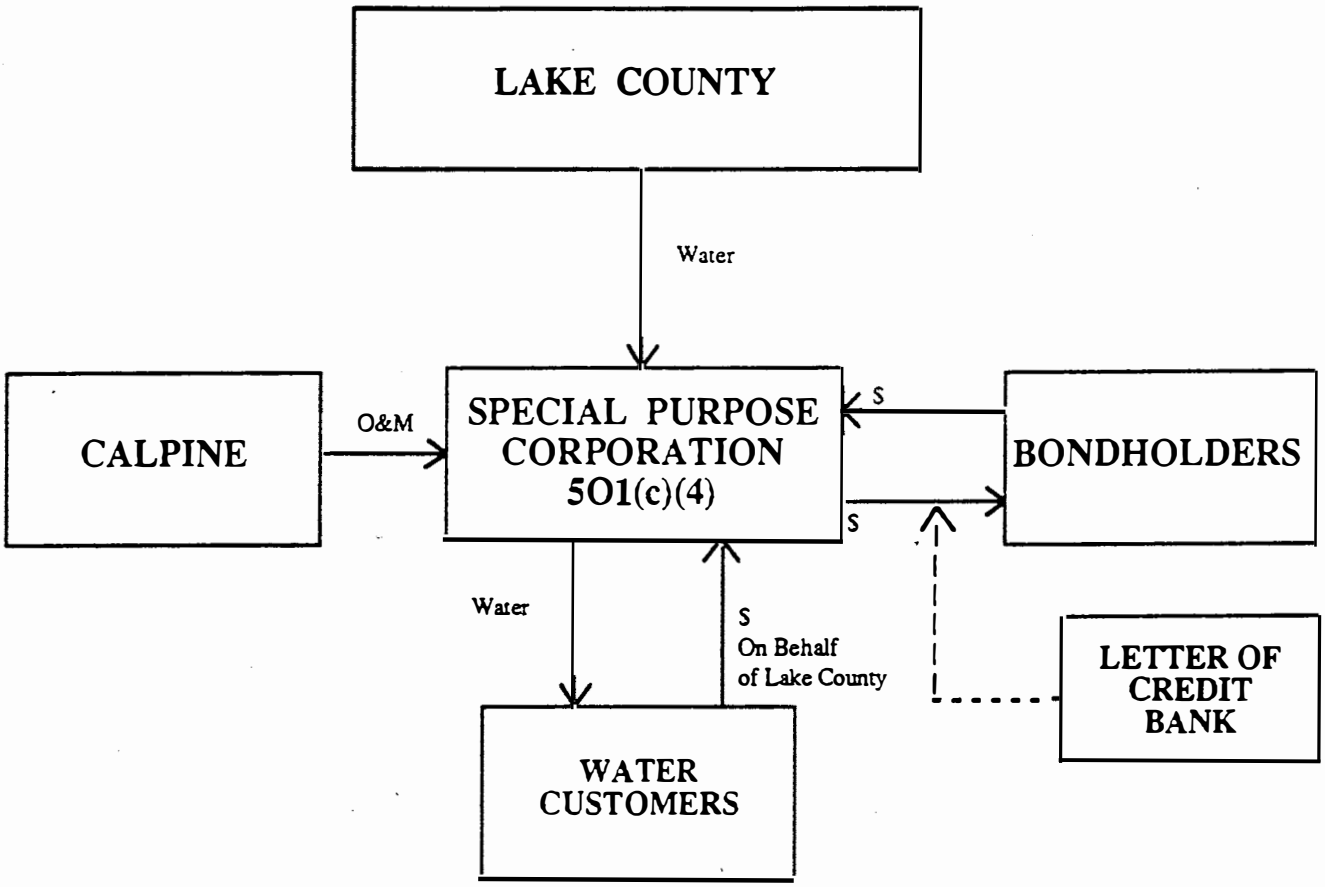


EXHIBIT A

PROJECT STRUCTURE

This is a brief outline of a proposed structure for the private financing, construction and operation of the Lake County Waste Water Disposal Project (the "Project") for the benefit of Lake County (the "County").

The proposal consists of the formation of a non-profit Special Purpose Corporation "SPC" to act as the financing entity and the nominal owner of the Project. The SPC would issue tax-exempt non-recourse obligations on behalf of the County to finance the costs of final design and construction of the Project. The SPC would enter into a contract with Calpine Corporation, or a related entity ("Calpine"), for the final design and construction of the facilities. A separate contract would be entered into between the SPC and Calpine for the operation of the Project upon completion. All water transported by the Project on behalf of the County would be sold to Calpine and/or other geothermal companys (the "Water Customers") for reinjection in The Geysers steam fields. The Water Customers would pay the County for the water delivered to the steam fields. The County would then pay the SPC for the transportation of the water under a long-term transportation agreement. Legal title to the Project would automatically pass to the County upon retirement of the indebtedness and the expiration of the transportation agreement.

1. FORMATION OF THE SPECIAL PURPOSE CORPORATION

The SPC would be created for the sole purpose of, and its powers would be specifically limited to, the construction and operation of the Project. No income or profits of the SPC would inure to any private individuals, except to the extent paid for services rendered.

The County could have control over the SPC. All rights of the SPC under the agreements described below would be assigned to the bondholders or to the County, as appropriate.

2. ISSUANCE OF TAX-EXEMPT OBLIGATIONS

The SPC would issue its own obligations to finance the costs of the Project. This indebtedness would be repaid out of the payments made by the County pursuant to its transportation agreement with the SPC. The County would be under no obligation to pay the indebtedness directly and would only pay for transportation when and as water is delivered. See the discussion under Sale of Waste Water Transportation to the County below. Repayment of the indebtedness would be further secured by a letter of credit provided by a bank and arranged by Calpine.

The indebtedness of the SPC would be issued on behalf of the County, and therefore would be tax-exempt under the Internal Revenue Code of 1986, as amended, and the applicable regulations and rulings thereunder. A number of requirements would have to be met, all of which we believe can readily be complied with. Most importantly, the County would obtain full legal title to the Project upon the retirement of the bonds without the payment of any additional consideration, and the County would have the ability, though not the obligation, to acquire the

Project at any time by paying off the indebtedness. The County would also approve both the formation of the SPC and the specific obligations to be issued by it.

Based upon the information provided to us, we do not believe that the bonds would be subject to state volume cap limitations.

3. CONSTRUCTION OF THE PROJECT

A contract for the final design and construction of the Project would be entered into between the SPC and Calpine. The contract could call for the posting of a performance bond from a surety company, as is generally required for public contracts, if this is deemed necessary or advisable. Calpine would agree to complete the Project for a fixed or determinable price.

4. OWNERSHIP OF THE FACILITIES

The SPC, as the entity financing, constructing and operating the Project, would be the nominal owner of the facilities. The County would agree to work with Calpine and the SPC in obtaining the necessary right of ways for the construction of the pipeline and securing all necessary federal and State permits and approvals with respect to the Project.

5. OPERATION OF THE PROJECT

Upon completion of the transportation facilities, the SPC would enter into a contract with Calpine or another party, such as the County, for the operation and maintenance of the Project. It is unclear as to whether a competitive bidding procedure would be necessary or advisable under state law with respect to this contract. In any event, certain provisions of the contract would be otherwise limited by the Federal tax laws. In particular, the initial contract would have to be for a maximum term of five years, and would be subject to cancellation without penalty at the end of three years. The contract could be renewed at the expiration of each five-year term with similar terms upon satisfactory performance by Calpine.

6. SALE OF WASTE WATER TRANSPORTATION TO COUNTY

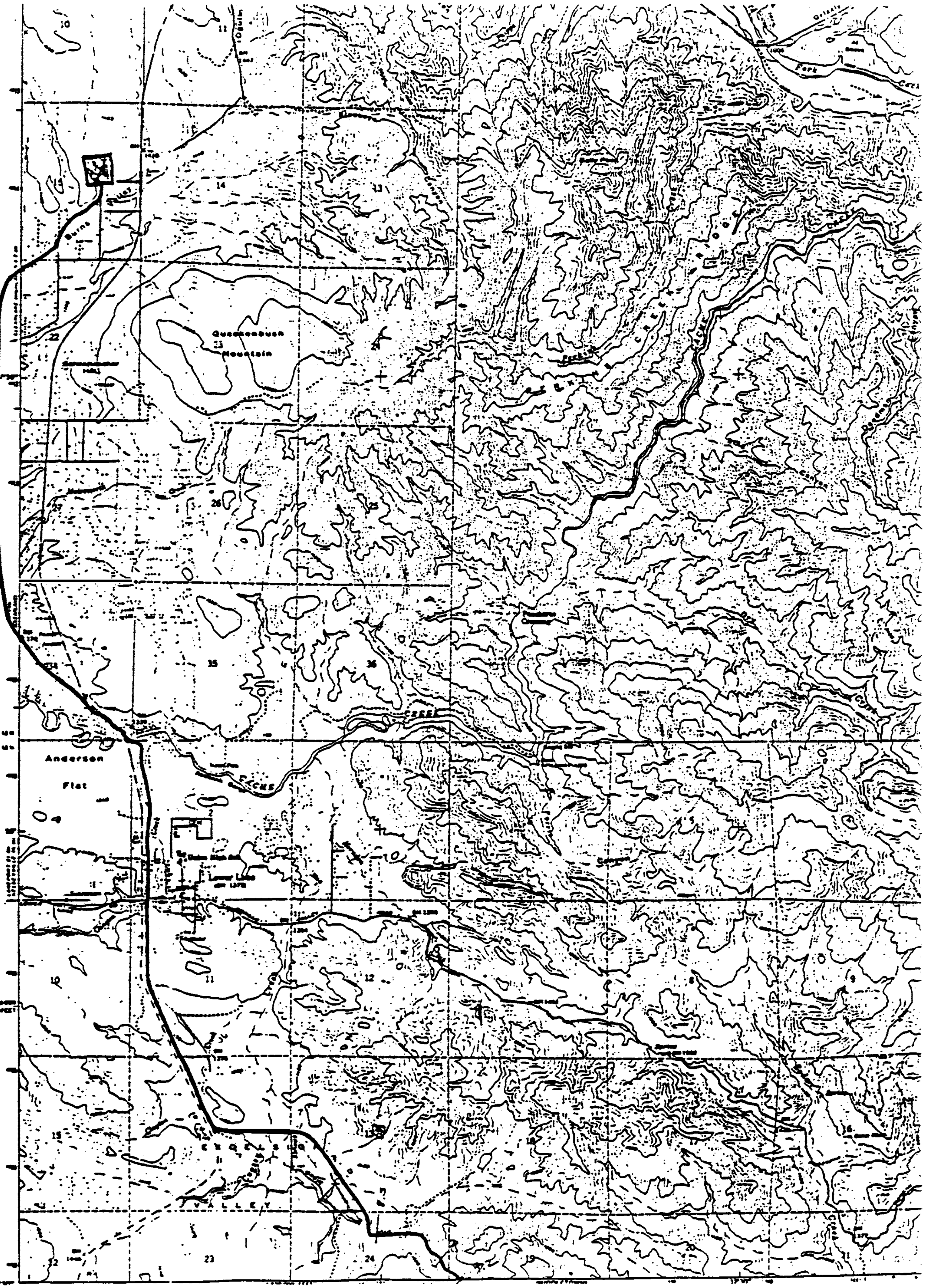
The SPC and the County would enter into a transportation agreement pursuant to which the County would agree to pay for all waste water transportation provided by the Project. There are several ways the County could pay for the transportation. The County could make periodic payments pursuant to a predetermined, fixed schedule over the term of the contract. The County could also enter into a contract providing a fixed GPM charge. However, the County would be under no obligation to pay if no water is transported.

The transportation agreement would terminate after the indebtedness incurred to finance the Project has been paid. At that time, legal title to the Project would automatically pass to the County, without the payment of any additional consideration.

7. SALE OF WASTE WATER TO THE WATER CUSTOMERS

The SPC and the Water Customers would enter into a water supply agreement pursuant to which the Water Customers would purchase the County's water delivered to the Water Customers by

the SPC. The water would be priced to cover the debt service on the bonds issued to build the project plus the cost of transportation that was charged to the County. Since the SPC is a non-profit company, it would rebate the payment for transportation back to the County. the Water Customers would effectively pay the SPC for transportation on behalf of the County. The net flow of money would be from the Water Customers to the SPC to the bondholders, with no net funds being paid by or to the County.


Quackenbush
Mountain
Anderson
Flat
Lower Lake
Burns
Fork
CREEK
E X C E L S I O R
V A L L E Y
10
11
13
14
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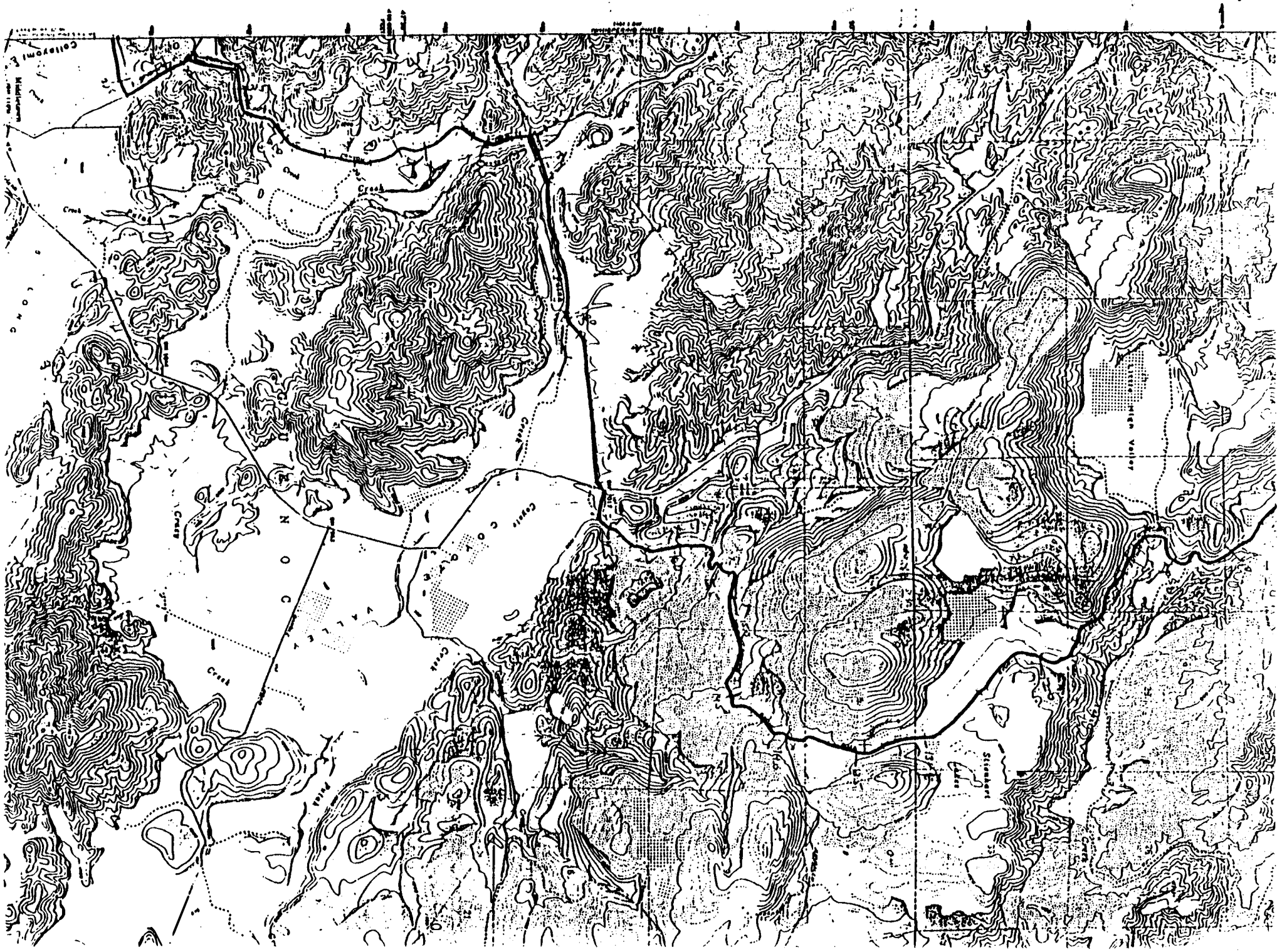


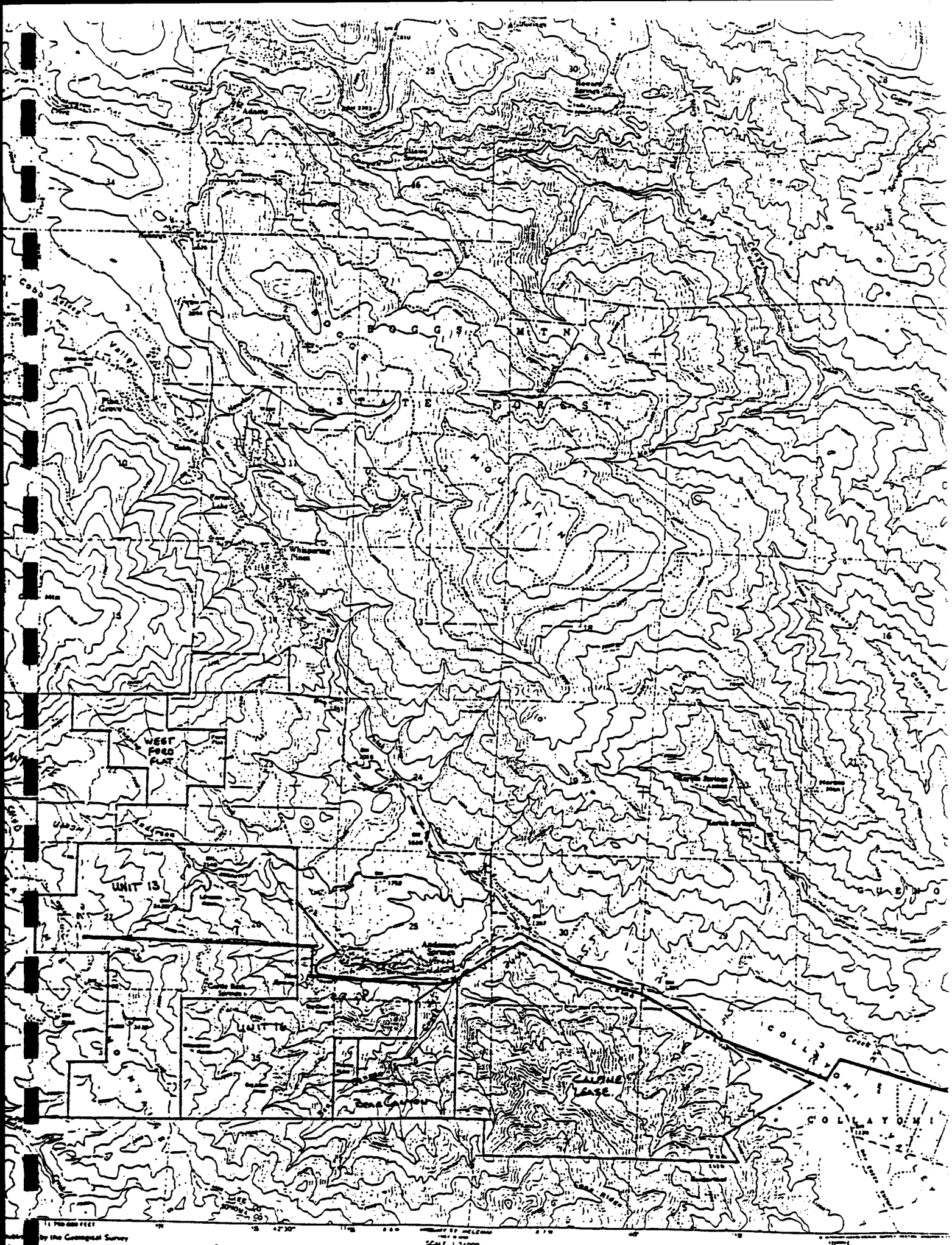

WEST FORD FLAT
UNIT 13
UNIT 16
CALPINE LEASE
COLLAYOMI
COLLAYOMI
SCALE 1:24000

TABLE 1

CAPITAL COST ESTIMATE

Pipeline from Clearlake to Geysers
(1991 $)

		Clearlake to Anderson Springs	Anderson Springs to Unit 13
Pipeline - (20" Coated Steel)		$16,000,000	$1,000,000
Pump Stations		300,000	3,800,000
Other Equipment		250,000	100,000
Right-of-Way		200,000	50,000
- Calpine	$50,000		
- PG&E	50,000		
- Private	100,000		
- County	25,000		
- State	25,000		
Permits		75,000	25,000
	Subtotal	$16,825,000	4,975,000
	Engineering	600,000	200,000
	Contingency (20%)	3,365,000	995,000
	TOTAL	$20,790,000	$6,170,000

NOTE: Price does not include pipeline distribution system to injection wells.

TABLE 2

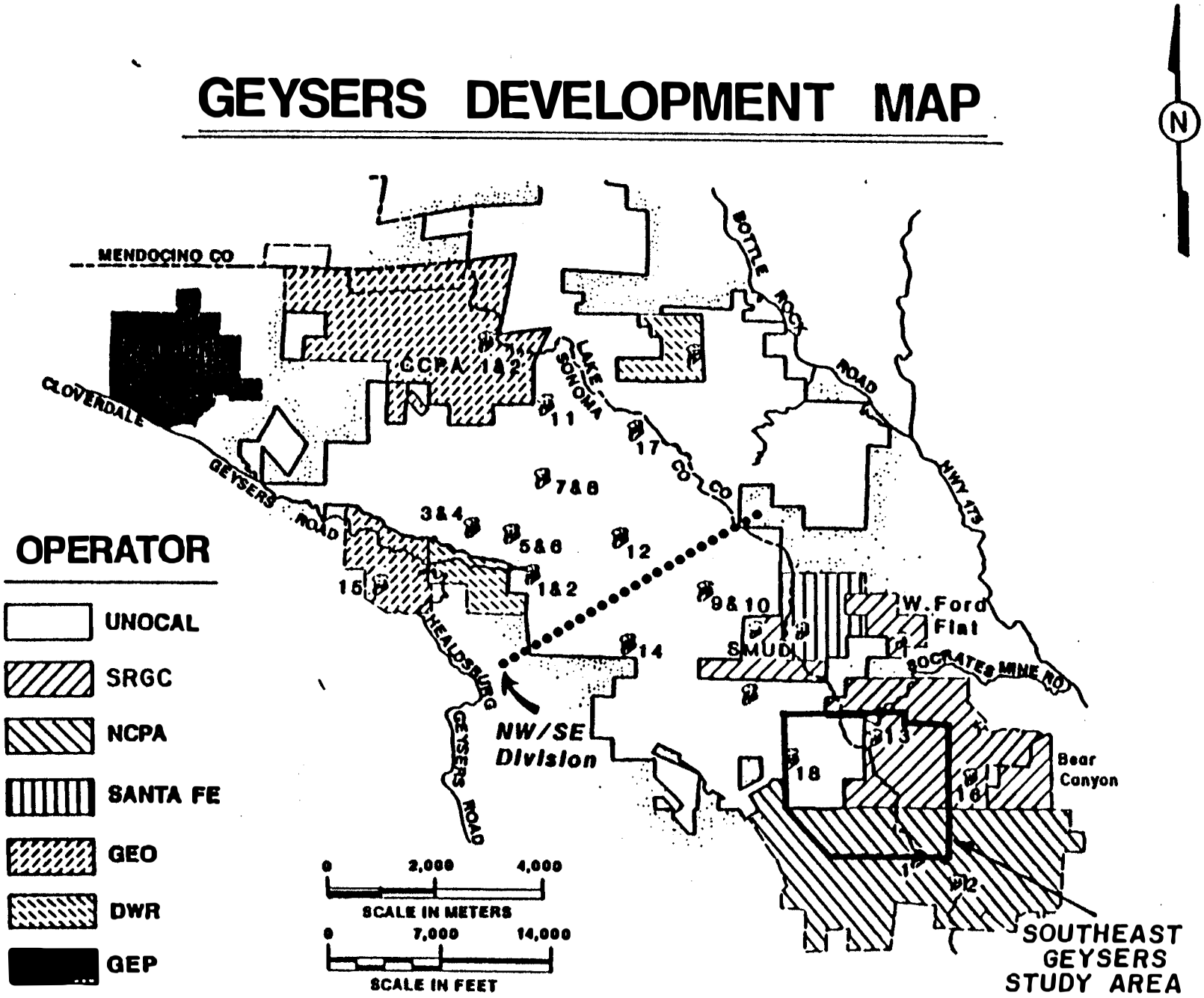
ANNUAL PIPELINE OPERATING COST
(1991 $)

	Clear Lake to Anderson Springs	Anderson Springs to Unit 13
Maintenance Cost[1]	$300,000	$300,000
Pumping Cost[2]	400,000	1,200,000
TOTAL	$700,000	$1,500,000

(1) Escalates at four percent (4%)

(2) Based on flow of 3,500 gpm. Energy price of $0.08/kWh escalating at four percent (4%) per year.

GEYSERS DEVELOPMENT MAP



FROM BARKER ET AL 1989

MODEL OF INJECTION FLUID BREAKTHROUGH

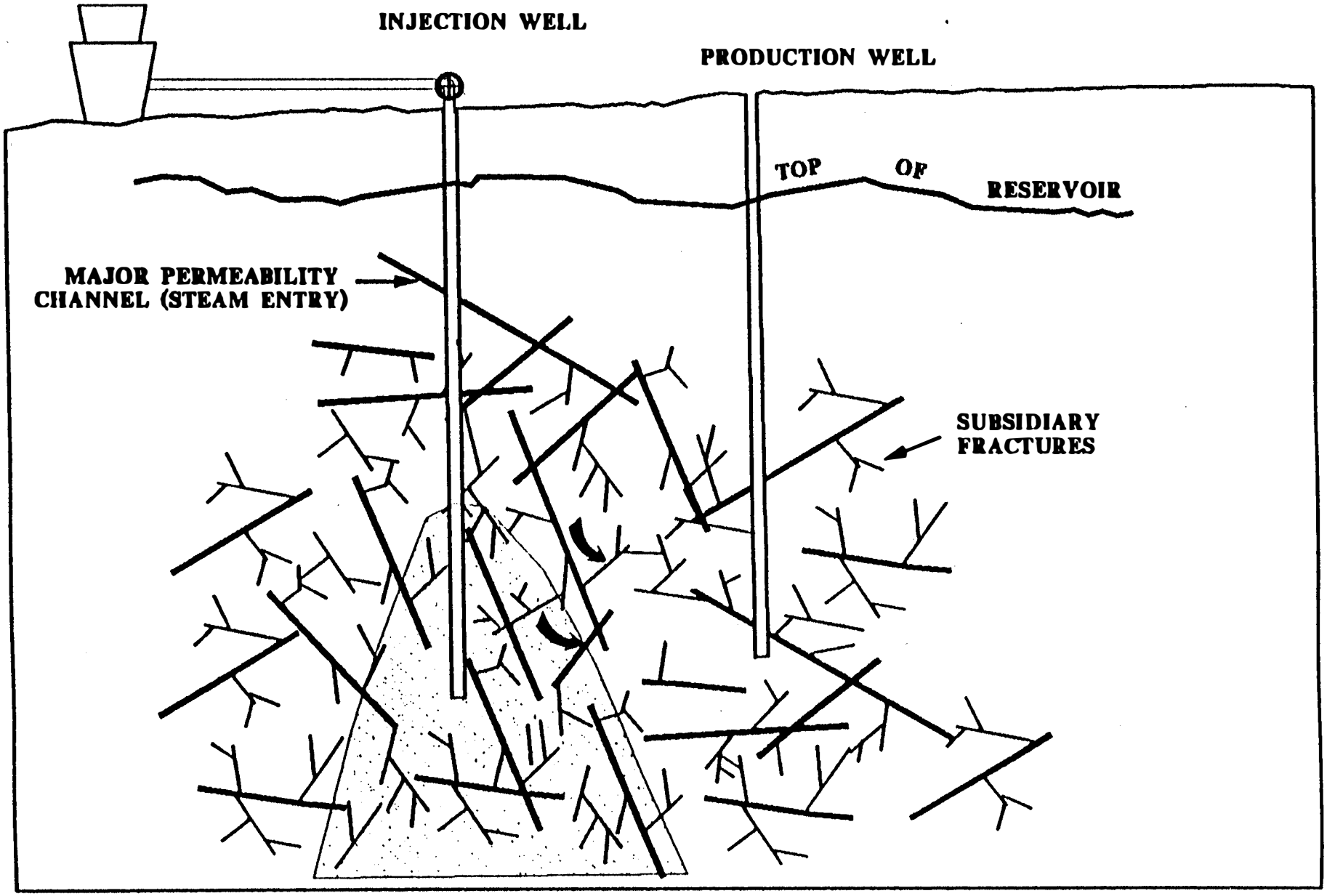
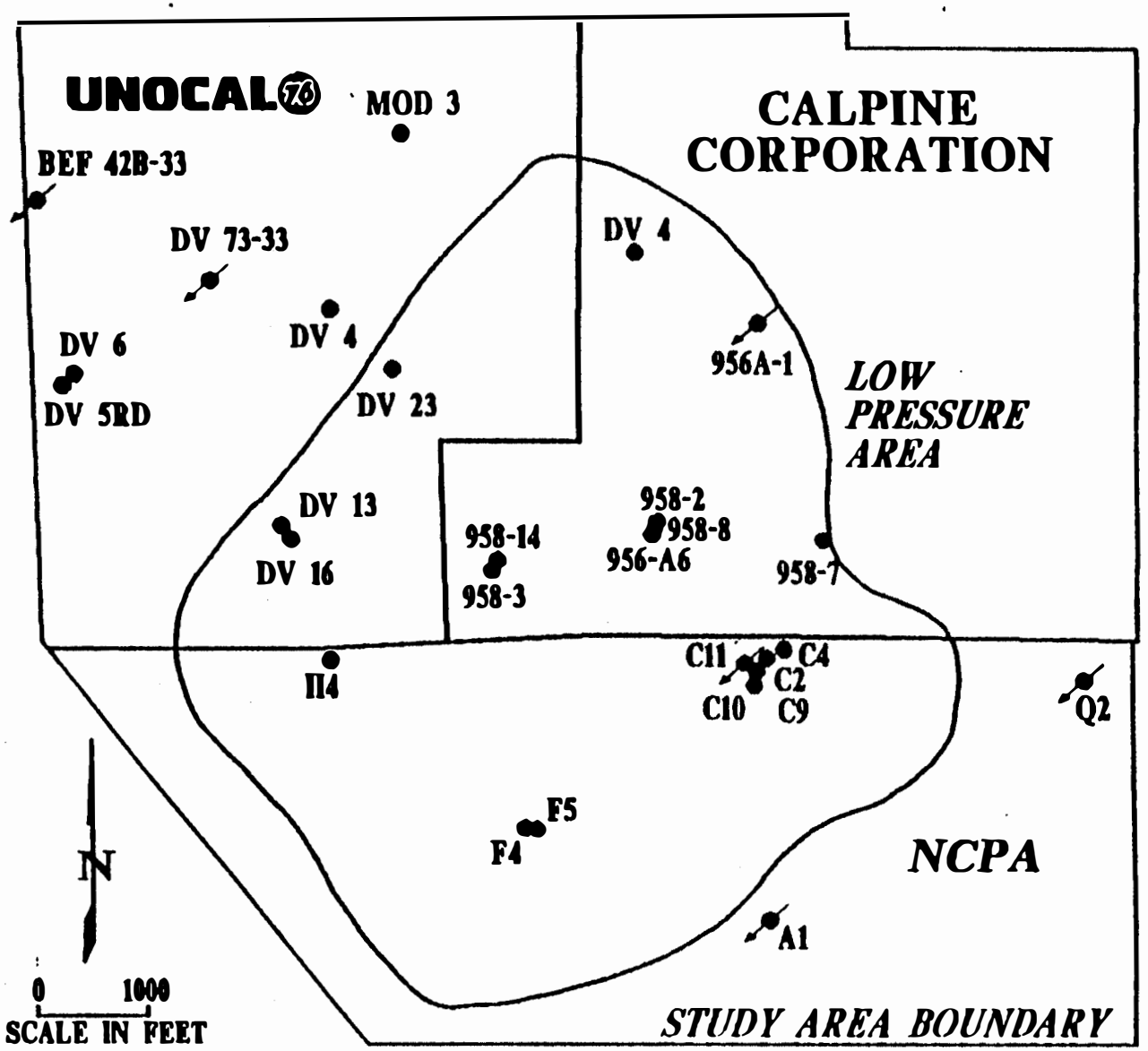
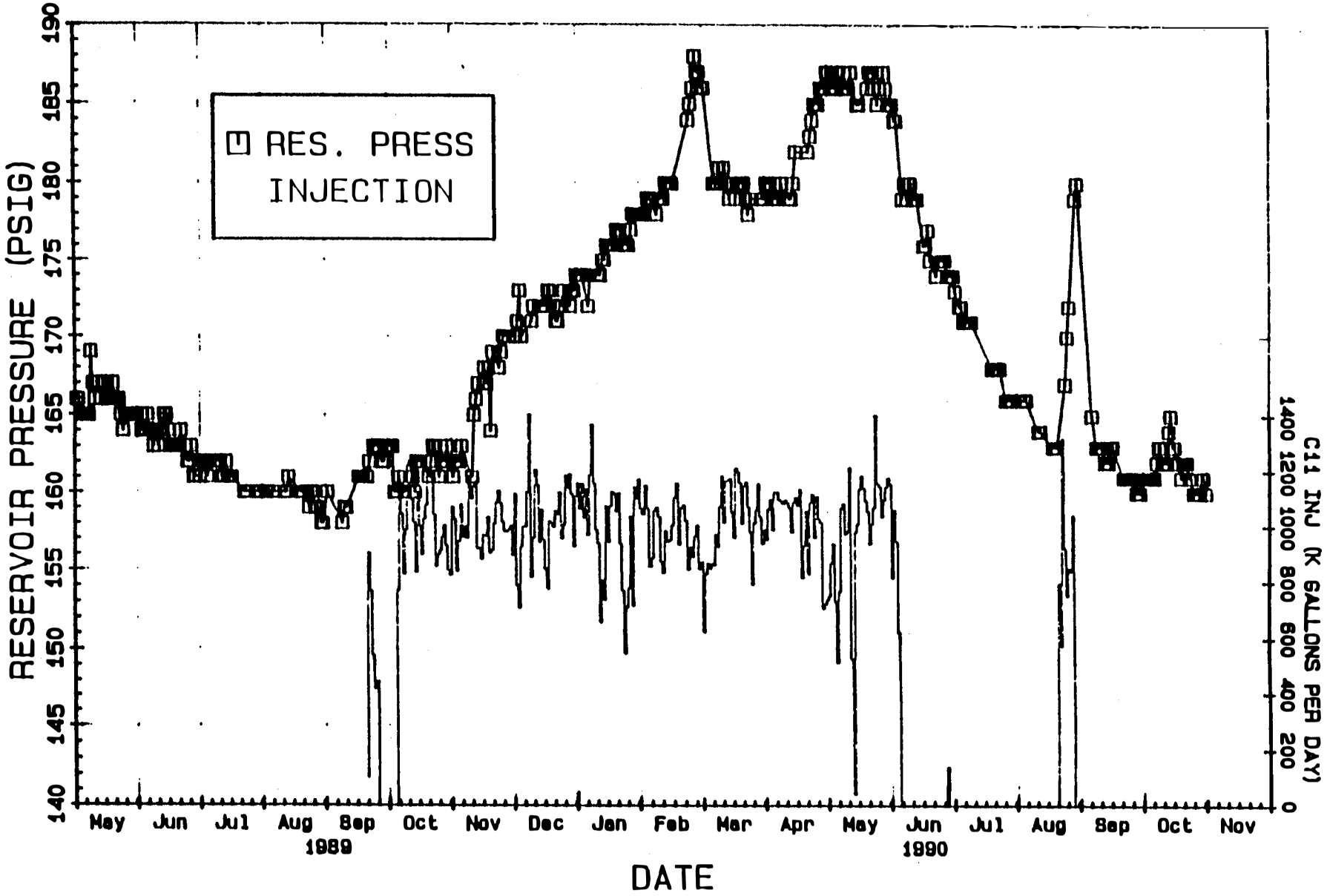


FIGURE 2
SOUTHEAST GEYSERS STUDY AREA

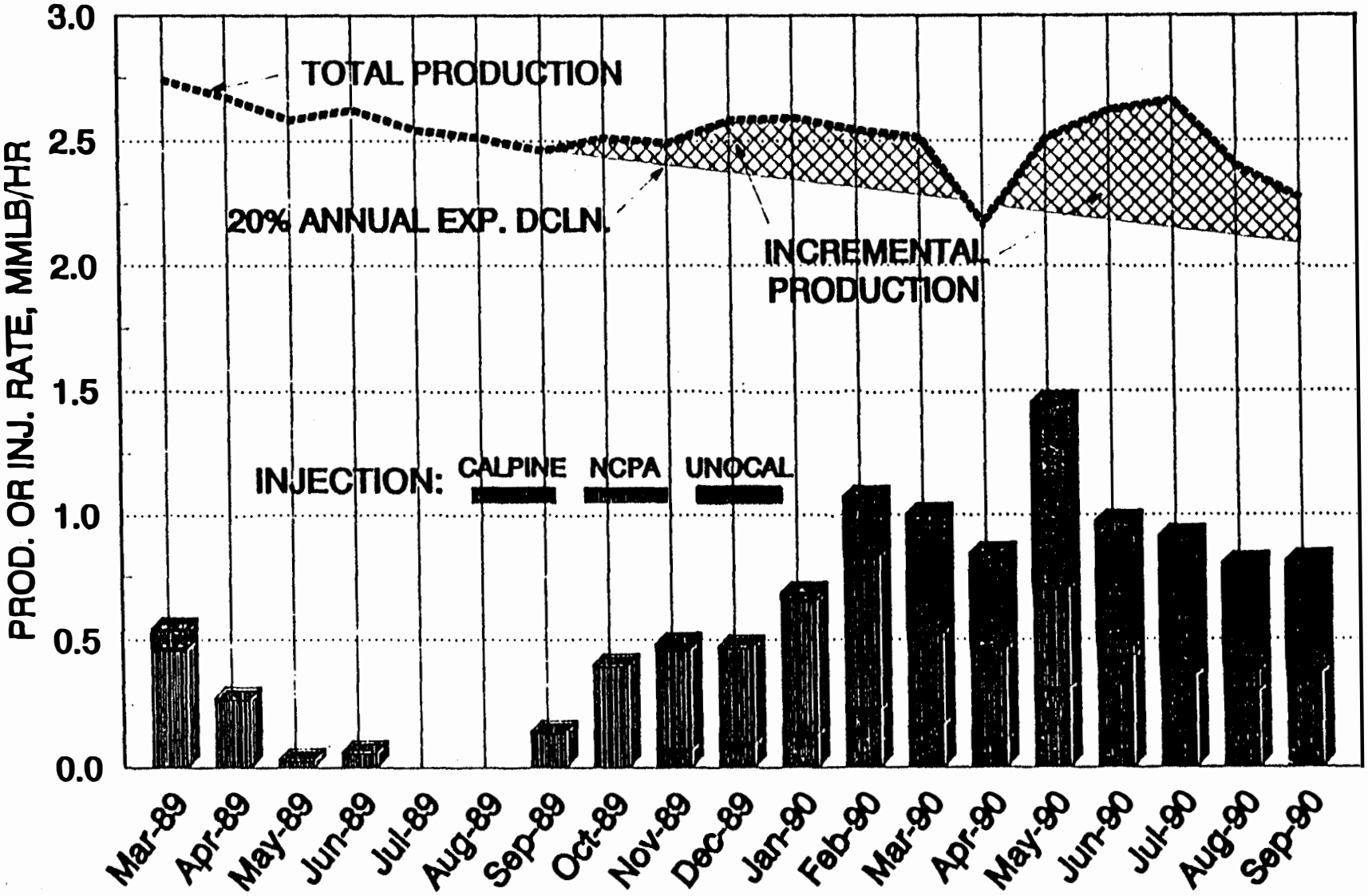


F-4 OBSERVATION WELL
VS C11 INJECTION



TOTAL LPA PRODUCTION/INJECTION

SOUTH EAST GEYSERS PROJECT



EFFLUENT VALUE - GEYSERS INJECTION

1. INCREASED POWER PLANT OUTPUT.

2. INCREASED STEAM FIELD RESERVES AND LIFE.

3. POLITICALLY AND ENVIRONMENTALLY ACCEPTABLE METHOD FOR THE DISPOSAL OF EFFLUENT.

4. PRESERVATION OF THE VALUE OF GEYSERS RESOURCE WHICH THEREFORE PROTECTS AN IMPORTANT SOURCE OF TAX REVENUES AND EMPLOYMENT IN LAKE COUNTY.

GEYSERS EFFLUENT INJECTION PROJECT

PROJECT VIABILITY DEPENDS ON:

1. JOINT PARTICIPATION IN PROJECT FROM STEAM SUPPLIERS, POWER PLANT OPERATORS AND LAKE AND SONOMA COUNTIES.

2. INCREASED INITIAL WATER FLOWS FROM THE PROJECT THROUGH UTILIZATION OF ADDITIONAL WATER SOURCES.

3. SUITABLE FINANCING STRUCTURE TO MAKE PROJECT VIABLE PARTICULARLY IN EARLY YEARS.