



DEPARTMENT OF COMMUNITY DEVELOPMENT

M E M O R A N D U M

DATE: November 4, 1994
TO: Santa Rosa Subregional Long-term Wastewater Project
FROM: Marie Meredith, Environmental Coordinator
SUBJECT: Response to NOP/NOI

*And to
A
dit*

On Friday, November 4, 1994, I received a voice-mail message from Abe Newman responding to the NOP/NOI. His message simply stated that he could only support Alternative 1 or Alternative 5.

MARIN COUNTY RESOURCE CONSERVATION DISTRICT
Point Reyes Station, California 94956 • (415) 663-1231

002

November 10, 1994

Marie Meredith
City of Santa Rosa
P.O. Box 1678
Santa Rosa, CA 95402

CITY OF SANTA ROSA
P.O. Box 1678
Santa Rosa, CA 95402

NOV 15 1994

DEPARTMENT OF
COMMUNITY DEVELOPMENT

Dear Ms. Meredith,

The Marin County Resource Conservation District (MCRCD), along with the Southern Sonoma County Resource Conservation District, recently completed an Enhancement Plan for the Stemple Creek/Estero de San Antonio Watershed. During the plan preparation, many questions arose concerning the impacts of the West County Option on the watershed. The MCRCD would like the following issues to be addressed in the new Environmental Impact Report to be prepared for the Long-Term Wastewater Project. These questions were also raised in Section 7 of the Stemple Creek/Estero de San Antonio Watershed Enhancement Plan.

Reservoir Storage Questions:

1. What are the downstream impacts of a 12% reduction in the total surface runoff (loss of 410 acre-feet/year) from the Button Ranch sub-watershed (Santa Rosa Subregional System, TM R11, Fig. R11-2)?
2. What are the impacts of a 68% reduction (340 acre-feet) in shallow groundwater outflow from the Button Ranch site (Santa Rosa Subregional System, TM R11, Fig. R11-2)?
3. What are the impacts of wastewater in the shallow aquifer immediately downstream of the dam?
4. What are the impacts of infiltration of wastewater into the Wilson Grove aquifer?
5. What are the impacts of hydrogen sulfide and ammonia, produced in the anoxic layer of the reservoir, as they travel into shallow and/or deep groundwater aquifers?
6. To what extent will hydrostatic pressure of the reservoir increase movement of water within and between the three watershed aquifers?
7. What impact will the proposed reservoir on the Button Ranch have in the event of an earthquake? What impact will the weight of the dam itself have upon activity along the underlying fault?

8. What impact will the loss of riparian, upland forest and perennial grassland habitat in the Button Ranch have on wildlife communities within the site and in the larger region? How will the reservoir affect the nesting Golden Eagles?

Irrigation Use Questions:

1. Will high TDS (total dissolved solids) in irrigation runoff raise TDS levels in surface and groundwater so that fish reproduction is inhibited and drinking water standards are exceeded?
2. Currently groundwater discharges into the Estero reduce high salinity; will salinity increases expected in irrigation runoff exacerbate salinity fluctuations or hypersaline conditions?
3. To what extent will groundwater mounding in irrigated areas (as much as a three- to four-foot increase) increase septic system failures and well contamination?
4. To what extent will mounding increase groundwater discharge to the stream during baseflow periods?
5. What are the impacts of increased groundwater discharge to Stemple Creek and the Estero?
6. How many more nutrients (in total amount, not rates or percentages) will reach the creek with the use of reclaimed water?
7. Will future water quality tests for metals have detection limits below the thresholds of the current aquatic life criteria and drinking water standards?
8. Will the total amount of metals leached from soils increase with irrigation? (Rate may remain the same, while the totals increase).
9. What will be the impacts if a high degree of irrigation efficiency is not achieved, as assumed?
10. Given irrigation suitability, the "services of an independent, professional irrigation management service" will be needed at each site to achieve high efficiency irrigation; how will this be accomplished? Who will pay? (Santa Rosa Subregional System, TM R12).
11. How will lands with bedrock less than three feet below the soil surface be excluded from irrigation? Who will delineate and enforce?

12. Will lands with summer groundwater levels within three feet of soil surface (factoring in irrigation mounding) be delineated and excluded from irrigation? Who will delineate and enforce?
13. What are the impacts of controlling grazing and restoring a riparian corridor, independent of wastewater use?
14. Can impacts, demonstrated to occur in the Americano watershed, automatically be extended to the Stemple/Estero de San Antonio watershed?
15. What are the impacts of the estimated 1.05-foot rise in Estero de San Antonio during summer due to reservoir leakage and irrigation effects (Santa Rosa Subregional System, TM W9, pg. 40)?
17. What are the impacts of drain-tile installation?
18. What are the impacts of changes in agricultural practices and products due to availability of reclaimed water?
19. What impact will changes in water quality due to the reservoir and irrigation have on freshwater shrimp and the ecology of the Estero de San Antonio?

We hope that the City of Santa Rosa will answer these important questions to the fullest extent possible. Thank you for your consideration.

Sincerely,



Donald J. McIsaac, Jr.
President

Marapple Farm
Nov 9, 1994

Marie Meredith
S.R.D. of Community Development -

CITY OF SANTA ROSA
P.O. Box 1678
Santa Rosa, CA 95402

NOV 15 1994

Dear Ms. Meredith -

DEPARTMENT OF
COMMUNITY DEVELOPMENT

a short note of my preliminary reaction
to the Project Description Report for
Scope Work Study Categories.

In short, too, too voluminous and
overwhelming in substance to be
addressed by anybody other than a few
who are paid to analyze and comment
upon it. There are "16 Tasks" - Anyone of
which would take a fortnight to
succinctly analyze.

I am most delirious and charitable
to pay HBA - a plus million for their
finalized summary and recommendation.
The report will benefit the exchequers
of HBA - far more than benefit us
who, as myself, would like to receive
some water in my life time.

as I read the document (rather
peruse it) there are so many
contentious subjects to discuss
and conclude upon that the nature
of the human reaction to them is
chaotic.

Page - 2 -

^{And} I would certainly ~~state~~ note
for a small pilot project -
B. try to induce the University of Calif
(Davis) to assist in the more tech-
nical phases of wastewater use.

The magnitude of your task
and problems overwhelms my
ability to comprehend them.

It is a privilege to me that I
may write this letter -

Sincerely
Joseph D. Pence
Past ~~int~~ former

Joe Pence
1250 Wagon Rd.
Sebastopol, Ca -
95472,

November 10, 1994
Santa Rosa, Ca.

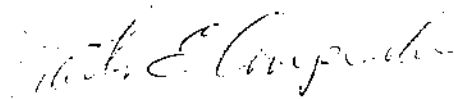
District Engineer
U. S. Army Corps of Engineers
San Francisco District
211 Main Street
San Francisco, Ca. 94105
Attn. Wade Eakle

6-10-94
A
I am a Committee Member for the SENSIBLE REUSE of WASTE WATER AND CONSERVATION, and I don't think the Public Workshops, gave our plan anything but short shift. I know you have been a part of every WETLANDS, RESERVOIR, MARSHLAND SYSTEM, INVOLVING WASTE WATER ALL ACROSS THE COUNTRY. Starting with the Michigan's Upper Peninsula and studies done by Biologist John Snyder, running raw sewage into a marsh that emptied into a trout stream and the water coming out of the marsh was clean. Biologists worldwide have long known, this to be fact about the natural water-purification of marshes, swamps, ponds and bogs. The Arcata Marsh and Wildlife Sanctuary, in Arcata, Ca. the city of Davis and their plan to restore about 4,000 acres of wetlands, including their waste water project. Denver, Colorado, has a small scale facility, which demonstrates wastewater can be cleaned up for portable uses. Fifty million gallons of it is discharged daily into the Santa Cruz River from Tucson's treatment plants and the same is true of Phoenix, which discharges 200 million gallons daily into the Salt River.

B
The city of Santa Rosa, already has two ponds, that show how plant wastewater can be used and the wildlife and growth of plants and trees, breed and survive as easily as they do on river's and lakes. A couple more reservoir's or wetlands and using the Laguna marsh would solve the problem and save a lot of unnecessary expense and costs to the public that is footing the bill for all this fol-de-rol. The Russian River would look better than it has, since I first saw it fifty years ago and I haven't been swimming in it since. We are already paying more than any city around for sewer and water, which the low income and seniors can ill afford. Now force all these other cities to clean up their act and a good start would be the Guerneville plant, Occidental, Graton, Forestville, Windsor, Healdsburg, Gyserville and Cloverdale. Together they dump more into the river than does Santa Rosa and nowhere near the treatment.

I want to see this plan pushed because it is being done all across the country, by the people that know and for a lot less than the city of Santa Rosa is planning on spending.

Sincerely,



Martin E. Coopender
200 Carina Drive
Santa Rosa, Ca. 95401
(707) 526-2844

cc Marie Meredith

The Wastewater Bulletin appears to be another waste of money, since there were only maybe twelve of us from the city at the past workshops.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
OFFICE OF THE TREASURER



HERBERT M. GORDON, CFA
Treasurer

PATRICIA A. SMALL
The Associate Treasurer

GARY S. DeWEESE, MAI
Assistant Treasurer-Real Estate

STEPHEN E. MOORE, CFA
Assistant Treasurer-Equity Investments

STEPHEN A. MORANGE
Assistant Treasurer-Finance

300 Lakeside Drive, 17th Floor
Oakland, California 94612-3350
(510) 987-9600
(510) 987-9617 Fax

November 14, 1994

Ms. Marie Meredith
Environmental Coordinator
City of Santa Rosa
Department of Community Development
100 Santa Rosa Avenue, Room 3
Santa Rosa, CA 95401

Re: Notice of Preparation of a Draft EIR/EIS for the Santa Rosa
Subregional Long-Term Wastewater Project

Dear Ms. Meredith:

This is in response to the Notice of Preparation dated October 21, 1994 regarding the referenced Project.

A The University of California has no response to the Notice of Preparation, but we would appreciate receiving a copy of the draft EIR and EIS as soon as they have been prepared.

Please direct future correspondence to the undersigned.

Sincerely,


Gary S. DeWeese
Assistant Treasurer - Real Estate

CITY OF SANTA ROSA
P.O. Box 1870
Santa Rosa, CA 95402

NOV 16 1994

DEPARTMENT OF
COMMUNITY DEVELOPMENT

DEPARTMENT OF FISH AND GAME

POST OFFICE BOX 47
YOUNTVILLE, CALIFORNIA 94599
(707) 944-5500



November 16, 1994

CITY OF SANTA ROSA
P.O. Box 1678
Santa Rosa, CA 95402

Ms. Marie Meredith
City of Santa Rosa
Department of Community Development
100 Santa Rosa Avenue
Santa Rosa, California 94501

NOV 17 1994
DEPARTMENT OF
COMMUNITY DEVELOPMENT

Dear Ms. Meredith:

Notice of Preparation/Intent (NOP/NOI) of a Draft Environmental
Impact Report/Statement (EIR/EIS) for the Santa Rosa
Subregional Long-Term Wastewater Project

Department of Fish and Game personnel have reviewed the NOP/NOI for the above project. We have communicated our concerns to the City of Santa Rosa Utilities Department, as well as to Harland Bartholomew and Associates Inc., the consultants preparing the EIR, through the recent scoping process. Additionally, we have communicated our concerns through our comment letter's regarding earlier versions of the project. Basically, the Department is concerned about impacts the various project alternatives may have on biotic resources. Resources of concern include, special-status species, wetlands, riparian habitat, sensitive plant communities, terrestrial and aquatic wildlife, and water quality as it relates to wildlife and/or wildlife habitat. We have provided input on the lists of special-status species that need to be addressed and provided survey protocols. Impacts to biotic resources and mitigation measures necessary to offset those impacts should be identified and discussed. We recommend impacts be mitigated by avoidance, minimization of impacts, and acquisition and preservation as open space of at least an equal area and quality as that lost.

Survey results and specific mitigation measures must be included in the environmental document. Surveys to be conducted at a later time, or mitigation measures to be identified at some future time, are not acceptable. It has been determined by court ruling that such studies and mitigation measures would be improperly exempted from the process of public and governmental scrutiny which is required under the California Environmental Quality Act (CEQA). A document which requests future studies or future identification of mitigation will be considered inadequate.

It is the policy of this Department that a project should cause no net loss of either wetland acreage or habitat value. We recommend impacts to wetlands be avoided where possible. Unavoidable impacts should be identified and mitigation provided

Ms. Marie Meredith
November 16, 1994
Page Two

for in the document. Areas proposed as wetland mitigation sites must be identified specifically in the document. Riparian vegetation removed should be replaced on a 3:1 in-kind basis using native species.

The Department recommends a minimum 100-foot buffer be established to protect streams and wetlands and their associated vegetation and provide a travel corridor for wildlife. The buffer should be measured outward from the top of each streambank or from the edge of any wetland. In the case of riparian vegetation along stream courses, the setback should be measured outward from the vegetative canopy. No roads or structures should be permitted within the buffer.

Any work within the banks of any creek, including road crossings and culverts, will require a streambed alteration agreement with this Department. The Department has direct jurisdiction under Fish and Game Code sections 1601-03 in regard to any proposed activities that would divert or obstruct the natural flow or change the bed, channel, or bank of any stream.

Impacts to biotic resources must be addressed not only for the construction of the various alternatives, but also for the operation of each of the alternatives. Issues of concern include reservoir fluctuation, drainage around reservoirs, flow augmentation, constructed wetland management, irrigation and runoff at places of use, and impacts on wetlands, riparian areas, and other native plant communities at places of use. Additionally, cumulative impacts must be addressed.

The EIR should include an evaluation of the operation of the existing reclaimed water disposal system in the Laguna de Santa Rosa. This evaluation is essential so that operational problems and limitations of the existing system can be avoided in any new systems. The evaluation should include such issues as the impacts and environmental conflicts related to distribution line and sprinkler maintenance, regulation of application rates on both City owned lands and private lands, runoff from over application, irrigation of oaks and other sensitive plant communities (including vernal pools), removal of oaks and other sensitive plant communities to facilitate irrigation, filling of vernal pools to facilitate farming or to solve mosquito problems, and enforcement of various Subregional System policies regarding application rates or habitat protection on private lands.

Ms. Marie Meredith
November 16, 1994
Page Three

If you have any questions regarding our comments, contact
Bill Cox, Associate Fisheries Biologist, at (707) 823-1001; or
Carl Wilcox, Environmental Services Supervisor, at (707) 944-5525.

Sincerely,

Cindy Catalano
for Brian Hunter
Regional Manager
Region 3

DEPARTMENT OF TRANSPORTATION

BOX 23660
OAKLAND, CA 94623-0660
(510) 286-4444
TDD (510) 286-4454



November 15, 1994

SON-General
SCH # 94103069
SON000060

Ms. Marie Meredith, Environmental Coordinator
City of Santa Rosa
Department of Community Development
100 Santa Rosa Avenue, Room 3
Santa Rosa, CA 94501

CITY OF SANTA ROSA
P.O. Box 1678
Santa Rosa, CA 95402

NOV 17 1994

DEPARTMENT OF
COMMUNITY DEVELOPMENT

Re: Notice of Preparation for a DEIR: SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT.

Dear Ms. Meredith:

Thank you for including the California Department of Transportation (Caltrans) in the early environmental review process for this project. We have examined the above-referenced document and forward the following comments:

The alternatives discussed in the EIR/EIS should identify all impacts that will occur in the State's highway right-of-way from the placement of pipeline for this project. The studies should include cultural resources surveys, biological surveys, hazardous waste surveys, visual assessment in the event that a visual resource is affected and a traffic study where the alternative will require a road closure or traffic delay.

Work within the Caltrans right-of-way will require an encroachment permit from the Department. A completed application, final environmental documentation and five sets of plans should be submitted to:

G. J. Battaglini, District Office Chief
Maintenance Services and Permits
Caltrans District 4
P. O. Box 23660
Oakland, CA 94623-0660

We look forward to reviewing the DEIR and expect to receive a copy from the State Clearinghouse. To expedite review, however, we request that you send two copies in advance to the following address:

Office of Transportation Planning
Caltrans – District 4
P. O. Box 23660
Oakland, CA 94623-0660

We appreciate the opportunity to work with you on this project. Should you have any questions regarding these comments, please call Timothy Sable of my staff at (510) 286-5555.

Sincerely,

JOE BROWNE
District Director

By: 

PHILLIP BADAL
District Branch Chief
IGR/CEQA

cc: Michael Chiriatti, SCH
Patricia Perry, ABAG
Craig Goldblatt, MTC

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION**

5550 SKYLANE BLVD. SUITE A
SANTA ROSA, CA 95403
PHONE: (707) 576-2220



November 16, 1994

CITY OF SANTA ROSA
P.O. Box 1673
Santa Rosa, CA 95402

NOV 17 1994

DEPARTMENT OF
COMMUNITY DEVELOPMENT

Ms. Marie Meredith, Environmental Coordinator
City of Santa Rosa, Dept. of Community Development
100 Santa Rosa Avenue, Room 3
Santa Rosa, CA 95401

Dear Ms. Meredith:

We have reviewed the Notice of Preparation/Notice of Intent (NOP/NOI) for the proposed Santa Rosa Subregional Long-Term Wastewater Project EIR (SCH# 94103069). As a responsible agency under the California Environmental Quality Act (CEQA) the Regional Board will have to make decision concerning approval of the Long-Term Wastewater Project. The Board will use the information contained in the EIR to help reach this decision.

The Scope of Work contained in the Preliminary Scoping Report seems to be very comprehensive and should provide valuable information upon which to make informed decisions. We believe that the following information pertaining to water quality issues should be included in the Long-Term Project EIR to assist the Regional Board in reaching their decision (these comments apply only to impacts associated with facilities or operations in the North Coast Region):

Should the long-term project involve the discharge of treated wastewater to the Russian River or its tributaries at a rate greater than one percent of the receiving stream's flow, an exception to the Water Quality Control Plan for the North Coast Region (Basin Plan) waste discharge prohibitions will be needed. The Basin Plan outlines the information needed to obtain such an exception and a copy of this information is included as an enclosure to this letter. This information should be used as a guide in evaluating the alternatives contained in the draft EIR/EIS.

The impacts of storage reservoirs, constructed wetlands, aquifer storage, rapid infiltration and irrigation on the beneficial uses of groundwater needs to be thoroughly evaluated. The impacts of the above upon all beneficial uses of surface waters should be evaluated as well. Monitoring programs to quantify these impacts should be included as a part of the draft EIR/EIS.

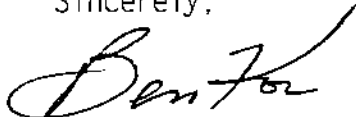
Some of the project alternatives described in the NOP/NOI may involve summertime flow augmentation streams in the North Coast Region. This proposed flow augmentation would be inconsistent with current Basin Plan waste

Ms. Marie Meredith
Page 2
November 16, 1994

9) discharge prohibitions. The draft EIR/EIS should include an evaluation of how a flow augmentation project can be implemented and comply with the Basin Plan waste discharge prohibitions.

Thank you for the opportunity to comment on the NOP/NOI for the Santa Rosa Subregional Long-Term Wastewater Project. If you have any questions, do not hesitate to call Tuck Vath at (707) 576-2699 or me at (707) 576-2220.

Sincerely,

A handwritten signature in cursive script, appearing to read "Ben Kor".

Benjamin D. Kor
Executive Officer

CTV:lmf/noicom

Enclosure

California Regional Water Quality Control Board
North Coast Region

RESOLUTION NO. 94-49

AMENDING THE
WATER QUALITY CONTROL PLAN FOR THE NORTH COAST REGION
SECTION IV, IMPLEMENTATION PLANS,
POINT SOURCE MEASURES, WASTE DISCHARGE PROHIBITIONS
FOR THE NORTH COASTAL BASIN

- WHEREAS, The California Regional Water Quality Control Board, North Coast Region (Regional Water Board) adopted the water quality control plans for the Klamath River Basin (1A) and North Coastal Basin (1B) on March 20, 1975. The Klamath River Basin (1A) plan and the North Coastal Basin (1B) plan were combined to form the Water Quality Control Plan for the North Coast Region (Basin Plan) on April 28, 1988, and approved by the State Water Resources Control Board on November 15, 1988. The Basin Plan has been updated several times since then; and
- WHEREAS, The Regional Water Board first declared a seasonal prohibition of waste discharge to the Mad, Eel, and Russian Rivers in its 1971 Interim Water Quality Control Plan for the North Coastal Basin (1B). The prohibitions were established in order to meet objectives and protect significant beneficial uses. At the time, the prohibition was being met or could be met by all or a majority of potential dischargers. The seasonal prohibition has remained in the Basin Plan, with an exception for discharges to the Laguna de Santa Rosa, since 1971.
- WHEREAS, There exist numerous significant beneficial uses in the Mad, Eel, and Russian rivers, which include municipal and domestic supply and freshwater habitat; and
- WHEREAS, There exist technologies which provide high quality wastewater effluent under controlled circumstances, which may not adversely impact beneficial uses of the Mad, Eel, and Russian rivers; and
- WHEREAS, Section 13225 of the Porter-Cologne Water Quality Control Act delegates the Regional Water Board with the responsibility for encouraging regional planning and action for water quality control; and
- WHEREAS, There exist several wastewater dischargers to the Mad, Eel, and Russian rivers who are involved with long range planning for wastewater treatment and disposal; and
- WHEREAS, The Regional Water Board, in its Triennial Review of the Basin Plan, adopted Resolution No. 93-14 on February 25, 1993, which contains a priority list of planning issues. In this list, the Regional Water Board identified the need to review the existing seasonal waste discharge prohibitions for the North Coastal Basin; and

- WHEREAS, The Regional Water Board conducted a public workshop on March 24, 1993 to receive and consider comments on the seasonal waste discharge prohibitions to the Mad, Eel, and Russian rivers; and
- WHEREAS, The California Department of Fish and Game in a March 21, 1994 letter finds that the amendment will not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of the species; and
- WHEREAS, A Notice of Filing and Notice of Public Hearing, a Public Report containing proposed revisions to the Basin Plan's waste discharge prohibitions and environmental documentation functionally equivalent to the California Environmental Quality Act (CEQA) requirements for the proposed revisions were transmitted to interested individuals and public agencies for review and comment; and
- WHEREAS, The Regional Water Board held a public hearing on August 25, 1993, and carefully considered all testimony and comments received on this matter, continued the public hearing to March 25, 1994; and
- WHEREAS, A Notice of Filing and Notice of Continuation of Public Hearing, a Supplemental Public Report containing the text of a revised proposed amendment and revised environmental documentation functionally equivalent to the CEQA requirements and a summary of comments and responses to the proposed Basin Plan amendment were transmitted to interested individuals and public agencies for review and comment; and
- WHEREAS, The Regional Water Board held a public hearing on March 24, 1994 and carefully considered all testimony and comments received on this matter, and has determined that the proposed Basin Plan amendment could have a significant effect on the environment, but that there will not be a significant effect because mitigation measures have been incorporated into the Basin Plan amendment.

THEREFORE, BE IT RESOLVED, that the Regional Water Board amends Section IV, Point Source Measures for the North Coastal Basin, as follows:

SECTION 4

IMPLEMENTATION PLANS

This section presents the actions intended to meet water quality objectives and protect beneficial uses of the Klamath River Basin and North Coastal Basin. The following measures shall be taken with respect to actual and potential point and nonpoint sources of water quality degradation.

POINT SOURCE MEASURES

WASTE DISCHARGE PROHIBITIONS

Section 13243 of the Porter-Cologne Water Quality Control Act authorizes the Regional Water Board - in a water quality control plan or in waste discharge requirements - to specify certain conditions or areas where the discharge of waste, or certain types of waste, will not be permitted.

Under this authority and in order to achieve water quality objectives, protect present and future beneficial water uses, protect public health, and prevent nuisance, the Regional Water Board declares that point source waste discharges, except as stipulated by the Thermal Plan, the Ocean Plan, and the Action Plans and policies contained in the Point Source Measures section of this Water Quality Control Plan, are prohibited in the following locations in the Region:

Klamath River Basin

1. All surface, freshwater impoundments and their tributaries, with the exception of the lower Lost River system.
2. Crescent City Harbor and all estuaries in accordance with the provisions of the State Board's "Water Quality Control Policy for the Enclosed Bays and Estuaries of California."
3. Smith River and its tributaries.
4. Klamath River and its tributaries, including but not limited to the Trinity, Salmon, Scott, and Shasta Rivers and their tributaries.
5. The Applegate, Illinois, and Winchuk Rivers and their tributaries.
6. On all coastal streams and natural drainage ways that flow directly to the ocean, all new discharges will be prohibited. Existing discharges to these waters will be eliminated at the earliest practicable date.
7. All intertidal reaches of the coast.
8. Areas of Special Biological Significance.
9. All other tidal waters unless it is demonstrated on the basis of waste characteristics, degree and reliability of treatment, rate of mixing and dilution, and other technical factors that water quality objectives will be met and all beneficial uses will be protected.

North Coastal Basin

1. All surface fresh water impoundments and their tributaries.

2. All bays and estuaries in accordance with the provisions of the State Water Resources Control Board's "Water Quality Control Policy for the Enclosed Bays and Estuaries of California."
3. The Mad and the Eel rivers and their tributaries during the period May 15 through September 30 and during all other periods when the waste discharge flow is greater than one percent of the receiving stream's flow as set forth in NPDES permits.¹
4. The Russian River and its tributaries during the period of May 15 through September 30 and during all other periods when the waste discharge flow is greater than one percent of the receiving stream's flow as set forth in NPDES permits. In addition, the discharge of municipal waste during October 1 through May 14 shall be of advanced treated wastewater in accordance with effluent limitations contained in NPDES permits for each affected discharger, and shall meet a median coliform level of 2.2 mpn/100 ml.²
5. The Regional Water Board will consider exceptions for cause to the waste discharge rate limitations set forth in Prohibitions 3. and 4. (above). Exceptions shall be defined in NPDES permits for each discharger, on a case by case basis, and in accordance with the following:
 - A. The wastewater treatment facility shall be reliable.

Reliability shall be demonstrated through analysis of the features of the facility including, but not limited to, system redundancy, proper operation and maintenance, and backup storage capacity to prevent the threat of pollution or nuisance.
 - B. The discharge of waste shall be limited to rates and constituent levels which protect the beneficial uses of the receiving waters.

Protection shall be demonstrated through analysis of all the beneficial uses of the receiving waters. For receiving waters which support domestic water supply (MUN) and water contact recreation (REC1), analysis shall include expected normal and extreme weather conditions within the discharge period, including estimates of instantaneous and long-term minimum, average, and maximum discharge flows and percent dilution in receiving waters. The analysis shall evaluate and address cumulative effects of all

¹ For dischargers not in compliance with the seasonal prohibition and waste discharge rate limitation, time schedules shall be set forth in National Pollutant Discharge Elimination System (NPDES) permit updates for each discharger. In addition, each discharger not in compliance shall report to the Regional Water Board on progress towards compliance on an annual basis.

² For dischargers not in compliance with the waste discharge rate limitation and/or advanced wastewater treatment, time schedules shall be set forth in NPDES permit updates for each discharger. In addition, each discharger not in compliance shall report to the Regional Water Board on progress towards compliance on an annual basis.

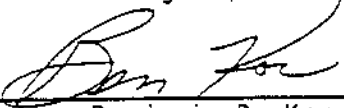
discharges, including point and nonpoint source contributions, both in existence and reasonably foreseeable. For receiving waters which support domestic water supply (MUN), the Regional Water Board shall consider the California Department of Health Services evaluation of compliance with the Surface Water Filtration and Disinfection Regulations contained in Section 64650 through 64655, Chapter 17, Title 22 of the California Code of Regulations. Demonstration of protection of beneficial uses shall include consultation with the California Department of Fish and Game regarding compliance with the California Endangered Species Act.

- C. The exception shall be limited to that increment of wastewater which remains after reasonable alternatives for reclamation have been addressed.
- D. The exception shall comply with State Water Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality Waters in California," and the federal regulations covering antidegradation (40 CFR §131.12).
- E. There shall be no discharge of waste during the period May 15 through September 30.

- 6. On all other coastal streams and natural drainageways that flow directly to the ocean all new discharges will be prohibited. Existing discharges to these waters will be eliminated at the earliest practicable date.
- 7. All intertidal reaches of the coast.
 - 8. Areas of Special Biological Significance.
 - 9. All other tidal waters unless it is demonstrated on the basis of waste characteristics, degree and reliability of treatment, location of discharge, rate of mixing and dilution, and other technical factors that water quality objectives will be met and all beneficial uses will be protected.

Certification

I, Benjamin D. Kor, Executive Officer,
do hereby certify that the foregoing
is a full, true, and correct copy of
a Resolution adopted by the California
Regional Water Quality Control Board,
North Coast Region, on March 24, 1994.



Benjamin D. Kor
Executive Officer

From: Patti Bender (AGNT99:PAB)
To: ehb,mam
Date: November 17, 1994, (Thursday) 10:46am
Subject: Phone message from K.M. Lo of 3900 Highway 37
Phone: 415 221 6868

<input checked="" type="checkbox"/> Telephoned	<input type="checkbox"/> Please call
<input type="checkbox"/> Will call again	<input type="checkbox"/> Returned your call
<input type="checkbox"/> Wants to see you	<input type="checkbox"/> Came to see you
<input type="checkbox"/> Urgent	

A
He called to say that he will not be able to attend the Wastewater meeting tonight but that he's in favor of bringing the project to his area.

CITY OF SANTA ROSA
P.O. Box 1678
Santa Rosa, CA 95402

NOV 17 1994

DEPARTMENT OF
COMMUNITY DEVELOPMENT

The Dept. of Community Development,
100 Santa Rosa Ave., Room 3,
Santa Rosa, Ca. 95401

Gentleman;

I wonder if the time has now come to go back to square one with this Wastewater mess, appoint new Planners and cut this foolishness. The path we have been following is getting us nowhere and the costs are causing great concern to the ratepayers I talk to.

I think it would be wise to listen to the Sonoma County Taxpayers' Assn. on this matter.

Thank you for your consideration,

R. E. Bartley

CITY OF SANTA ROSA
P.O. Box 1678
Santa Rosa, CA 95402

NOV 17 1991

DEPARTMENT OF
COMMUNITY DEVELOPMENT

The Shrimp Club
46 Green Valley Court
San Anselmo, CA., 94960

November 17, 1994

CITY OF SANTA ROSA

P.O. Box 1678
Santa Rosa, CA 95402

NOV 17 1994

City of Santa Rosa

RE: Environmental Impact Report, Button Ranch

DEPARTMENT OF
COMMUNITY DEVELOPMENT

Dear Sirs,

We are from Brookside School in San Anselmo. We are trying to save the California Fresh Water Shrimp. We are rehabilitating Stemple Creek. We are fencing, planting, and putting in a cattle bridge.

We would like to ask you a few questions about the proposed dam on Button Ranch. They are:

- 1) What endangered species live on the proposed dam site?
- 2) How clean would the water be?
- 3.) What chemicals will be in the water?
- 4) Will the chemicals harm the California Fresh Water Shrimp? If so, how?
- 5.) Will there be copper in the waste water?
- 6.) If there is copper in the waste water, will it harm the California Fresh Water Shrimp?
- 7.) Will the waste water kill the vegetation on the banks of the creek?
- 8.) Will the waste water seep through the ground and go into the rancher's wells?
- 9.) Would the waste water harm the Stemple Creek watershed?

John
A WL

Don
B WCR

Don
C WCR

John
D

Don
E

John
F

John
G

John
H

Don
I

10.) Will the waste water make the detritus poisonous?

Thank you for answering our questions.

Sincerely yours,

Zoe Dagan, Nick Ferrari, Nina Alvarez, & Madeline Merritt
The Shrimp Club, Stemple Creek Committee

To Whom it May Concern:

My ancestors settled in the Bodega/Valley Ford/ Tomales area in 1851. I and my family are adamantly against Santa Rosa's (my birth town) proposal to build a gigantic wastewater reservoir in a pristine valley; then send treated waste into the fragile esteros and into the Farallones National Marine Sanctuary. The effluent would be carried along Dillon Beach - one of the most popular swimming areas on the North Coast - and into Tomales bay, which has the purest coastal waters outside of Alaska. The waste would touch the delicate inlets of Point Reyes National Seashore.

CITY OF SANTA ROSA

It seems there could be a suit in the offering.
Santa Rosa, CA 95402

Sincerely

Sincerely,
Kenneth S. Roe

Kenneth S. Roe
3415 Adams Lane Redding, CA 96002

NOV 17 1994

DEPARTMENT OF
COMMUNITY DEVELOPMENT

SCOPING COMMENT FORM

Due December 5, 1994

Name: Phil ScullyDate: Nov 17 1994Address: 1525 Sutton StCITY OF SANTA ROSA
P.O. Box 1678
Santa Rosa, CA 95402City: Blountfield State: CA Zip: 95452

NOV 17 1994

Phone: (707) 664-8715DEPARTMENT OF
COMMUNITY DEVELOPMENT**How to use:**

Please fill out the above information. Please provide your written comments about the Summary EIR/EIS Consultants Draft Scope of Work or the Preliminary Scoping Report on the form below. Please print or write legibly, or attach this form to your typed comments. You may add additional pages of your own if needed. When completed fold the form so the City's address is showing and tape the edge together, (Do not use staples), and drop in the mail.

Comments:

Please see attached sheet.

42
Proy Scholze
11533 Sutton
Blamfield CA
94752
664-8215
Nov. 17, 1994

A 1

I do not believe you have chosen a reasonable range of alternatives, and I disagree on how you are going about evaluating the alternatives for waste-water disposal sites in the County of Sonoma.

Given the fact that, the previous study of disposal plan was ruled inadequate by a Superior Court judge, at a cost to the County of millions and millions of dollars resulting in a 156% jump in cost. and

Given the fact that the faults in the EIR report were brought to the attention of our Counties judicial system by organizations such as: Friends of the Estero, Blamfield Rural Alliance, & the Shrimp Club, who are fighting the wastewater alternative of Button Ranch due to its direct impact on two of only a few Esteros left on the West Coast of North America. And.

Heaven the fact that today our elected legislative bodies that represent our County, plus a verbal commitment from the Sierra Club, plus the above mentioned organizations is friends of the Estero plan to step in ~~the~~ and fight the EIR report again in court if Button Ranch were considered a waste water alternative.

And
Not
I ask then, How can/do you justify Button Ranch (West County alternative) as a possible site. It has already cost the people of this County millions and millions of dollars and you are obviously setting them up again for more expense, as you will surely get a fight.

B
Irrigation in the West County site does not work given the fact that we do not irrigate cattle, we do not irrigate hay (we pray it does not rain) and we do not irrigate in flood zones.

Attn: Marie Meredith



CITY OF SANTA ROSA

BUILDER'S INC. 50 FALLON ROAD - PETALUMA, CALIFORNIA 94952
LIC. No. 373850
707 - 763-1027

DEPARTMENT OF
COMMUNITY DEVELOPMENT
November 17, 1994

RE: SANTA ROSA/SUBREGIONAL LONG-TERM WASTEWATER PROJECT EIR/EIS.
"HEREIN IS RESPONSE TO NOTICE OF PREPARATION DATED OCT. 18, 1994"

TO: WHOM IT MAY CONCERN;

THIS DOCUMENT IS TO BE INCLUDED INTO THE PRESENT SCOPING PHASE,
LISTING THE ISSUES TO BE STUDIED, WITH CONCENTRATION, AND SOLUTIONS
FOR THE FOLLOWING PROBLEMS.

A
ALTERNATIVE # 4 - OUR MAIN CONCERNS ARE EXCLUSIVELY WITH THIS ALTERNATIVE.

B
West County Reclamation has multiple Environmental issues of concern. The reservoir site S20 Two Rock and the irrigation of 5,965 acres along Stemple and American Creeks poses great potential for a vast amount of environmental destruction. S20 site in Two Rock Valley located in West Sonoma County, is a rare and unique area with regard to wells that serve the Property Owners and are replenished with ground water from the Aquifers in the S20 Site.

C
HYDROLOGY/GROUNDWATER: Property Owners have very limited amounts of water in this area. Many wells are shallow and hand-dug and over one hundred years old. They are twelve to fifteen feet deep and recovery is slow. Only a few areas have water - due to the "Saucer-shaped" hard rock found at the bottom of these wells. In the areas above the Center of the "Saucer", water is more likely to be found. Near the edges of the Saucer there is no water. This is the reason that a good number of Property Owners own the exclusive water rights to their well that is located on someone else's property. Sonoma County property records verify this.

S20 Site contains all the water that replenishes these wells. An alternative (Potable) water source must be made available to these well owners, prior to any construction/excavation to begin.



BUILDER'S INC. 50 FALLON ROAD - PETALUMA, CALIFORNIA 94952
LIC. No. 373850
707 - 763-1027

QUESTIONS:

1. HOW DO YOU PLAN TO FURNISH THE WELL OWNERS WITH POTABLE WATER?
2. WILL THIS WATER BE AN EXPENSE TO THE WELL OWNERS?
3. WHEN DO YOU PLAN TO BRING THIS WATER?
4. WILL THIS BE PRIOR TO ANY RESERVIOR CONSTRUCTION?
5. WHERE WILL THIS WATER COME FROM?

D (100) PLEASE NOTE: If you plan on supplying the water after the Dam has been constructed, the well owners will have dry wells for the duration of the construction which could take several years. If this should happen, the Well Owners will have your "Project" tied up in Litigation.

FOR INFO PURPOSES:

Early Settlers in this area during the mid 1800's found very little water here in the Two Rock Valley and soon learned to dig shallow wells with the source coming from the S20 Canyon. About forty years ago Mr. Button dammed up the pond in the S20 Canyon and the wells to the south in the Valley went dry. Well Owners embarked upon Mr Button, he released the water and the Wells again filled with water. This can be verified by Margaret and James Bradley at 390 Fallon Road, Petaluma.

When deep well drilling machinery was invented, earlier in this century, Two Rock property owners have since spent thousands of dollars having deep wells drilled with high-powered Jet drill rigs going 300 to 800 foot depths through the hard rock to find nothing. We have documentation to support this history.

E Please note that every Dairy Rancher in this critical water area that has a shallow well in addition has a Dam or Reservoir on his place to water his cows and wash down his facility,

Currently, there is vast Documentation to verify this. We can produce this further into your Project. Our Data goes back to the 1940's



BUILDER'S INC. 50 FALLON ROAD - PETALUMA, CALIFORNIA 94952
LIC. No. 373850
707 - 763-1027

and the Drilling Records of Keyt Well Drilling Co. Inc. at which time the US Army Military Reservation was being built (Coast Guard now) on Tomales Road west of Petaluma. Several Wells were dug to no avail. Water was finally pump over Wiggins Hill from Petaluma and to present day it is still the same situation. In addition, these records and well drilling documents come from the Pump and Well Companies from through out Sonoma County and are in our possession. These Company's have been gracious enough to contribute their "Critical" water data in written form to substantiate well/water facts of the Two Rock Area.

WITH REGARD TO: AGRICULTURE IRRIGATION.

F Your proposed acreage to consist of almost 6000 acres located in the Stemple and Americana Creek watersheds, must be verified with the Property Owners, as the Two Rock, Bloomfield and Valley Ford people will not accept any Wastewater for irrigation if the Project consists of their "Neighbors" falling prey to Condemnation.

In addition, these two Creeks are located in small flat land areas thus creating small amounts of acreage that show potential for irrigation.

QUESTIONS:

1. Do you plan to request "Letters of Intent" from these Owners?
2. Do you plan to do "field-work" on these potential properties to identify the degree of steepness of the hills in the area's that reduce the irrigatable amount of acres considerabley. For example an owner may own 300 acres but only 75 is flat enough to be irrigated. Within this Alternative No. 4 - will you map out and indicate precisely how many acres you can actually irrigate in this area?
3. With regard to this irrigation, how do you plan to keep these Pollutants and Effluents out of the creeks in regard to run off? Build Berms along the edges of the creeks?



BUILDER'S INC. 50 FALLON ROAD - PETALUMA, CALIFORNIA 94952
LIC. No. 373850
707 - 763-1027

4. With regard to the Two Rock shallow wells being subjected the application of Wastewater irrigation over a given period of time, with what provisions can you guarantee the well owners that "Chronic Toxicity will not occur in the ground as well as the under ground water source?
Well water contamination must not occur.

IN CLOSING:

If Alternative No. 4 is chosen to be Santa Rosa's long-term Wastewater Project, we urge you to adequately study and address all of these problems in their entirety. We, the Property Owners, intend to have our deepest concerns and worries herein, answered and the solutions offered for these Problems prior to the selection and vote by the City, for any Reservoir and Irrigation chosen for the West County.

Our telephone number is 707-763-1027

Please call at any time for a look at our Valleys and observe the Wells and Creeks.

Frank & Bea Glazier

Rep. of Well Owners for
Two Rock Valley

cc:

City of Santa Rosa, Marie Meredith
City Public Works Dept, Dan Carlsen
Harland Bartholomew & Associates, Anders Hauge
U.S. Army Corps of Engineers, Wade Eakle

F. G. Frank Glazier
B. G. Bea Glazier

SCOPING COMMENT FORM

Name:

DAVID CANNISTER

Address:

7915 St. Helena Rd.

City:

52

State:

Zip:

95404

Phone:

() 578-3364

Date _____

P.O. Box 1070

Santa Rosa, CA 95400

NOV 17 1994

DEPARTMENT OF
COMMUNITY DEVELOPMENT

Please fill out the above information. Please provide your written comments about the Summary EIR/EIS Consultants Draft Scope of Work or the Preliminary Scoping Report on the form below. Please print or write legibly, or attach this form to your typed comments. You may add additional pages of your own if needed. When completed fold the form so the City's address is showing and tape the edge together, (Do not use staples), and drop in the mail.

Comments:

See Attached

Sierra Club, Sonoma Group
Wetlands From Wastewater
Position Statement
by David Bannister

We support the concept of the creation of wetlands from Santa Rosa's tertiary-treated wastewater because it is a *beneficial reuse* of this resource. If this concept is to be successfully carried to fruition we believe that a number of conditions must be met:

a) All state and federal laws (NEPA, CEQA, ESA, etc.) and agency regulations must be strictly adhered to.

b) In order that project success can be determined, specific, measurable goals should be set out in advance of project design.

c) One of these goals should be the creation of native plant and wildlife habitat *without undue disruption to existing habitat values*.

d) In order to meet a) and c) and for economic reasons we believe that the type of wetland to be created (seasonal, salt marsh, fresh marsh, wooded, etc.) should closely approximate the type of wetland that historically takes place in the area.

e) Multidisciplinary expertise in planning and careful project supervision at all project phases (design, implementation, monitoring, and management) is needed.

f) Wetlands created should **not** be considered as mitigation for the loss of any other wetland; created wetlands should be net additions to the resource base.

g) Bioaccumulation of heavy metals in the food chain is a potential risk. Before proceeding even to the early project phases, all scientific research on the subject should be studied, and bioaccumulation studies should be conducted on the city's own wetland demonstration projects (Kelly Pond).

Unfortunately, the sites selected for wetland creation (Santa Rosa Plain and South County) as part of the six wastewater options under study do not meet many of these conditions according to the Screening Report and Alternative Evaluation Report prepared by Harland Bartholomew & Assoc. in March of this year.

♦ **Santa Rosa Plain-** May not meet parts of a) c) and d).

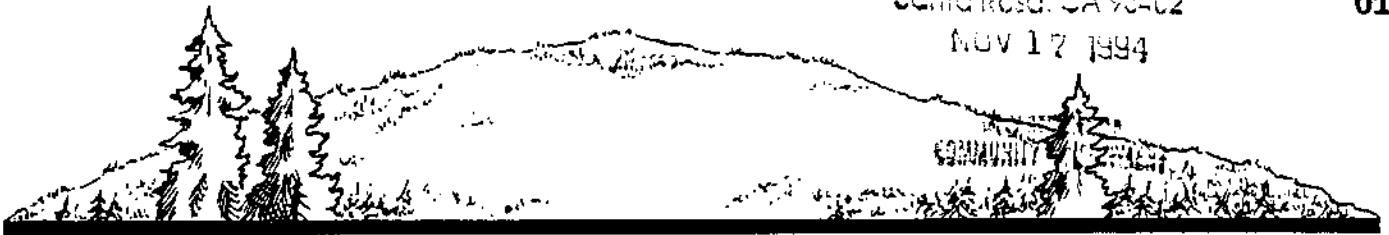
This alternative calls for creation/restoration of 1,000 acres of wetlands in the Santa Rosa Plain. Further work will be required to identify specific sites for wetlands where this is biophysically feasible, and where property can be acquired for wetlands creation. It is doubtful that 1,000 acres of suitable area is available. Potential impacts to vernal pools, oak savannah and other sensitive habitats would have to be avoided.

...there are at least 2 threatened or endangered wildlife species, 11 threatened or endangered plant species, and 8 other special status species which may be substantially affected by the actions connected with this alternative.

♦ **South County-** May not meet parts of a) c) d) and f).

The creation of freshwater wetlands in former bayflats has been proposed. These areas are currently used for agriculture, but were historically salt marsh. Conversion of this area to freshwater or brackish marsh may not be acceptable from a regulatory standpoint.

...there are at least 4 threatened or endangered wildlife species, 3 threatened or endangered plant species, and 6 other special status species which may be substantially affected by the actions connected with this alternative.



Friends of Cobb Mountain

November 17, 1994

City of Santa Rosa
Department of Community Development
City Hall, Room 3
100 Santa Rosa Avenue
Santa Rosa, California

Dear Madam or Sir:

I write to you on behalf of Friends of Cobb Mountain, an environmentally and socially concerned citizen's organization in the community of Cobb, located in southern Lake County immediately to the east of The Geysers geothermal field. We express to you our concerns with regard to The Geysers option for the Santa Rosa Subregional Long-Term Wastewater Project, asking that the issue which we address will be included for treatment in the planned EIR/EIS for the proposed project.

STAN K
This issue is the likely seismic effects of the injection of large volumes of wastewater into The Geysers geothermal field. We note with some concern that this issue is not alluded to in the Summary of the Environmental Consultants' Proposed Scope of Work for the Environmental Study Phase, Santa Rosa/Subregional Long-Term Wastewater Project Environmental Impact Report Environmental Impact Statement (EIR/EIS). This issue was treated at some length -- albeit in our opinion inadequately -- in the EIR/EIS for a current but much smaller parallel project, namely the Lake County Southeast Regional Wastewater Treatment Plant Facilities Improvements and Geysers Effluent Pipeline and Injection Project.

A
↓
The region of The Geysers geothermal field is well known as being seismically very active. It is the prevailing opinion in the scientific community that the vast majority of the earthquakes in the region are caused by steam extraction and fluid injection by the industrial steam producers. The earthquakes range from very small micro-earthquakes (too low in magnitude to be felt) to significant quakes as high in magnitude as 4.5, which are capable of causing structural damage. Our concern is with quakes of 3.0 magnitude and above, for these quakes are disturbing to people as well as being hazardous to structures.

The connection between steam extraction and fluid injection and seismic activity at The Geysers is well demonstrated by the his-

torical record in the files of U.S. Geological Survey and of the Seismographic Station at the University of California in Berkeley. In 1984 seismic activity increased markedly in The Geysers region, with the incidence of earthquakes of M3.0 to 3.9 at an average rate of sixteen per year from 1987 to 1993. In 1988, the year of highest incidence, there were twenty-four Geysers quakes in this range. During the same period, there were only 1.4 earthquakes per year in the same magnitude range in the area outside The Geysers for fifty kilometers in all directions. During the present year, 1994, through August 8th there have been seventeen Geysers quakes of M3.0 and above. Prior to this period, from 1970 to 1983, the rate of earthquake incidence in The Geysers region in the same magnitude range was 1.9 per year, with no Geysers quakes at all in this range in 1970 or 1971. This clearly demonstrates the causal effect of geothermal operations on seismic activity and that naturally occurring seismic events are scarcely significant in the present level of Geysers earthquake activity.

It has been pointed out by seismologists involved in the discussion of these issues during the processing of the parallel Lake County project alluded to above that the industrially induced seismic activity in The Geysers region is not only exhibited in specific present events but that it is affecting the region in another way as well. This is "stress loading," which means that closely neighboring historic faults are stressed by the presently occurring quakes in The Geysers region, and that Geysers quakes can possibly trigger higher magnitude quakes along these faults.

We in the Cobb Mountain area have to live with this situation. We do not like it, and, in face of the Geysers injection project being presently considered by the City of Santa Rosa, we do not want an increase in the frequency of the quakes nor the chance of their increased intensity. We ask that the planned EIR/EIS will treat this issue realistically, forthrightly and in depth. In connection with this, we ask that a plan for up-front mitigation be designed for implementation if the project goes forward for recompense to homeowners in the event that personal injury or structural damage occurs as a result from the seismic effects which may result from it.

Yours sincerely,



Hamilton Hess
Vice Chairman

November 17, 1994

017

City of Santa Rosa
Mr. Edwin H. Brauner, Jr.

DEPARTMENT OF
COMMUNITY DEVELOPMENT

Re: Long-Term Wastewater Project - Scoping Meeting

Our property is involved in the Vast Oak alternative for the wastewater project. As we have stated before, we feel our area is not a suitable site and we are not willing participants in this project. Below find some of our concerns.

- 1) Loss of our property. The original plan calls for flooding flat acreage and not gaining any depth for the reservoir. This will contaminate our septic leach field and household well. We will lose access to our home as our driveway will be underwater. We have one 300 year oak in this area that will die if flooded.
- 2) Loss of property value. No one will want to purchase a high-end home with a wastewater dumping lake on or near the property. If the reservoir were full all year it might make a difference. But since it is going to be empty more than half the year, it will be an eye-sore.
- 3) The reservoir will be visible from a populated area on the west Sonoma Mountains. Sonoma State University and Rohnert Park will look at a earthen dam. No one wants to look out onto an empty lake. Have all property owners in the area (up Roberts and Pressley Roads, up Lichau Rd., on Sonoma Mountain) been notified that this reservoir is in their immediate area? We only found out about it in August because it involves our property.
- 4) Crane Regional Park is adjacent to the proposed reservoir. This will be an attractive nuisance for people visiting the park. We will have visitors crossing our property to get to the lake.
- 5) Rogers Creek Fault lies very near this area. There was a recent study that found this area to be high risk for a strong earthquake. (Press Democrat, Nov. 5, 1994, copy enclosed).
- 6) We have a wide variety of wildlife on our property. We have seen fox, badger, coyote, racoons, skunks and others that would be lost to our area.
- 7) We are very concerned with the odor that will be emitted. Since the reservoir will be empty some of the time, what about rotting vegetation?

If the farmers in this area want this water for irrigation, find a site on their property. Don't take our property to benefit them. We feel a long term resolution such as Tolay is a better choice instead of a stop-gap expensive measure as Vast Oaks. Thank you for your consideration.

Sincerely,
William and Nancy Adams

William & Nancy Adams
6725 Pressley Road
Penngrove, CA 94951

Julian Sutter, 12, of Occidental takes an in-line skate ride in the rain Friday.

'A good day to sit by a fire'

By RANDI ROSSMANN
Staff Writer

North Bay residents should brace for a cold and stormy weekend.

Weather forecasters are predicting heavy rainfall today, with gusty southerly winds and brisk temperatures.

"It'll be a good day to sit by a fire," said Keith Pence, meteorologist.

ogist for Earth Environment Services.

The storm, which reached parts of the North Bay on Friday, appears to be slow moving and packed with moisture. It could drop about 2 inches of rain north of the Golden Gate, Pence said.

As of Friday afternoon, rainfall totals on the North Coast measured in tenths of an inch. Fort

Bragg had the most with .22.

The storm, which moved south from Alaska, dropped significant rainfall and snow in Washington and Oregon on Friday, and should bring new snow to the Sierra.

On Sunday, the rain is expected to give way to scattered showers. Pence said Monday should be cloudy and a cool wind should clear the skies by Tuesday.



600 STAN 15

Quake lurking in east Petaluma hills?

Rodgers Creek Fault called one to watch

By ROBERT DIGITALE
Staff Writer

PETALUMA — In the rolling hills east of town David Schwartz walks along the hidden fissure he believes is most likely to let loose and wallop the Bay Area.

Beneath him the Rodgers Creek Fault, two giant slabs of earth clutching one another, hasn't erupted in a major earthquake in at least 186 years. Schwartz, a geologist for the U.S. Geological Survey, puts the chances at up to 35 percent of a magnitude 7 quake somewhere between San Pablo Bay and Sania Rosa within the next 30 years.

No other fault in the Bay Area has as great a probability.

"I think we could be very close to the next large earthquake," he said of the fault.

This week Schwartz discussed five years of geological studies in trenches along the fault. He spoke at Sonoma State University to geology students and consultants and later led several on a tour of three digging sites above

the Petaluma Adobe in the hills east of Petaluma.

Schwartz and the other researchers found evidence that three magnitude 7 earthquakes struck along the fault within the past 1,000 years. The geologists estimate the quakes occurred at an interval of roughly 230 years. The last quake likely struck in the 1700s, though the researchers are still trying to better pinpoint the time by locating more pieces of buried charcoal for carbon dating.

To Schwartz, the research indicates the likelihood of a major quake clobbering the Bay Area is higher than geologists previously have predicted. Officially the chances of such a tremor are pegged at 67 percent within the next three decades. But Schwartz said new studies could put that probability as high as nine in 10.

Schwartz, an engaging guide with a resemblance to The Who's Pete Townshend, tries to bring balance to such striking predictions. He jokes about lowering local real estate values and acknowledges that geologists have erred in a few past predictions about the San Andreas fault. But he also speaks of witnessing what the earth's unleashed fury has wrought — most recently in Southern California.

"After I came back from Northridge I increased my insurance," he told students and professors during lunch at the faculty's outdoor dining area.

His career also happens to coincide with an increase in major seismic activity after more than 60 years of relative calm around the Bay Area. Geologists estimate that 18 quakes of magnitude 6 or greater struck between 1830 and 1911. None occurred again until 1979, after which there have been four such temblors.

This movement occurs because two gigantic plates of the earth's crust slide past one another beneath California, the Pacific Plate and the North American Plate. In some places along the San Andreas Fault the movement averages 40 millimeters a year. The Bay Area's other major faults — the Calaveras, Hayward and Rodgers Creek — average about 8 millimeters a year.

But the Rodgers Creek Fault is considered locked, meaning it hasn't slipped since the last major quake when the land on either side moved about six feet.

In their efforts to learn the timing of that last quake, researchers looked through mission records and other historical documents.

See Quake, Page B2

The money was spent for a mailer and signs supporting Kathy Austin, Terry Bell and Sam Crump.

Seven candidates, including two incumbents, are running for three seats on the council.

"We felt that we were very committed to having people in there we felt shared our goals for the city," said Chris Piehoff, a police dispatcher and union treasurer. "We felt so strongly we wanted to put more into the effort than just talk."

The 18-member association formed a political action committee in October and funded it with \$6,000.

Piehoff said the \$6,000 came from a large personal donation to the association by a grateful Sebastopol resident. She said it did not come from money solicited by the association during one of its regular charity fund drives.

So far, \$4,242 has been spent,

See Police, Page B4



Geologist David Schwartz shows a group from SSU the Rodgers Creek Fault in Petaluma.

ANNIE WELLS/PRESS DEMOCRAT

Quake

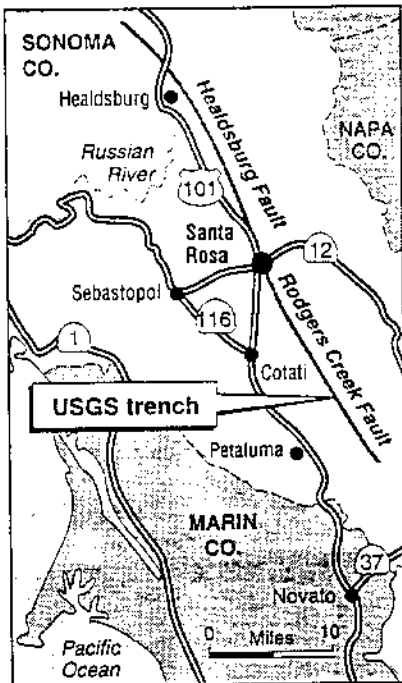
Continued from Page B1

dating back to 1808. No quakes were recorded. Of Bay Area faults, Schwartz said, the Rodgers Creek has gone the longest period without a major quake. In fact, unlike other Bay Area faults that often rumble with small quakes, the Rodgers Creek fault shows almost no seismic activity.

Old-timers may wonder why Schwartz doesn't take into account the 5.6 and 5.7 quakes that struck Santa Rosa on Oct. 1, 1969. His answer is he and other geologists no longer believe the quakes erupted on the Rodgers Creek Fault. They more likely occurred north of town somewhere in the undefined confluence of the Rodgers Creek and Healdsburg faults. Regardless, he said, the location of the 1969 quake wouldn't change the predictions on the likelihood of an even greater event along the Rodgers Creek Fault.

On the bright fall afternoon, Schwartz led a group to three sets of trenches in the oak-spotted hills east of Petaluma.

He pointed out the spot where Rodgers Creek drops down from the hills and crosses the fault. The last earthquake wrenched the watercourse more than five feet. Looking upstream viewers can see the creek take a hard right at the



PRESS DEMOCRAT GRAPHIC

fault and bend up like the bottom curve in a question mark.

Nearby geology students walked into trenches that were perhaps eight feet deep. Schwartz pointed to the top of a faint line marked by colored tacks, separating chocolate-colored earth on the west from more rocky soil to the east. There the fault's two sides last slipped about six feet.

"This is the tip of the crack that started 12 to 14 kilometers below the surface," he said.

Dead Petaluma youth described as a daredevil

By RONNIE COHEN
Press Democrat Bureau

PETALUMA — Friends say Michael Lorenz would jump on moving tractors, dodge cars and generally act like a daredevil.

On Thursday night, a daring antic appears to have killed the 13-year-old Petaluma boy.

Michael was driving an off-road motorcycle on Corona Road at about 9 p.m. Thursday, Petaluma police said. They said the boy had been driving fast, and his 1994 Honda dirt bike did not have a headlight.

down Corona Road for several minutes before the accident.

An air ambulance took Michael to Memorial Hospital, where a doctor pronounced the boy dead shortly after 10 p.m.

Michael attended El Colegio, a special education junior high in Rohnert Park primarily intended for students with behavioral problems.

"He was kind of a sociable guy," said Linda Grimes, who was a school secretary until a few weeks ago. "He was very outgoing, and he likes to chat with us, which not all

Belli to t

By RON DeLACY
McClatchy News Service

SONORA — Tuolumne County's case of the incredible barking dogs has attracted one of this town's most famous native sons and dog lovers — flamboyant attorney Melvin Belli.

Belli announced Friday from his San Francisco office that he will represent Terry Lorusso, a Jamestown antique dealer whose two dogs keep racking up tickets for barking too loud even though their vocal cords have been surgically removed.

Lorusso's dogs, Joshua and Charity, have been cited more than 30 times over the past two years for violating the county's anti-barking ordinance. Lorusso faces a two-day infraction trial starting Nov. 17 on the most recent charges — 13 counts filed between June and August.

Driver who

By BOB NORBERG
Staff Writer

The driver of a pickup that plowed into a group of teen-agers during a Halloween night free-for-all has been released from jail while police try to determine whether she was at fault.

Keavy Magill, 19, of Healdsburg was released on her own recognizance two days after the incident. She was booked on three counts of assault with a deadly weapon, but the District Attorney has not filed a complaint. She will be back in court Dec. 2.

One of the three teen-agers hurt is still in Community Hospital. Juan Navarro, 19, of Healdsburg, was in stable condition Friday. Atticus Echols, 19, of Cloverdale, was

Four men with arrested on M

NAVARRO BEACH — Four men

NOV 17 1994

WATER CONSERVATION
Suggestions for Improving Integration with Wastewater Treatment and Disposal

SUMMARY

While project developers deserve commendation for identifying water conservation as an important element of this project, steps to more fully integrate the results of water conservation studies with the scope of the disposal alternatives appear warranted. Two reasons suggest this will be worthwhile. First, a mechanism for determining the least-cost combination of conservation and treatment/disposal projects is not evident. Second, it appears that water conservation improvements will be financed on a different basis than those for treatment and disposal: the former relies on cash extracted from the rate base (and participants); the latter on long-term loans spread among all ratepayers. This financial inequity, although a common practice among water utilities, tilts the playing field against conservation.

To the extent the observations above are true, and that it is cost-effective to expand the Subregional Retrofit Program's flow reduction capability beyond the 1,070 MG/yr cited in the NOP/NOI (thus reducing water consumption and wastewater disposal), significant reductions in total lifecycle project cost and environmental impact are likely. These comments suggest changes in the Environmental Study Phase Scope of Work that might help achieve these savings.

These comments relate directly to at least two of the seven supporting project objectives given on p.3 of the Notice of Preparation:

- Optimize water resource conservation where practical; and
- Develop a disposal system that can be successfully financed and is economically feasible.

COMMENTS ON WATER CONSERVATION ISSUES¹

The principal issue set out for the consultants is the examination of costs and benefits of various water conservation technologies. The perspective(s) used, scope of analysis, and initial assumptions, however, are not identified. These are important, for the conclusions suggested from the studies may vary considerably according to the analytical framework selected. These points are discussed below.

Given the supporting project goals noted above, it seems the consulting team should concentrate on assembling the information needed to identify the set of cost-effective water conservation measures that is appropriate for each of the disposal alternatives. Ideally, this will be a list of conservation measures, organized in order of present worth unit cost (\$/MG of water saved per year). A curve should be plotted that depicts cumulative savings (throughout the Subregion) vs.

¹ Refers to issues summarized on p. 18 of Urban Alternatives' document dated Nov. 4, 1994

total present worth cost, beginning with the measures that save water at the least cost, and progressing to the measures with the highest unit cost. The supplementary information sought by the proposed studies, of course, should be appended (impacts, sources of the technologies, warranties, etc.). When the relationship between saved water and cost is established, and corresponding information is available to describe the relationship between wastewater flow and its cost (including water supply, treatment, and disposal costs), it is then possible to make an "apples-to-apples" comparison between investments in saving and using water. This will provide the information required to optimize water conservation to minimize the total project cost.

COMMENTS ON WATER CONSERVATION PROPOSED STUDIES²

Six studies are proposed. The directions are in some cases unclear (e.g. #1 and #4 study "standard" conservation measures, and #2 says "standard" conservation measures require no further study; assumptions needed to evaluate costs and benefits are not stipulated).

The following information should be developed:

- ANC*
1. Evaluate current conservation programs in the Subregional System (proposed study #3)
 2. Summarize all wastewater-saving technologies that might apply (proposed studies #1, 2, 4, 5, and 6), including
 - description of technology (water conservation *and I&I reduction*)
 - estimated lifetime
 - installed cost (note range in costs depending on individual or "utility scale" programs) and O&M cost, if any
 - best estimate of unit water savings (and source for the estimate)
 - lifestyle impacts (proposed study #1 & Issue #3)
 - warranties
 - institutional barriers (interim regulations required, if any: proposed study #5)
 3. Evaluate Potential Water Conservation Program Policy
 - Evaluate service delivery options on basis of cost, speed, market penetration, and quality of service (keeping in mind total resource cost of wastewater program, where an inexpensive water conservation program might cause large expenditures for water and disposal that could otherwise have been avoided). Examples:
 - fully funded, performance-based installation contracts
 - avoided cost rebates paid to water service companies for specialized (e.g. commercial/industrial sector) services based upon actual water savings
 - present individual rebate program
 - Evaluate financing options (availability of capital, rate impacts, etc.)
 - methods presently employed by member agencies
 - debt financing
- B*

² Refers to studies summarized on pp. 18-19 of Urban Alternatives' document dated Nov. 4, 1994

4. Establish the relationship between cost and wastewater flow reduction
 - determine unit present worth cost for each conservation, I&I measure (\$/MG-yr)
 - estimate market penetration for each measure
 - calculate total wastewater reduction and total present worth cost attributable to each measure
 - plot a "Saved Water Supply Curve" (cumulative wastewater reduction vs. cumulative present worth cost - beginning with the least expensive measure)
5. Establish the relationship between cost and incremental wastewater flow additions (note there is a different relationship for each disposal alternative). Aspects of this are included in Task 31 (Population, Housing, & Employment/Socioeconomics), and Task 32 (Energy). The energy cost should extend to include that used to dispose wastewater as well as treat it.
 - determine the unit present worth cost for new water supplied to the Subregion
 - determine the unit present worth cost for incremental wastewater treatment (beyond current capacity)
 - determine the unit present worth cost for new disposal measures (including O&M, monitoring, etc.)
 - combine the above and plot a curve of incremental wastewater volume vs. cumulative present worth cost (water, wastewater treatment, and disposal)
6. Integrate the Saved Water Supply Curve with the companion cost curve for each disposal alternative and identify the water conservation measures that are cost-effective
 - the least-cost combination of wastewater reduction and disposal measures is the economically optimal project (the environmentally optimal project might be different)

DISCUSSION

Cost/Benefit Analysis

The draft proposed scope of work, as summarized by Urban Alternatives, indicates that cost/benefit analysis of water conservation measures is important for this study. This is a complex matter, however, because benefits are dependent upon avoided costs, and the latter vary from one situation to another. Some analytical rigor is required so that the results will make sense.

While one expects the study team is fully aware of these matters, this is the official time for public comment. Therefore, without disrespect, the following points are provided to expand on the above.

Perspective

The primary perspective should be *total resource cost*. For example, when computing the costs and benefits in the case of replacing a residential toilet, the cost is the total installed cost of the toilet (hardware, labor, and program costs), and the benefits are the avoided water, wastewater treatment, and disposal costs. When we use total resource cost, note the effect of a "rebate" (in

reality only a transfer payment) drops out, because we are fairly counting the total cost of this measure to save water, just as we will have to count the total cost of treatment plants and disposal projects. The full costs will be borne by the ratepayers no matter how the pie is sliced.

The perspective of *time* must also be included in the analyses, as some costs are capital costs, and others are recurring. Using the toilet example above, the toilet has an installation cost (incurred every 30 years or so), and a flapper valve replacement perhaps every five years (if we are concerned about maintaining ultra low flow performance). More importantly, the avoided water, wastewater treatment, and disposal costs (the benefits of conservation) have capital and O&M components. Furthermore, these vary between each disposal alternative, and vary according to the total volume of water handled. The analyst should develop present worth lifecycle unit costs (\$/MG-yr) for each water conservation measure and disposal option (with the latter including avoided water supply and wastewater treatment costs). Without this information, an "apples-to-apples" comparison is not possible.

The urge to report cost-benefit analyses based upon the participant's perspective should be resisted for the common measures that deserve a high participation rate. The real benefit for participants in this case is a smaller bill (not rate) increase for the total wastewater project than would be the case without the conservation device. The units for bills are \$/time; for rates are \$/volume. The economic goal should be to minimize ratepayer's bills, not their rates (increased water efficiency translates to a higher rate, but, if cost-effective, a lower bill). For measures that will have fewer participants than non-participants, however, such as specialized services for industrial customers, it is useful to examine services from their perspective. The benefits of water conservation to industrial customers, of course, include factors unique to their situation that far outweigh the benefits that will accrue to the Subregional System: their own wastewater treatment chemicals, energy, sludge hauling, etc.

Scope

All costs should be included in the analysis. Water conservation costs include hardware, installation, and program costs (administration, marketing, measurement and verification, etc.). Disposal costs include everything associated with municipal water from the source to final disposal.

Initial Assumptions

Key assumptions that need to be addressed are those that affect total project cost: program development and financing are the big ones. These are outlined in item #3 of page 2 above. Experience of the energy utilities makes it clear that fully funded demand management programs - where the installation, hardware, and program costs are paid by the utility - are rapid and achieve much higher penetration rates than do programs that offer only rebates. This is arguably the delivery program of choice for toilets and showerheads, just as it is for efficient lighting. Large-scale programs that cost millions of dollars (and save even more millions) likewise deserve attention to their financing. When the disposal projects will be financed with long-term loans (with costs spread to all ratepayers), the financing for conservation measures that are more

cost-effective should be financed the same way. After environmental and other non-economic considerations are settled, project investments should be made in order of their cost-effectiveness.

FURTHER INFORMATION

The above was prepared by Ned Orrett, P.E. If there are any questions regarding the above, he may be reached at:

Pacific Technology Associates
625 Second Street, Suite 209
Petaluma, CA 94952

Telephone: 707 769-5335
Fax: 707 769-5336

NOV 17 1994

DEPARTMENT OF
SEWER OPTIONS MEETING, 11/17/94 7:00 PM (DEVELOPMENT)

A WL
Wetlands are a high priority for the Sierra Club, both in California and nationally. As co-chair of the Water Committee of our Sonoma Group of the Sierra Club, I appreciate the opportunity to address our concerns about the waste water disposal as it may effect the Laguna de Santa Rosa option, the creation of buffer wetlands in community separator areas, and the wetlands of several watershed areas; namely the Russian River, the Petaluma River, Stemple Creek and Estero Americano.

B
C
Recently Sierra Club activists at more than 50 press conferences through the country called for a phase-out of the industrial processes that produce dioxin, a class of highly toxic chemicals. The Environmental Protection Agency has reassessed dioxin, and reported that it is linked to cancer as well as reproductive, immunological and developmental dysfunction. Dioxin is present in the water of all communities; the results of its presence include low sperm counts, infertility and genital deformities associated with estrogen-mimicking chemicals. These reproductive, immunological and developmental disruptions are currently found in wildlife species in the Great Lakes, Florida and elsewhere, and are likely to soon be exhibited in humans as the bioaccumulation rises through the food chain. Those groups at highest risk are young children, infants and unborn babies. Dioxin passes through the placenta, builds up in developing tissues and concentrates in breast milk. It may foster immune-system abnormalities, hormone related disease and even diabetes. (Goldman: EPA 1994) There are currently no federal standards for dioxin contamination and state and federal guidelines relate only to fish, although the contamination pervades produce, meat and milk.

B
Polychlorinated biphenyls (PCBs) and furans are of equal concern and equally dangerous, but are more widely known. However, less widely known is the potential these chemicals have to bind with each other, forming even more deadly compounds.

B
Of additional concern is the low-level radioactivity in sewage. In a recent General Accounting Office investigation determined that radionuclides form elevated concentrations of cobalt-60 when

7
incinerated (Science News 1994) Neither the NRC nor the Environmental Protection Agency have mandated requirements to test specifically for radionuclides and the issue has not been studied closely enough to yet determine if there's a significant health hazard. "The full extent of radioactive contamination of sewage sludge, ash and related by-producted nationwide is unknown. Neither NRC nor the EPA has conducted or required testing to determine the extent of the radioactive contamination occurring at treatment plants that receive radioactive discharges." (GAO, 1994). The sources of this radioactivity are varied and include manufacturers, medical centers, even patient excreta and nature itself. Radiation therapy and diagnostic tests contribute, as well as low-level radioactive laboratory wastes that are now just washed down the drain. Smaller amounts of longer-lived isotopes used in radioimmunoassays (cobalt-57, tritium, and carbon-14) also enter the sewage system. Cost cannot override these concerns and the danger to plant, animal and human life.

Recent newspaper reports tell us that the midwest drinking water is now polluted by several types of chemical weedkillers. In other words, people are drinking water laced with these chemicals, and there has been no testing to determine the chemical levels accumulating in the tissues of the populace. We would not want this to happen in Sonoma County, and the plant and animal life in the wetlands areas would likely not be appreciative.

We ask that you implement regular toxicity tests, and consider keeping a close eye on the amount of estrogen-related chemicals in waste water, which potentially cause gender changes in wildlife. We are causing Darwinian changes to the gene pool through our carelessness with chemicals, and there will be a terrific clean up bill in the future unless we take action now.

Elizabeth Anthony
Sierra Club



Pitkin Lily
Lilium pitkinense

CALIFORNIA NATIVE PLANT SOCIETY

Milo Baker Chapter
1123 Palomino Road
Cloverdale, California 95425
(707) 894-5798

CITY OF SANTA ROSA
P.O. Box 1678
Santa Rosa, CA 95402

NOV 17 1994

DEPARTMENT OF
COMMUNITY DEVELOPMENT

November 17, 1994

Santa Rosa Long-Term Wastewater Project
EIR/EIS Scoping Session
Steele Lane Community Center
Santa Rosa, California

We have reviewed the Proposed Scope of Work Summary and the Preliminary Scoping Report and have the following concerns and comments:

In the interest of staying within the five minute time limit for oral comment, I will comment only on the most significant issues, detailed scoping comments will be submitted in writing next week.

A
↓
JH
3/2/95
Alternative 2: Although including factors that make it appear preferable to some of the other alternatives, the south county alternative as proposed has the potential to impact the tidal marshes in the lower reaches of Adobe Creek, Petaluma River, Petaluma Salt Marsh and resident endangered species, including the endangered Salt Marsh Harvest Mouse and plant species, *Polygonum marinense* and *Cordylanthus mollis* ssp. *Mollis*

Alternative 3: Community Separator-South County Alternatives- has the potential to convert existing seasonal wetlands into agricultural use in the western Santa Rosa Plains creating impacts to vernal pool habitat and species. As currently proposed, the alternative also has the potential to impact Blucher Creek, which supports populations of *Syncaris pacifica*, the state and federally endangered freshwater shrimp. Blucher Creek is also the water source for the Cunningham Marsh, a significant eutrophic freshwater marsh that contains many species found elsewhere in the county only in Pitkin Marsh in the Vinehill area. Cunningham Marsh contains nine listed plant species of varying degrees of rarity, including some that are state or federally listed or are federal candidates for listing. As much of the Pitkin Marsh wetlands have been degraded by incompatible land uses, it is crucial that this project avoid impacts to Blucher Creek and Cunningham Marsh.

Alternative 4 includes similar impacts to Blucher Creek, and has the potential to impact the Chileno Valley wetlands, the Estero

Americano, Stemple Creek, San Antonio Creek and the Estero de San Antonio, which support a variety of significant wetland habitats. This alternative also will result in the loss of significant plant communities and wetlands on the Button Ranch, including the only remaining substantial woodland plant community still in existence in the Petaluma Gap. Conversion of rangelands to irrigated croplands has the potential to destroy historically known location sites for endangered plant species.

Alternative 5: Many of the Geothermal units at the Geysers are located on serpentine soils, a unique soil type that supports a variety of rare plant species restricted to serpentine, including several *Streptanthus* species and subspecies, and *Eriogonum nervulosum*. The Geyser's region also provides habitat for *Lupinus sericatus* and the Geysers Panicum, *Panicum thermale*.

In spite of this, the Geyser's alternative has the advantage of not requiring additional Russian River discharge, and given some flexibility is siting treatment plants and pipelines away from significant biotic resources, this may be an alternative that provides a less complicated solution to wastewater disposal.

Because of the scope of this project and the potential for each of the alternatives to impact and degrade the county's already diminished biological resource integrity, we strongly recommend that the project's environmental consultants be given adequate field season time to conduct and complete the necessary biological studies and that organizations such as local chapters of Audubon and the California Native Plant Society be contacted to augment biological information that has not yet been included in the California Natural Diversity Data Base files. Unlike newspaper articles, these organizations provide documented information supported by literature or field research. Contact information for Marin, Napa And Sonoma County Chapters of these organizations will be included with our detailed written comments.

Thank You

Red Tides

Many experts believe these blooms of toxic algae have recently become more prevalent, posing a greater threat to human and marine health

by Donald M. Anderson

DEPARTMENT OF
OCEANOGRAPHY

Late in 1987 scientists faced a baffling series of marine catastrophes. First, 14 humpback whales died in Cape Cod Bay, Mass., during a five-week period. This die-off, equivalent to 50 years of "natural" mortality, was not a stranding, in which healthy whales beach themselves. Instead the cetaceans died at sea—some rapidly—and then washed ashore. Postmortem examinations showed that the whales had been well immediately before their deaths and that many of them had abundant blubber and fish in their stomachs, evidence of recent feeding. Alarmed and saddened, the public and press blamed pollution or a chemical spill for the mysterious deaths.

Two more mass poisonings occurred that month, but the victims in these new cases were humans. Fishermen and beachgoers along the North Carolina coast started complaining of respiratory problems and eye irritation. Within days, residents and visitors who had eaten local shellfish experienced diarrhea, dizziness and other symptoms suggesting neurotoxic poisoning. The illnesses bewildered epidemiologists and even prompted public conjecture that a nearby sunken submarine was leaking poison gas.

Concurrently, hospitals in Canada began admitting patients suffering from disorientation, vomiting, diarrhea and abdominal cramps. All had eaten

mussels from Prince Edward Island. Although Canadian authorities had dealt with shellfish poisoning outbreaks for decades, these symptoms were unfamiliar and disturbing: some patients exhibited permanent short-term memory loss. They could remember addresses but could not recall their most recent meal, for example. The officials quickly restricted the sale and distribution of mussels but eventually reported three deaths and 105 cases of acute poisoning in humans.

We now know that these seemingly unrelated events were all caused, either directly or indirectly, by toxic, single-celled algae called phytoplankton—vast blooms of which are commonly referred to as red tides. Although red tides have been recorded throughout history, the incidents mentioned above were entirely unexpected. As we shall see, they illustrate several major issues that have begun to challenge the scientific and regulatory communities.

Indeed, there is a conviction among many experts that the scale and complexity of this natural phenomenon are expanding. They note that the number of toxic blooms, the economic losses from them, the types of resources affected and the kinds of toxins and toxic species have all increased. Is this expansion real? Is it a global epidemic, as some claim? Is it related to human activities, such as rising coastal pollution? Or is it a result of increased scientific awareness and improved surveillance or analytical capabilities? To address these issues, we must understand the physiological, toxicological and ecological mechanisms underlying the growth and proliferation of red tide algae and the manner in which they cause harm.

Certain blooms of algae are termed red tides when the tiny pigmented plants grow in such abundance that they change the color of the seawater to red, brown or even green. The name is misleading, however, because many toxic events are called red tides even when the waters show no discoloration.

Likewise, an accumulation of nontoxic, harmless algae can change the color of ocean water. The picture is even more complicated: some phytoplankton neither discolor the water nor produce toxins but kill marine animals in other ways. Many diverse phenomena thus fall under the "red tide" rubric.

Of the thousands of living phytoplankton species that make up the base of the marine food web, only a few dozen are known to be toxic. Most are dinoflagellates, prymnesiophytes or chloromonads. A bloom develops when these single-celled algae photosynthesize and multiply, converting dissolved nutrients and sunlight into plant biomass. The dominant mode of reproduction is simple asexual fission—one cell grows larger, then divides into two cells, the two split into four, and so on. Barring a shortage of nutrients or light, or heavy grazing by tiny zooplankton that consume the algae, the population's size can increase rapidly. In some cases, a milliliter of seawater can contain tens or hundreds of thousands of algal cells. Spread over large areas, the phenomenon can be both visually spectacular and catastrophic.

Some species switch to sexual reproduction when nutrients are scarce. They form thick-walled, dormant cells, called cysts, that settle on the seafloor and can survive there for years. When favorable growth conditions return, cysts germinate and reinoculate the water with swimming cells that can then bloom. Although not all red tide species form cysts, many do, and this transformation explains important aspects of their ecology and biogeography. The timing and location of a bloom can depend on

RED TIDES appear when pigmented algae proliferate and form blooms. Even nontoxic species, including *Noctiluca*, shown blooming in a Japanese harbor, can kill marine animals by depleting the oxygen in shallow waters.

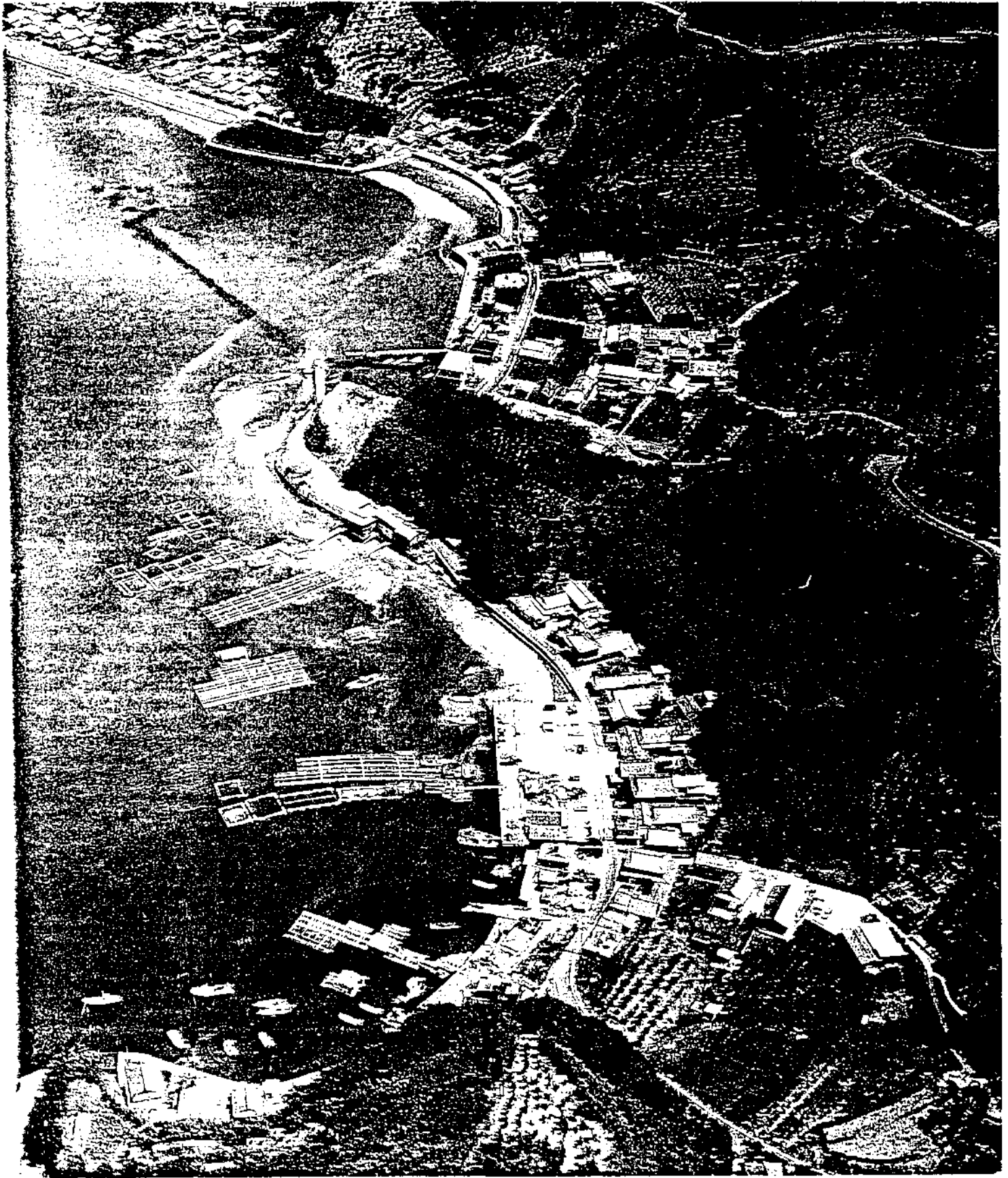
DONALD M. ANDERSON is a Senior Scientist at the Woods Hole Oceanographic Institution. In 1977 he earned a doctorate in aquatic sciences from the department of civil engineering at the Massachusetts Institute of Technology. Anderson studies the physiological and genetic regulation of toxicity in dinoflagellates, their bloom dynamics and the global biogeography of toxic *Alexandrium* species. He also participates in various international programs for cooperative research and training on red tides, marine biotoxins and harmful algae.

when the cysts germinate and where they were deposited, respectively. Cyst production facilitates species dispersal as well; blooms carried into new waters by currents or other means can deposit "seed" populations to colonize previously unaffected areas.

A dramatic example of natural dispersal occurred in 1972, when a massive red tide reaching from Maine to Massachusetts followed a September hurricane. The shellfish toxicity detected then for the first time has recurred in that region virtually every year now

for two decades. The cyst stage has provided a very effective strategy for the survival and dispersal of many other red tide species as well.

How do algal blooms cause harm? One of the most serious impacts on human life occurs when clams, mussels,





LIFE CYCLE of many toxic species enables them to survive for years under adverse conditions. When nutrients are scarce, the algae form thick-walled, dormant cysts (left). The cysts of-

ten travel into new waters. When favorable growth conditions return, the cysts germinate (center) and colonize previously unaffected areas with harmful organisms (right).

oysters or scallops ingest the algae as food and retain the toxins in their tissues. Typically the shellfish themselves are only marginally affected, but a single clam can sometimes accumulate enough toxin to kill a human being. These shellfish poisoning syndromes have been described as paralytic, diarrhetic and neurotoxic, shortened to PSP, DSP and NSP. The 1987 Canadian outbreak in which some patients suffered memory loss was appropriately characterized as amnesic shellfish poisoning, or ASP. The North Carolina episode was NSP.

A related problem, ciguatera fish poisoning, or CFP, causes more human illness than any other kind of toxicity originating in seafood. It occurs predominantly in tropical and subtropical islands, where from 10,000 to 50,000 individuals may be affected annually. Dinoflagellates that live attached to seaweeds produce the ciguatera toxins. Herbivorous fishes eat the seaweeds and the attached dinoflagellates as well. Because ciguatera toxin is soluble in fat, it is stored in the fishes' tissues and travels through the food web to carnivores. The most dangerous fish to eat are thus the largest and oldest, often considered the most desirable as well.

Symptoms do vary among the different syndromes but are generally neurological or gastrointestinal, or both. DSP causes diarrhea, nausea and vomiting, whereas PSP symptoms include tingling and numbness of the mouth, lips and fingers, accompanied by general muscular weakness. Acute doses inhibit respiration, and death results from respiratory paralysis. NSP triggers diarrhea,

vomiting and abdominal pain, followed by muscular aches, dizziness, anxiety, sweating and peripheral tingling. Ciguatera induces an intoxication syndrome nearly identical to NSP.

Illnesses and deaths from algal-derived shellfish poisons vary in number from year to year and from country to country. Environmental fluctuations profoundly influence the growth and accumulation of algae and thus their toxicity as well. Furthermore, countries differ in their ability to monitor shellfish and detect biotoxins before they reach the market. Developed countries typically operate monitoring programs that permit the timely closure of contaminated resources. Illnesses and deaths are thus rare, unless a new toxin appears (as in the ASP crisis in Canada) or an outbreak occurs in an area with no history of the problem (as in North Carolina). Developing countries, especially those having long coastlines or poor populations who rely primarily on the sea for food, are more likely to incur a higher incidence of sickness and death from algal blooms.

Phytoplankton can also kill marine animals directly. In the Gulf of Mexico, the dinoflagellate *Gymnodinium breve* frequently causes devastating fish kills. As the wild fish swim through *G. breve* blooms, the fragile algae rupture, releasing neurotoxins onto the gills of the fish. Within a short time, the animals asphyxiate. Tons of dead fish sometimes cover the beaches along Florida's Gulf Coast, causing several millions of dollars to be lost in tourism

and other recreation-based businesses.

Farmed fish are especially vulnerable because the caged animals cannot avoid the blooms. Each year, farmed salmon, yellowtail and other economically important species fall victim to a variety of algal species. Blooms can wipe out entire fish farms within hours, killing fingerlings and large fish alike. Algal blooms thus pose a large threat to fish farms and their insurance providers. In Norway an extensive program is under way to minimize these impacts. Fish farmers make weekly observations of algal concentrations and water clarity. Other parameters are transmitted to shore from instruments on moored buoys. The Norwegian Ministry of Environment then combines this information with a five-day weather forecast to generate an "algal forecast" for fish farmers and authorities. Fish cages in peril are then towed to clear water.

Unfortunately, not much more can be done. The ways in which algae kill fish are poorly understood. Some phytoplankton species produce polyunsaturated fatty acids and galactolipids that destroy blood cells. Such an effect would explain the ruptured gills, hypoxia and edema in dying fish. Other algal species produce these hemolytic compounds and neurotoxins as well. The combination can significantly reduce a fish's heart rate, resulting in reduced blood flow and a deadly decrease in oxygen.

Moreover, nontoxic phytoplankton can kill fish. The diatom genus *Chaetoceros* has been linked to dying salmon in the Puget Sound area of Washington State, yet no toxin has ever been identi-

fied in this group. Instead species such as *C. convolutus* sport long, barbed spines that lodge between gill tissues and trigger the release of massive amounts of mucus. Continuous irritation exhausts the supply of mucus and mucous cells, causing lamellar degeneration and death from reduced oxygen exchange. These barbed spines probably did not evolve specifically to kill fish, since only caged fish succumb to the blooms. The problems faced by fish farmers are more likely the unfortunate result of an evolutionary strategy by certain *Chaetoceros* species to avoid predation or to stay afloat.

Algal toxins also cause mortalities as they move through the marine food web. Some years ago tons of herring died in the Bay of Fundy after consuming small planktonic snails that had eaten the PSP-producing dinoflagellate *Alexandrium*. From the human health standpoint, it is fortunate that herring, cod, salmon and other commercial fish are sensitive to these toxins and, unlike shellfish, die before toxins reach dangerous levels in their flesh. Some toxin, however, accumulates in the liver and other organs of certain fish, and so animals such as other fish, marine mammals and birds that consume whole fish, including the viscera, are at risk.

We now can reconstruct the events that killed the whales in 1987. A few weeks of intense investigations that year by marine pathologist Joseph R. Geraci of the Ontario Veterinary College, myself and many others revealed that the PSP toxins most likely caused these deaths. The dinoflagellate *Alexandrium tamarense* produced the toxins, which reached the whales via their food web. We analyzed mackerel that the whales had been eating and found saxitoxin, not in their flesh but concentrated in the liver and kidney. Presumably the mackerel ate zooplankton and small fish that had previously dined on *Alexandrium*.

The humpbacks were starting their southward migration and were feeding heavily. Assuming that they consumed 4 percent of their body weight daily, we calculated that they received a saxitoxin dosage of 3.2 micrograms per kilogram of body weight. But was this a fatal dose? Unfortunately, in 1987 we had no data that directly addressed how much toxin would kill a whale. We knew the minimum lethal dose of saxitoxin for humans is seven to 16 micrograms per kilogram of body weight, but that was two to five times more than what the whales had probably ingested.

Our calculations were initially disheartening, but as we thought about it we realized that whales might be more

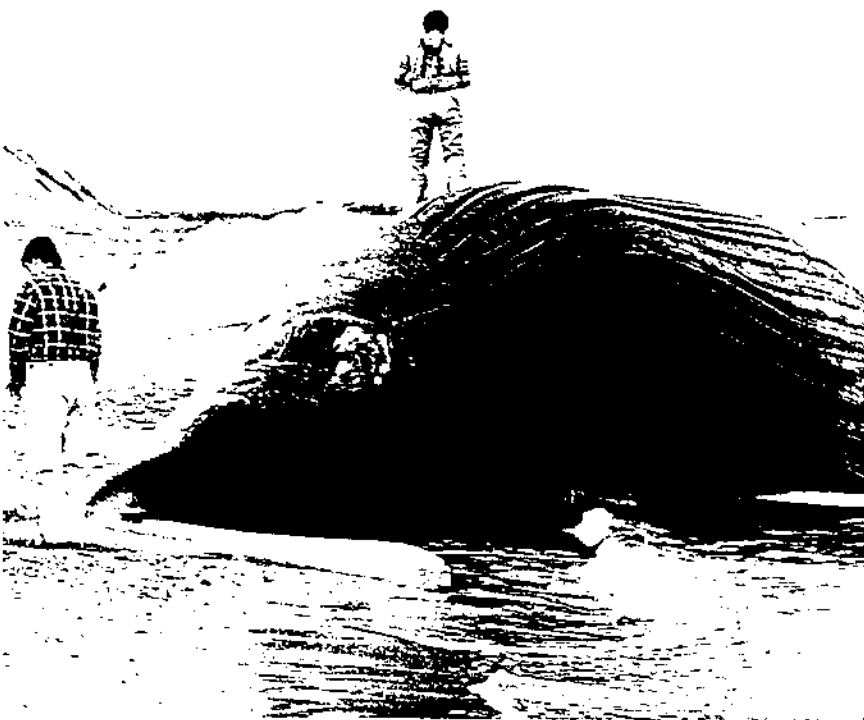
sensitive to the toxins than are humans. First, whales would have received continual doses of toxin as they fed, whereas human mortality statistics are based on single feedings. Second, during a dive, the mammalian diving reflex channels blood and oxygen predominantly to the heart and brain. The same mechanism sometimes protects young children who fall through thin ice and survive drowning, despite being underwater for half an hour or longer. For humans, cold water induces the reflex, but for whales, it is activated during every dive.

Each dive then would expose the most sensitive organs to the toxin, which would bypass the liver and kidney, where it could be metabolized and excreted. Finally, saxitoxin need not have killed the whales directly. Even a slightly incapacitated animal might have difficulty orienting to the water surface or breathing correctly. The whales may actually have drowned following a sublethal exposure to saxitoxin. The exact cause will never be known, but the evidence strongly suggests that these magnificent creatures died from a natural toxin originating in microscopic algae.

Other examples of toxins traveling up the food web appear nearly every year. In 1991 sick or dying brown pelicans and cormorants were found near Monterey Bay, Calif. Wildlife experts could

find no signs that pesticides, heavy metals or other pollutants were involved. The veterinarian in charge of the study telephoned Jeffrey Wright of the National Research Council laboratory in Halifax, Nova Scotia. Wright had directed the Canadian Mussel Toxin Crisis Team that identified the poison responsible for the mysterious ASP episode in 1987. His team had isolated a toxin from the Prince Edward Island mussels, called domoic acid, and traced it to its source—a diatom, *Pseudonitzschia pungens*, that had been considered harmless. Four years later members of the same Canadian team quickly ascertained that the sick and dying birds in California had eaten anchovies that contained domoic acid, again from *Pseudonitzschia* (but a different species).

The toxins responsible for these syndromes are not single chemical entities but are families of compounds having similar chemical structures and effects. For example, the saxitoxins that cause PSP are a family of at least 18 different compounds with widely differing potencies. Most algal toxins cause human illness by disrupting electrical conduction, uncoupling communication between nerve and muscle, and impeding critical physiological processes. To do so, they bind to specific membrane receptors, leading to

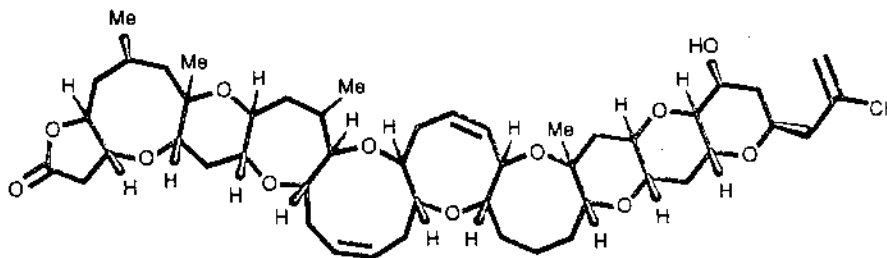
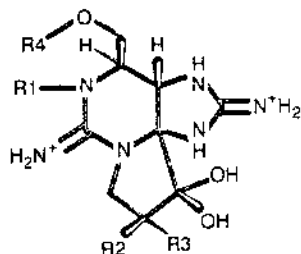


HUMPBACK WHALES, a total of 14, died suddenly from exposure to a bloom of *Alexandrium tamarense* in Cape Cod Bay, Mass., in 1987. Researchers later learned that the whales had eaten mackerel whose organs contained high concentrations of saxitoxin, a neurotoxin produced by the algae.

Algal Toxins

The structure of red tide toxins varies considerably. Saxitoxin compounds (one example shown at left) sport different combinations of H^+ , OH^- and SO_3^- on the R1 to R4 sites, but all members of this family block the sodium channel and thus prevent communication between neurons and muscles. H. Robert Guy of the National Institutes of Health has pro-

posed a structural model of this interaction (right). The carbon backbone of the sodium channel is colored gray, the carboxyls are red, nitrogen is blue, and hydrogen is white. Saxitoxin binds in the narrowest region of this channel. The brevetoxins (one example shown at center) that cause NSP are much larger molecules that also affect the sodium channel.



changes in the intracellular concentration of ions such as sodium or calcium.

The saxitoxins bind to sodium channels and block the flux of sodium in and out of nerve and muscle cells. Brevetoxins, the family of nine compounds responsible for NSP, bind to a different site on the sodium channel but cause the opposite effect from saxitoxin. Domoic acid disrupts normal neurochemical transmission in the brain. It binds to kainate receptors in the central nervous system, causing a sustained depolarization of the neurons and eventually cell degeneration and death. Memory loss in ASP victims apparently results from lesions in the hippocampus, where kainate receptors abound.

Why do algal species produce toxins? Some argue that toxins evolved as a defense mechanism against zooplankton and other grazers. Indeed, some zooplankton can become slowly incapacitated while feeding, as though they are being gradually paralyzed or otherwise impaired. (In one study, a tintinnid ciliate could swim only backward, away from its intended prey, after exposure to toxic dinoflagellates.) Sometimes grazing animals spit out the toxic algae as though they had an unpleasant taste. These responses would all reduce grazing and thus facilitate bloom formation.

All the same, nontoxic phytoplankton also form blooms, and so it is unlikely that toxins serve solely as self-defense. Scientists are looking within the algae for biochemical pathways that require the toxins, but the search thus far has been fruitless. The toxins are not proteins, and all are synthesized in a series of chemical steps requiring multiple genes. Investigators have proposed biosynthetic pathways, but they have not isolated chemical intermediates or en-

zymes used only in toxin production. It has thus been difficult to apply the powerful tools of molecular biology to these organisms, other than to study their genes or to develop detection tools.

We do have some tantalizing clues about toxin metabolism. For example, certain dinoflagellate strains produce different amounts of toxin and different sets of toxin derivatives when we vary their growth conditions. Metabolism of the toxins is a dynamic process, but we still do not know whether they have a specific biochemical role. As with the spiny diatoms that kill fish, the illnesses and mortalities caused by algal "toxins" may be the result of the accidental chemical affinity of those metabolites for receptor sites on ion channels in higher animals.

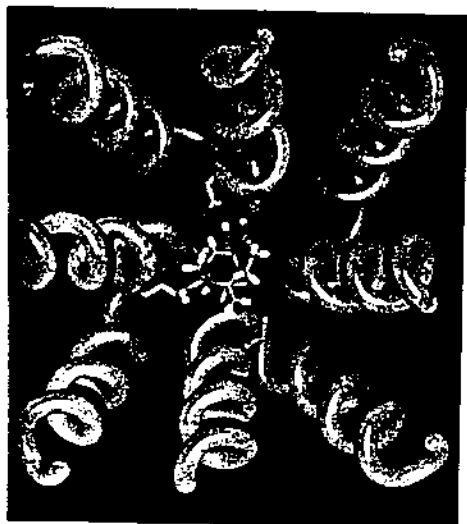
The potential role of bacteria or bacterial genes in phytoplankton toxin production is an area of active research. We wonder how a genetically diverse array of organisms, including phytoplankton, seaweeds, bacteria and cyanobacteria, could all have evolved the genes needed to produce saxitoxin [see "The Toxins of Cyanobacteria," by Wayne W. Carmichael; *SCIENTIFIC AMERICAN*, January]. Several years ago Masaaki Kodama of Kitasato University in Japan isolated intracellular bacteria from antibiotic-treated *A. tamarense* cultures and showed that the bacteria produced saxitoxin. This finding supported an old and long-ignored hypothesis that toxins might originate from bacteria living inside or on the dinoflagellate cell.

Despite considerable study, the jury is still out. Many scientists now accept that some bacteria produce saxitoxins, but they point out that dense bacterial cultures produce extremely small quantities. It is also not clear that those bac-

teria can be found inside dinoflagellates. That intracellular bacteria produce all of the toxin found in a dinoflagellate cell therefore seems unlikely, but perhaps some synergism occurs between a small number of symbionts and the host dinoflagellate that is lost when the bacteria are isolated in culture. Alternatively, a bacterial gene or plasmid might be involved.

Given the diverse array of algae that produce toxins or cause problems in a variety of oceanographic systems, attempts to generalize the dynamics of harmful algal blooms are doomed to fail. Many harmful species, however, share some mechanisms. Red tides often occur when heating or freshwater runoff creates a stratified surface layer above colder, nutrient-rich waters. Fast-growing algae quickly strip away nutrients in the upper layer, leaving nitrogen and phosphorus only below the interface of the layers, called the pycnocline. Nonmotile phytoplankton cannot easily get to this layer, whereas motile algae, including dinoflagellates, can thrive. Many swim at speeds in excess of 10 meters per day, and some undergo daily vertical migration: they reside in surface waters by day to harvest sunlight like sunbathers, then swim down to the pycnocline to take up nutrients at night. As a result, blooms can suddenly appear in surface waters that are devoid of nutrients and would seem incapable of supporting such prolific growth.

A similar sleight-of-hand can occur horizontally, though over much larger distances. The NSP outbreak in North Carolina illustrates how ocean currents can transport major toxic species from one area to another. Patricia A. Tester,



a biologist at the National Oceanic and Atmospheric Administration's National Marine Fisheries Service laboratory in Beaufort, examined plankton from local waters under a microscope soon after the initial reports of human illnesses. She saw cells resembling the dinoflagellate *G. breve*, the cause of recurrent NSP along Florida's western coast. Experts quickly confirmed her tentative identification, and for the first time in state history, authorities closed shellfish beds because of algal toxins, resulting in a loss of \$20 million.

Tester and her co-workers have since used satellite images of sea-surface temperatures to argue that the *G. breve* population in North Carolina originated off the southwestern coast of Florida, nearly 1,000 kilometers away. That bloom traveled from the Gulf of Mexico up the southeastern coast of the U.S., transported by several current systems culminating in the Gulf Stream. After 30 days of transport, a filament of water separated from the Gulf Stream and moved onto North Carolina's narrow continental shelf, carrying *G. breve* cells with it. The warm water mass remained in nearshore waters, identifiable in satellite images for three weeks. Fortunately, *G. breve* does not have a known cyst stage, so it could not establish a seedbed and colonize this new region.

This incident, taken together with

many others like it throughout the world, speaks of an unsettling trend. Problems from harmful red tides have grown worse over the past two decades. The causes, however, are multiple, and only some relate to pollution or other human activities. For example, the global expansion in aquaculture means that more areas are monitored closely, and more fisheries' products that can be killed or take up toxins are in the water. Likewise, our discovery of toxins in algal species formerly considered nontoxic reflects the maturation of this field of science, now profiting from more investigators, better analytical techniques and chemical instrumentation, and more efficient communication among workers.

Long-term studies at the local or regional level do show that red tides (in the most general sense of the term) are increasing as coastal pollution worsens. Between 1976 and 1986, as the population around Tolo Harbor in Hong Kong grew sixfold, red tides increased eightfold. Pollution presumably provided more nutrients to the algae. A similar pattern emerged in the Inland Sea of Japan, where visible red tides proliferated steadily from 44 per year in 1965 to more than 300 a decade later. Japanese authorities instituted rigorous effluent controls in the mid-1970s, and a

50 percent reduction in the number of red tides ensued.

These examples have been criticized, since both could be biased by changes in the numbers of observers through time, and both are tabulations of water discolorations from blooms, not just toxic or harmful episodes. Still, the data demonstrate what should be an obvious relationship: coastal waters receiving industrial, agricultural and domestic waste, frequently rich in plant nutrients, should experience a general increase in algal growth. These nutrients can enhance toxic or harmful episodes in several ways. Most simply, all phytoplankton species, toxic and nontoxic, benefit, but we notice the enrichment of toxic ones more. Fertilize your lawn, and you get more grass—and more dandelions.

Some scientists propose instead that pollution selectively stimulates harmful species. Theodore J. Smayda of the University of Rhode Island brings the nutrient ratio hypothesis, an old concept in the scientific literature, to bear on toxic bloom phenomena. He argues that human activities have altered the relative availability of specific nutrients in coastal waters in ways that favor toxic forms. For example, diatoms, most of which are harmless, require silicon in their cell walls, whereas other phytoplankton do not. Because silicon is not



WARM WATER PLUME (green), revealed in a satellite infrared image of sea-surface temperature, traveled from southern Maine into Massachusetts Bay in 1987, carrying *A. tamarense*. Remote-sensing techniques help investigators track blooms traveling within discrete water masses.



OUTBREAKS of paralytic shellfish poisoning affected more than twice as many areas in 1990 as they did in 1970. Some

experts believe coastal pollution and shipping practices have contributed to the expansion.

abundant in sewage, but nitrogen and phosphorus are, the ratio of nitrogen to silicon or of phosphorus to silicon in coastal waters has increased over the past several decades. Diatom growth ceases when silicon supplies are depleted, but other phytoplankton classes, which often include more toxic species, can proliferate using "excess" nitrogen and phosphorus. This idea is controversial but not unfounded. A 23-year time series from the German coast documents a fourfold rise in the nitrogen-silicon and phosphorus-silicon ratios, accompanied by a striking change in the composition of the phytoplankton community: diatoms decreased, whereas flagellates increased more than 10-fold.

Another concern is the long-distance transport of algal species in cargo vessels. We have long recognized that ships carry marine organisms in their ballast water, but evidence is emerging that toxic algae have also been hitchhiking across the oceans. Gustaaf M. Hallegraeff of the University of Tasmania has frequently donned a miner's helmet and ventured into the bowels of massive cargo ships to sample sediments accumulated in ballast tanks. He found more than 300 million toxic dinoflagellate cysts in one vessel alone. Hallegraeff argues that one PSP-producing dinoflagellate species first appeared in Tasmanian waters during the past two

decades, concurrent with the development of a local wood-chip industry. Empty vessels that begin a journey in a foreign harbor pump water and sediment into their tanks for ballast; when wood chips are loaded in Tasmania, the tanks are discharged. Cysts easily survive the transit cruise and colonize the new site. Australia has now issued strict guidelines for discharging ballast water in the country's ports. Unfortunately, most other nations do not have such restrictions.

The past decade may be remembered as the time that humankind's effect on the global environment caught the public eye in a powerful and ominous fashion. For some, signs of our neglect come with forecasts of global warming, deforestation or decreases in biodiversity. For me and my colleagues, this interval brought a bewildering expansion in the complexity and scale of the red tide phenomenon. The signs are clear that pollution has enhanced the abundance of algae, including harmful and toxic forms. This effect is obvious in Hong Kong and the Inland Sea of Japan and is perhaps real but less evident in regions where coastal pollution is more gradual and unobtrusive. But we cannot blame all new outbreaks and new problems on pollution. There are many other factors that contribute to the proliferation of toxic species; some in-

volve human activities, and some do not. Nevertheless, we may well be witnessing a sign that should not be ignored. As a growing world population demands more and more of fisheries' resources, we must respect our coastal waters and minimize those activities that stimulate the spectacular and destructive outbreaks called red tides.

FURTHER READING

- PRIMARY PRODUCTION AND THE GLOBAL EPIDEMIC OF PHYTOPLANKTON BLOOMS IN THE SEA: A LINKAGE? Theodore J. Smayda in *Novel Phytoplankton Blooms: Causes and Impacts of Recurrent Brown Tide and Other Unusual Blooms*. Edited by E. M. Cosper, V. M. Bricej and E. J. Carpenter. Springer-Verlag, 1989.
- MARINE BIOTOXINS AT THE TOP OF THE FOOD CHAIN. Donald M. Anderson and Alan W. White in *Oceanus*, Vol. 35, No. 3, pages 55-61; Fall 1992.
- DOMOIC ACID AND AMNESIC SHELLFISH POISONING: A REVIEW. Ewen C. D. Todd in *Journal of Food Protection*, Vol. 56, No. 1, pages 69-83; January 1993.
- A REVIEW OF HARMFUL ALGAL BLOOMS AND THEIR APPARENT GLOBAL INCREASE. Gustaaf M. Hallegraeff in *Phycologia*, Vol. 32, No. 2, pages 79-99; March 1993.
- MARINE TOXINS. Takeshi Yasumoto and Michio Murata in *Chemical Reviews*, Vol. 93, No. 5, pages 1897-1909; July/August 1993.

POLLUTION TO PARK

CITY OF SANTA ROSA

P.O. Box 1673
Santa Rosa, CA 95402

NOV 17 1994

DEPARTMENT OF
COMMUNITY DEVELOPMENT

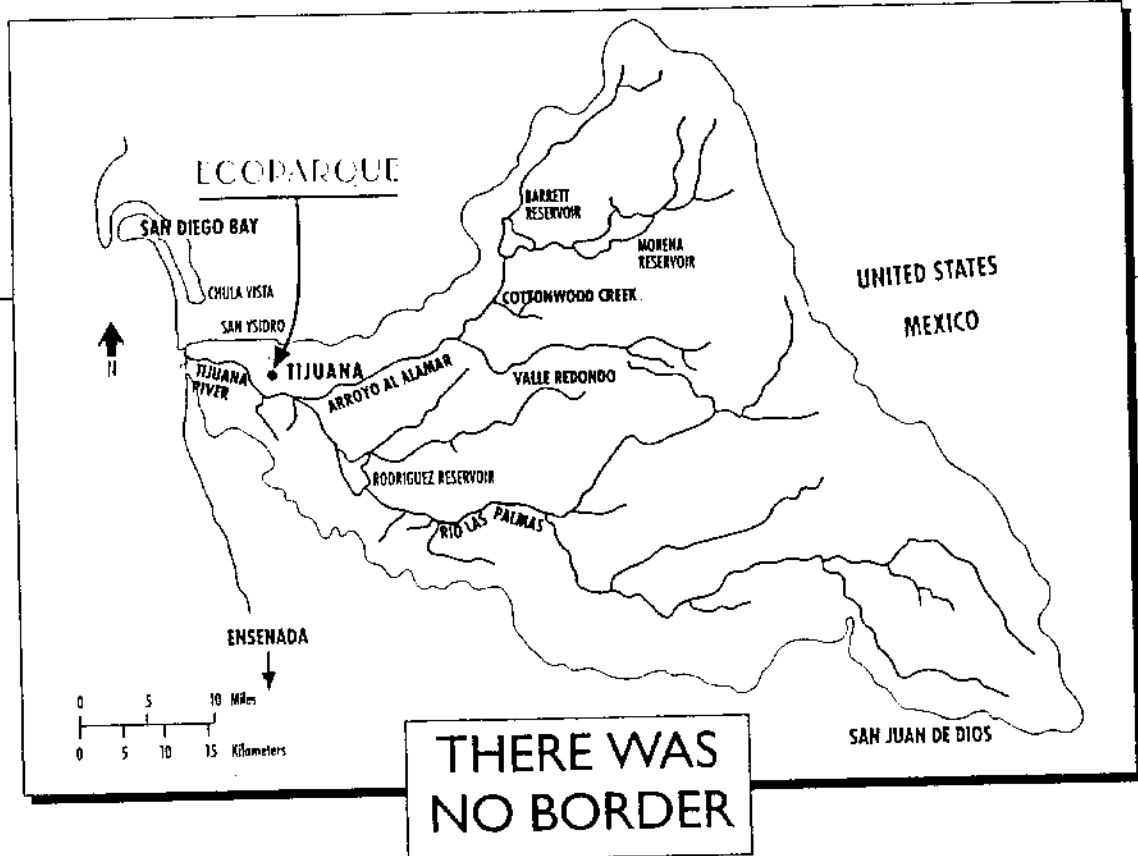
EXPERIMENT IN TIJUANA: A LOW-TECH APPROACH TO WASTEWATER MANAGEMENT

DANIEL F. LUECKE & CARLOS DE LA PARRA

THE ISSUE WAS A FLASH POINT in the debate over the North American Free Trade Agreement (NAFTA): water pollution along the U.S./Mexican border in general, and sewage treatment—or the lack of it—in particular. In California, most of the attention has been on Tijuana, Mexico, and the untreated wastewater that has fouled wetlands and beaches on both sides of the border for decades. The problem has grown along with population on both sides of the border—despite years of effort to find a solution.

The conventional method of dealing with wastewater is treatment followed immediately by disposal. Subsidies for water supply and wastewater treatment, direct and indirect, disguise their true costs. Rarely is wastewater considered as a resource, even more rarely as a potential economic benefit or public asset. Proposals for recycling treated effluent evoke suspicions, even fear. Most of Tijuana's fresh water is imported, used once, then finds its way into the ocean, either through deliberate discharge after treatment or without any treatment at all.

Now, a low-cost wastewater treatment and reuse facility on a Tijuana hillside is demonstrating that the pollution problem can be significantly alleviated by means of an inexpensive alternative system; and that treated effluent can be used for landscape irrigation, creating green space in an otherwise



WHEN ECOPARQUE WAS DEDICATED in Tijuana, there was no border. People of Mexico and the United States, as well as government, academic, and citizens organizations from both countries, had worked together toward a solution to a common problem. The project's vision encompassed the Tijuana River watershed, without regard to the arbitrary lines of administrative and political convenience.

Geography demands a bi-national water management effort. No wall or fence can prevent the destruction of valuable wildlife habitat and recreational area by pollution, erosion, and sedimentation. More effective use and re-use of resources in Mexico will benefit inhabitants of both countries, and vice versa.

Since 1980, the California State Coastal Conservancy has been a leading source of funding, energy, initiative, and support for protection of the Tijuana River and its estuary. The Conservancy has spent nearly four million dollars to acquire land, research wetland restoration, carry out demonstration projects, assess environmental impacts, provide public access, and educate the public in the Tijuana National River Estuarine Research Reserve. Ecoparque, supported by half a million of these Conservancy dollars, represents the most recent and successful of its efforts to address the problem of negative impacts on the estuary directly. Ecoparque demonstrates what can be done. It is a working model, now ready to be replicated. To be sure, this one small treatment plant can process only a tiny proportion of the city's wastewater. It is not the whole answer to the huge problem it addresses. But it turns a problem (untreated sewage) into a public asset (water and fertilizer) and is a pioneering effort to set a new course.

The edges of things are where the action is: frontiers, cellular walls, modern art and music, the littoral where the sea meets the land. In such places there is opportunity and risk, possibility and uncertainty; there are problems and there are solutions. That is clearly evident in the Tijuana River watershed.

—Peter Grenell

FROM POLLUTION TO PARK

barren urban environment. The Environmental Defense Fund (EDF) and El Colegio de la Frontera Norte (COLEF, a Mexican applied research institute specializing in border issues) have teamed up with the California State Coastal Conservancy in this project, launched more than a decade ago at the initiative of the Southwest Wetlands Interpretive Association (SWIA), a citizens organization in the border city of Imperial Beach. Getting the project up and running has taken almost ten years of work by a diverse international alliance of individuals and institutions, both public and private. The new facility finally opened in October, eloquent testimony to their collective patience and persistence in overcoming seemingly endless financial and logistical roadblocks.

THE CITY THAT GREW TOO FAST

Tijuana, the second largest city on the California's coast, has a population of more than 1.2 million, expected to double by the year 2010 if present trends continue. For the last two decades the annual growth rate has exceeded five percent, overwhelming the urban infrastructure, including water and sewage systems. Many dwellings are not connected to sewers;

treatment facilities cannot cope with the ever-growing volume of waste water.

The city's early residents settled along the valley of the Tijuana River, at the base of its bordering hills and steep slopes. Within the last 30 years, however, subdivisions and densely populated squatter settlements spread to the surrounding hilltops and canyons. Water and sewage systems had to be installed in very difficult terrain; in some cases they were never built at all. As the hilltop population grew, interceptors were overloaded and the canyons became wastewater canals draining into the Tijuana River.

In the early 1980s, the problem took on international proportions. The river and "renegade" flows of untreated water in the canyons began to carry as much as four or five million gallons of sewage across the border into the U.S. Tijuana River National Estuarine Reserve, a major wetland preserve, habitat for many migratory and resident bird species, some of them endangered. The spillage across the border prompted strong protests from environmental organizations and individuals in the United States—particularly in the border city of Imperial Beach, where environmental, health, and economic concerns converged as polluted beaches were closed.

Old Slough, in the Tijuana River Estuary, site of a future Coastal Conservancy restoration project



DEWEY SCHWARTZENBURG

After sewage-laden flood waters drenched the Tijuana River Valley in January 1993, causing much misery to residents of the flood plain, signs blaming "environmentalists" appeared in the valley. These are among several posted on private property along Monument Road, which runs along the U.S.-Mexico border.



Tijuana's reliance on an international interceptor, the so-called "emergency connection," added another dimension to the border pollution problem. With the city's pump station and other facilities overloaded, the connection carried some 13 million gallons per day (MGD), about 60 percent of Tijuana's sewage, into the San Diego metropolitan sewage system, to be treated at Point Loma. The system had been built in 1965 by the International Boundary and Water Commission (IBWC) as a 20-year temporary backup to the Mexican system. In 1983, Mexico began to expand Tijuana's disposal system to accommodate all of the city's wastewater. A treatment plant has since been built on the coast, south of the city, but Tijuana's treatment needs have already exceeded its capacity. In addition, the plant discharges into a shallow nearshore area.

Public pressure for urgent action continued to mount in the United States. With the conclusion of the 1983 La Paz Agreement on environmental border issues, the city of San Diego, with the support of the U.S. Environmental Protection Agency, issued a counter-proposal to solve the border sewage problem. The plan called for an ambitious joint international facility that could treat 100 MGD from Tijuana and up to 30 MGD from the South Bay area of San

Diego County. Disposal was to be into an ocean outfall. The total cost of the proposal was a staggering \$729 million, almost one-third of it for interceptors and treatment facilities for Tijuana. For Mexico, the new system's operating costs alone are expected to exceed the total costs of Tijuana's current water and sewage system.

A NEW CONCEPT TAKES SHAPE

In Imperial Beach, concern was growing over the enormous costs of the border treatment proposal and the prospect of building yet another ocean outfall to dispose of imported water. SWIA, a local nonprofit organization that had played a key role in the successful struggle to establish the Tijuana National Estuarine Research Reserve, sought and obtained funds from the California State Coastal Conservancy to study the problem. The result was an imaginative design for an alternative technology, relatively low in cost and simple to operate, but capable of treating concentrated wastewater efficiently. If successful, it promised to be a model for use elsewhere in Mexico.

The Coastal Conservancy saw enough potential in the plan to provide SWIA with funding for a first phase demonstration project, and

FROM POLLUTION TO PARK

construction began in July 1984. The facility consisted of two easily maintained parts: a fine stainless steel screen, widely used in industry to separate solids, and a plastic biological filter to which bacteria adhere. The bacteria remove dissolved organic matter from wastewater as it trickles through the filter. The plant was built on the U.S. side of the border on land leased by a farmer from the International Boundary Water Commission (IBWC), adjacent to the emergency connection. It used water diverted from the connection. To build and operate the plant, SWIA hired a group of consultants from the U.S. and Mexico that included a staff member from COLEF.

Because wastewater from Tijuana is highly concentrated, some skeptics doubted that the design could perform well. But during a six-month trial period, the two components proved to be very effective in treating wastewater flowing through the emergency connection. In fact, the initial test phase was so successful that SWIA proposed a second phase, with additional treatment components. SWIA again approached the Conservancy for funding, and then asked EDF to help direct the expansion.

In spring 1986, EDF and the Conservancy signed a contract. Shortly after the new construction began, however, U.S. IBWC Commissioner Joseph Friedkin, who supported the project, retired. Acting Commissioner D.C.



Organic solids are separated from the wastewater stream by a screening unit (left) and composted. Carlos de la Parra (right) explains that the Ecaparque system can operate without electricity or any mechanical parts, using gravity and biological processes. All parts of the treatment process are easily visible.



PHOTOS: RASA GUSTATIS

~~~~~

McNealy refused to extend the lease on the land occupied by the plant. EDF reluctantly dismantled the plant, stored the components, and began to search for another location. Unable to find a suitable site on the U.S. side of the border, EDF and COLEF, with Conservancy approval, decided to seek one in Mexico.

## BUILDING THE PLANT IN TIJUANA

Making the transborder move possible wasn't easy. It required the active participation of both the government of Mexico and the State of California, as well as of San Diego State University. The federal government of Mexico gave COLEF the use of a 23-acre parcel of land for five years, the California Attorney General's office gave the Coastal Conservancy special authorization to fund an out-of-state project, and San Diego State

allowed EDF to move the plant equipment and construction materials across the border, duty free, under an existing arrangement between the University and COLEF. The new plant location, on a hillside facing south over the river valley, was in a section of Tijuana known as Colonia Buenavista. The land itself was vacant, little more than a casual dump and community eyesore below a modest neighborhood, the Colonia Buenavista, and directly below a highway. The site overlooks the Tijuana River and the city's downtown.

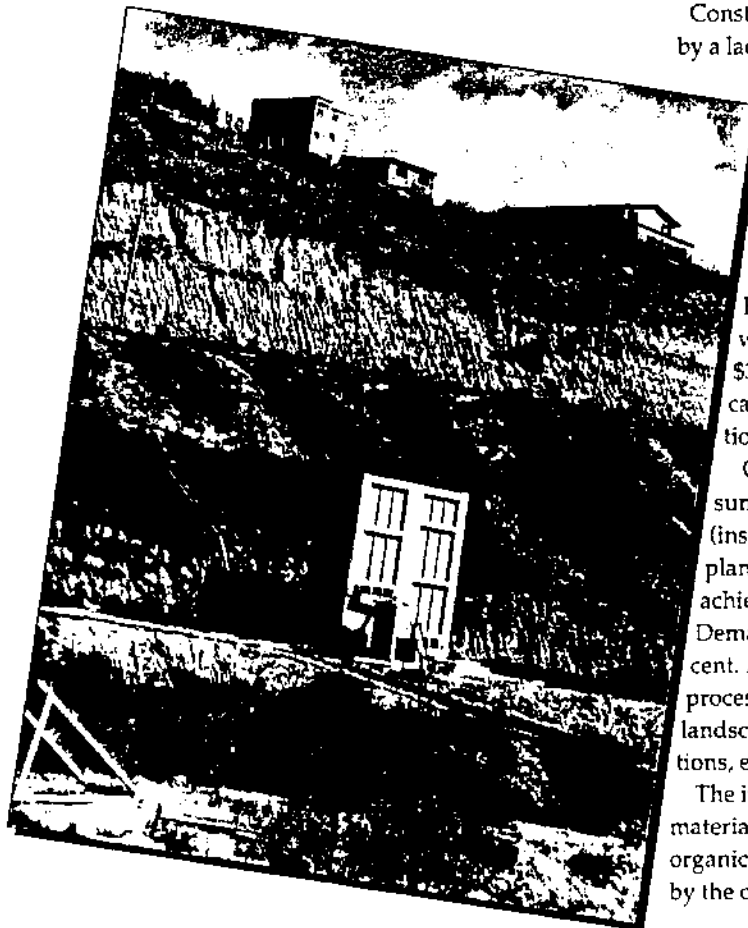
In early 1987, EDF and COLEF began to design and construct the new treatment plant. Like the original one, it contained a screening unit and a biological filter. These components were followed by a settling basin, where solids collect and are easily removed, and a composting unit. Space was also set aside for an artificial wetland as a final treatment unit, to be built later as funds become available.

Construction was interrupted for two years by a lack of funding. The funds remaining in the contract with the Conservancy were sufficient to complete the project at its original site north of the border. They did not suffice to cover the costs of the move to Mexico and of adapting to a new site and new conditions. Eventually the General Service Foundation, which had supported EDF water projects in the past, offered \$35,000, and the Coastal Conservancy came in with another \$88,000. Construction was completed in 1991.

Operational testing was completed in summer 1993. With one modification (installation of a recirculation system), the plant performed very efficiently. It achieved reduction in Biochemical Oxygen Demand (BOD) in the range of 80 to 85 percent. After passing through the treatment process, wastewater was suitable for reuse in landscaping and might, under certain conditions, even be acceptable for irrigating crops.

The initial plan also called for mixing solid material from the screening unit with other organic wastes to be delivered to the plant site by the city public works department. The

Ecoparque treats water diverted from city sewage pipes serving homes on the steep hillside above it. This tower houses the biofilter, heart of the treatment process. Microorganisms adhere to a plastic filter inside the tower and remove dissolved organic matter from the wastewater as it trickles through.



ELENA EGGER

# FROM POLLUTION TO PARK

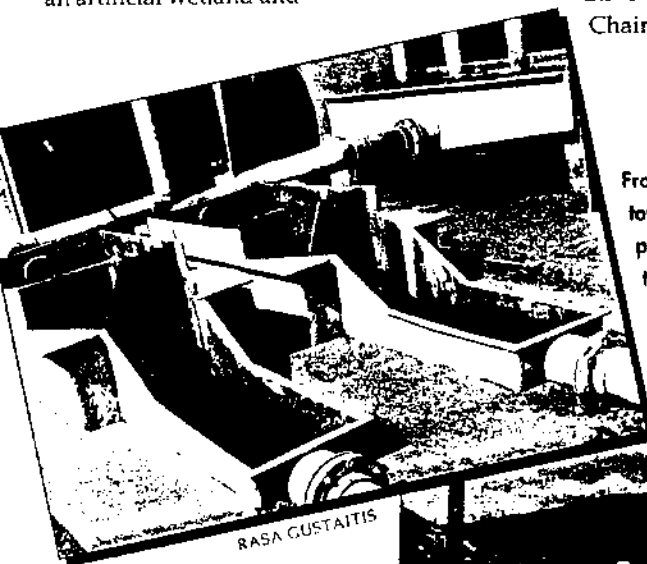
off-site wastes were not satisfactory, however, because they often contained plastic materials and other litter that would have required off-site separation. Composting was stopped until the Coastal Conservancy, in April 1993, offered to provide additional funding of \$9,700 for needed equipment.

Although still in the development stage, the project can now be called a success. The plant is doing the work for which it was designed, and it promises to be self-financing. Treated water is already irrigating several acres at the site, now landscaped with native vegetation, and 15 of the original 23 acres have been ceded permanently to COLEF. A contract for the sale of water to be used for off-site irrigation is being negotiated with the city of Tijuana. The income will be used to expand the plant and add an artificial wetland and

several ponds. The ponds will serve as reservoirs for the wetland's effluent and as sites for aquaculture experiments, and, by increasing the effluent's exposure to the sun's ultraviolet light, they will provide a measure of disinfection.

The plant is now surrounded by grass, small trees, shrubs and flowers, a rare and welcome green space in Tijuana. Named Ecoparque, the site is also a laboratory for examining ways to transform the undesirable byproducts of urban growth into useful resources. Above all, the plant is achieving the project's primary goal, to reduce the untreated wastewater reaching sensitive and shallow coastal waters.

When Ecoparque was officially opened in October, among those in attendance were U.S. State Department Counselor Tim Wirth, COLEF President Jorge Bustamante, EDF Executive Director Fred Krupp, the Conservancy's Chairman Penny Allen and Executive Officer



RASA GUSTAITIS

From the biofilter, water moves through weirs toward the clarifier, a large tank in which solids produced during the biofiltering process settle to the bottom. The water is now suitable for reuse in landscaping. It is turning a barren hillside into a green and blossoming park.



ELENA EGER

### Ecoparque: Decentralised System for Wastewater Treatment and Reuse

*Carlos de La Parra is the director of Ecoparque and a researcher for El Colegio de la Frontera Norte. He holds a degree in civil engineering from the Instituto Politecnico Nacional in Mexico City.*

Sierra Club - Sonoma Group Water Committee CITY OF SANTA ROSA

Santa Rosa Wastewater Scoping Session Santa Rosa, CA 95402

Request for Study/Review

November 17, 1994

NOV 17 1994

DEPARTMENT OF  
COMMUNITY DEVELOPMENT

1. A viable plan with alternatives that can be implemented to reduce the inflow of water to be treated. Include a financial analysis and a timeline for implementation. Specify the volume that can be saved with different alternatives and the effect on the wastewater treatment system longevity.
2. Cumulative impact from the introduction of effluent from the cities located in Sonoma County and Lake County. What realistically can the resource endure? What are the number of injection wells needed? Is the approach a true restoration of the resource depletion brought on by overdevelopment? Analyze ability of resource to recover from a "watering out". Analyze the long-term plan of a "trickle" injection over a larger area.
3. Induced Seismic activity and lack of safety for area residents. Establish the base as pre-1960 seismic activity. Establish the increase over the last thirty years of seismicity; including all data from all depths and from a minimum of a 50 mile radius. Development of safety element or mitigation plan. Analyze financial cost and creation of a non-profit entity to hold mitigation funds to reimburse area residents who sustain dwelling and business damages from increased seismicity. Quantify the effect of the seismicity in relation to triggering of local area faults. Quantify the volume of water injected and the potential seismic action.
4. If the City is not to be the sole responsible fiscal entity, then there needs to be an analysis describing the entity created wherein funds are transferred on behalf of the City and third parties. There needs to be a detailed description of the bylaws, Board of Directors, and mission.
5. Analyze the fiscal viability of the project when the main entity, PG&E will be drastically altered through the actions of the Public Utilities Commission. Analyze the fiscal viability to the long-term commitment of all third parties, for instance, Unocal.
6. The financial viability of allowing the steam developers to have a "walk-away" option with no financial responsibility, leaving the county with effluent and no way to handle it.
7. Cumulative impact of pipe breakage spills into waterways and effect on drinking water or on fisheries
8. Potential for pipe breakage spills in an area of serpentine or asbestos soils and the cinnabar or mercury soils or mining tailing sites.

- H
- I
- J
- K
- L
- M
- N
- O
- P
- Q
- R
- S
9. Potential for injection well blowouts and possibility of creating a "producing" well when breaks occur and injection water is stopped. Cost of repairs. Timeline for fixing. Potential for inability to control. (Prior blowout took one year to control.)
  10. Identification of riparian withdrawal of water from area streams and the potential impact if pipes break.
  11. Cost and implementation plan for reclamation for the removal of the pipeline in the event of the failure of the project. Back up plan for turnover of "unwanted" effluent to another system.
  12. Clearly identify and define the regulating agency with ultimate oversight. Delineate areas of responsibility.
  13. A substantiated botanical study that clearly defines the impacts on unique plant and wildlife species with even a comparison of the count and percentage of species destroyed with what remains in the area. Show patterns of travel or habitation.
  14. A comprehensive, onsite study of current effects on fish from the mercury mine tailings, asbestos runoff, current production spills and the atmospheric outfall caused by current levels of electricity production. Show comparison of the effect from increased levels with increased production and spills
  15. Analyze the effect of removing water from it's watershed and from the normal ocean inflow and weather production. Calculate the effect of increasing toxic condensate and the interrelated production of energy. Compare the cost of increasing toxic condensate and the subsequent effect on the environment with the cost of energy production.
  16. Analyze the effect of increased injection of condensate on the porosity of the resource soils and fractures. Fully analyze the introduction of silica compounds into a heated system and the influence on porosity.
  17. Analyze the increase of toxic substances introduced from effluent on the mechanical parts of the steam production facility. What is the resultant cost to maintain/repair?
  18. Identify the pesticide residues and chemical compounds that are held in the effluent and what the effect will be in terms of scaling.
  19. Amount and cost of electricity and storage facilities to pump water to The Geysers, hold in tanks and to inject into injection wells.
  20. Show a comparative study with the potential for electrical use reduction with educational techniques and a timeline for implementation. Show when the reduction of use and the cost of operation/maintenance would meet in time and the project is no longer financially viable.
  21. Show volume of toxic and heavy metals from cumulative increase through introduction from Lake County wastewater, Lake County Superfund Mercury mine wastewater, and the Santa Rosa Wastewater. Show the effects of heavy metals on fisheries, mammals, birds, reptiles and on area water drinkers.

- T →
22. Cost analysis for increasing the production of the current facilities based on retooling of the plants and the introduction of a resource-wide, comprehensive schedule of steam withdrawal and plant production. Assess the feasibility of selling electricity to out-of-area purchasers to meet the schedule of production.
23. Cost analysis for removal of all plants and wells should this project fail. Show the increased cost of removal for the pipelines and facilities as they would be proposed should this project occur. Include the cost for the Lake County Injection plan.
24. Financial analysis of the royalties and tax-revenue from the increased production in The Geysers. Show the financial cost incurred from lost production and from the continuation of payments on bonds.
25. Analysis of the volume and content of the steam that is created from injected wastewater and the effect of heating on those elements. What is the cumulative load on the area inhabitants from the atmospheric release?
26. What will be the increase in radon and sulphur dioxide to the atmosphere with the increase in production? What is the cumulative load and the health effect from long term exposure. Where is the plume likely to drift?
27. What are the cataloged and uncataloged areas in The Geysers showing the archaeological sites and the historical sites for native Indian use. What is the current native Indian use of area sites?
28. Perform a comprehensive survey showing all the current and potential injection well sites.
29. Analyze the feasibility and cost for a mitigation plan that would allow the shipped wastewater to be measured and compared to the documentation of injected wastewater. This mitigation is to identify the loss of wastewater through pipe leakage and through spills by steam well producers.
30. Fiscal cost for safety mitigation plan that would encompass emergency plans for responding when there are spills and when there is damage from seismicity or slope failures/landslides. A plan should include periodic inspection of approaches including into areas without viable roadways. There should be semi-annual drills.
31. Complete cataloging of all area waterways, both tributaries and groundwater. This should include water that is currently a resource for either domestic or cattle, and the potentially developable sites.
32. Mail/phone survey of area property owners to identify all riparian and groundwater water uses. The location of extraction points should be correlated to potential runoff from spills and potential/current injection wells sites.
33. Cost analysis for using pipe and tanks that can withstand substantial landslides or seismicity.
34. Identify fault lines and landslide areas.
- U
- V
- W
- X
- Y
- Z
- AA
- AB
- AC
- AD
- AE

- AF 35. Identify historical and onsite inspection siting of mercury mines and mining tailings. Show comprehensive data on a contour map.
- AG 36. Identify asbestos outcroppings and correlate to contour maps showing potential for spill runoffs and disturbance potentially entering area waterways.
- AH 37. Cost of increased traffic on area roads. Study showing the amount of new roads to be created and costs of maintaining. Identify who is to pay.
- AI 38. Identification of all waterways that are currently impacted waterways. Detailed description of which water ways in which areas and levels of contamination. Amount of potentially introduced contamination from production increase and introduction of wastewater. Cumulative effect on animals, fish and people when introduced over the potential life of the project.

K.Rector C:\word\srwaste.doc



Sierra Club - Sonoma Group Water Committee

Geysers Commentary - Appendix to Request for Study/Review

November, 1994 Scoping Session for Santa Rosa Wastewater EIR/EIS

This is a small sampling of the information and/or controversies surrounding the recently approved injection of wastewater at The Geysers by the County of Lake and the information available on the unique aspects of The Geysers and its environment.

Cumulative impacts - Seismicity:

1. Man-made Earthquakes in Denver
2. U.S. Department of the Interior Letter of August 24, 1994
3. "Data shows increase in earthquakes...", Middletown Times, July 28, 1994
4. "Some in Cobb fear increases in quakes", R. Bee June 9, 1994
5. "Volcanic danger a possibility...", R. Bee Aug. 24, 1989
6. "Concerns of increased seismicity..." Middletown Times, July 21, 1994
7. "Small quakes shook county..." R. Bee March 28, 1994
8. "Quake rattles Geysers" R. Bee Sept. 22, 1992

Injection:

1. Model Study of Historical Injection in the Southeast Geysers, Faulder
2. Reservoir Technology Research at LBL Addressing Geysers Issues, Bodvarsson
3. Numerical Modeling of Injection Experiments at The Geysers, Eneidy.
4. Analysis of Reinjection Strategies for The Geysers, Faulder
5. Geysers Productivity Decline Analysis & Water Availability Survey, CH2MHill

Fiscal stability/Utility:

1. "Breaking up a monopoly" Press Dem. October 25, 1994
2. "Electric Utilities preparing for end..." Press Dem. August 15, 1994
3. "PG&E plans to slash 3,000 jobs" Press Dem Aug. 31, 1994
4. CPUC Hearing on PG&E rate increases to \$157 million Press Dem Aug 31, 1994
5. "PG&E shuts 2 plants at The Geysers" Press Dem August 1, 1994
6. "Unocal may sell assets in California" Chronicle June 21, 1994

Cumulative impacts - toxins to area waters/land:

Pipeline breakage/contamination:

1. "New info may modify EPA cleanup plan for mercury mine", CO, Sept 28, 1994
2. "EPA Holds meeting on superfund cleanup..." Middletown T., Oct. 16, 1994
3. "EPA Sulphur Bank Mine..." R. Bee Oct 7, 1994
4. Use of Lake County Treated Municipal Wastewater for Geothermal Resource Replenishment, Goddard, Goddard
5. "Public fears include possible pipeline leakage, groundwater contamination" Times July 21, 1994
6. "Pipeline Plan..." R. Bee Sept. 23, 1994
7. "Groups voice concern over pipeline project" R. Bee July 15, 1994
8. "County wants Oaks to participate in Geysers..." R. Bee May 20, 1994
9. "Clearlake Oaks may also join..." Aug 25, 1994

Available at Laguna Treatment plant.

Impacts on Fisheries:

1. Geysers-Calistoga KGRA Fish Populations and Element loads, June 1990
2. Investigation on chemical elements in The Geysers, CA, 1985+

Regulatory Agencies and Policies:

1. Geysers KGRA Generating and Steam Resources, CEC, December, 1991
2. Geothermal; Regulatory Policy Options, K. O Banion
3. Extract EIR; Geothermal Development Revenues pgs 3-146, 146
4. "Emergency response system...CEC" Middletown Times July 14, 1994
5. "Pipeline project has a manager" R.Bee Sept 8, 1994

Hydrogen sulfide:

1. "Hydrogen sulfide gas..." R.Bee Sept 28, 1994

The Geysers Unique Geology:

1. A Reservoir Assessment of The Geysers Geothermal Field, DOC
2. Blowout of a Geothermal Well at The Geysers/Happy Jack, CDMG
3. The Geysers Geothermal Field and The McLaulin Mine Fieldtrip...1959 collapse crater
4. Geology and Slope Stability - The Geysers GRA, CDMG.

### SCOPING COMMENT FORM

Due December 5, 1994

Name: David Reimov

Date: 11/12/94

Address: 529 Living Oaks Ct

City: Santa Rosa State: Ca Zip: 95401

Phone: (707) 573-515

#### How to use:

Please fill out the above information. Please provide your written comments about the Summary EIR/EIS Consultants Draft Scope of Work or the Preliminary Scoping Report on the form below. Please print or write legibly, or attach this form to your typed comments. You may add additional pages of your own if needed. When completed fold the form so the City's address is showing and tape the edge together, (Do not use staples), and drop in the mail.

Comments: I support the south county / buffer plan. Any other plan is awful. Please don't make us pay more to help a few greedy developers! Thank you

CITY OF SANTA ROSA

P.O. Box 1573

Santa Rosa, CA 95402

NOV 21 1994

DEPARTMENT OF

COMMUNITY DEVELOPMENT



Nov. 18, 1994

Marie Meredith  
Environmental Coordinator  
City of Santa Rosa  
PO Box 1678  
Santa Rosa, CA. 95402

CITY OF SANTA ROSA  
P.O. Box 1678  
Santa Rosa, CA 95402

NOV 23 1994

DEPARTMENT OF  
COMMUNITY DEVELOPMENT

Subject: Scoping Comments EIR/EIS

Dear Ms. Meredith,

I am representing the Western Sonoma County Rural Alliance, an environmentally active group originally formed to control rampant development in the rural areas of the county.

**A** Our Board of Directors recommends a combination of options 2 and 3, the south county reclamation and the community separator & wetlands option assuming it includes the restoration of the Laguna de Santa Rosa.

We wish to remind the scientists involved that "pure" water is non-existent in nature and that the question revolves around degrees of contamination, how reliable the treatment system is, how redundant and the public perception of purity.

There are three items that I thought got short shrift in the scoping document:


- B** 1. Conservation or other methods to reduce the waste water stream.
- C** 2. A method of analyzing proposed options that would consider serious obstacles to the viability of each option, in some organized method, early in the EIR/EIS process and be able to discard options that are obviously flawed.
- D** 3. I didn't find any consideration of advantages and disadvantages of shipping the effluent out of sight and out of mind as opposed to the idea of keeping it in your own back yard or at least in the vicinity.

**E** It would appear that the reduction of the waste stream considers only the reduction in water usage, using low flush toilets for example. There are other ideas and methods that should be considered; on site gray water use, that recently gained State approval; or assurance that citizen conservation of water will not result in proportional increase in their water and sewer rates. I'm sure that the prestigious panel of consultants the City has assembled could produce a long list of similar ideas.

The idea I'm trying to get at in item #2 is best shown by an example: Let us assume that the owners/operators of the Geysers cannot guarantee that they will be able to accept the treated effluent for more than 10 years. Would this kill this option? Or why would an option be pursued that will be fought tooth and nail by all means fair and (foul?) causing a five to ten year project delay. If it is suspected options are non-viable, the reasons for such ought be identified and analyzed early on in the process so that the remaining options receive the benefits of the available time, moneys and talent. I understand the Law allows this approach, if not perhaps the City ought to consider attempting to get the Law or rules altered. It appears that the stakes are high enough to consider this approach!

Item #3 comments are more pragmatic and consider that one does not mess up ones own bed and the natural human tendency is "out of sight, out of mind". It is my opinion that the waste water disposal system will function best when the citizenry views the results on a regular basis. This ought be a consideration for the option selection.

Sincerely



John A. Prunuske

cc Robert Sharp

*Santa Rosa*

Subregional Long-Term Wastewater Project

**SCOPING COMMENT FORM**

Due December 5, 1994

Name: JOHN A. FRUNUSKE

Date: 11/18/94

Address: 18020 WILLOW CREEK ROAD

City: OCCIDENTAL State: CA Zip: 95465

Phone: (707) 874-2630

**How to use:**

Please fill out the above information. Please provide your written comments about the Summary EIR/EIS Consultants Draft Scope of Work or the Preliminary Scoping Report on the form below. Please print or write legibly, or attach this form to your typed comments. You may add additional pages of your own if needed. When completed fold the form so the City's address is showing and tape the edge together, (Do not use staples), and drop in the mail.

Comments:

SEE ATTACHED





**SCOPING COMMENT FORM**

Due December 5, 1994

Name: Charles Black

Date: 21 November 1994

Address: 89 Elliott Avenue

City: Santa Rosa

State:

Zip: 95401

Phone: ( )

**How to use:**

Please fill out the above information. Please provide your written comments about the Summary EIR/EIS Consultants Draft Scope of Work or the Preliminary Scoping Report on the form below. Please print or write legibly, or attach this form to your typed comments. You may add additional pages of your own if needed. When completed fold the form so the City's address is showing and tape the edge together, (Do not use staples), and drop in the mail.

*A* Comments: Although it was not a requirement of your report, it would have been helpful to include an estimate of the cost of implementing each of your proposed plans. As I recall, Alternative 5, the Geyser discharge, has already been eliminated from the proposal because of the prohibitive cost.

*B* You are also forgetting that many senior citizens are on fixed incomes. For them, the increased water and sewer fees would pose a real hardship. Some type of financial relief should be found for them.

There have been numerous AIRs written on the Russian River and Santa Rosa Creek. Wouldn't a Negative Declaration be sufficient this time; especially if purity of the treated water meets the requirements of the Regional Water Quality Control Board and the State Department of Public Health.

It has always been my contention that public input into preliminary reports such as this one is largely ignored by the consultants, and have little actual impact on the reports.

CITY OF SANTA ROSA  
P.O. Box 1673  
Santa Rosa, CA 95401

NOV 27 1994

DEPARTMENT OF  
COMMUNITY DEVELOPMENT



Department of Community Dev.  
100 Santa Rosa Ave.  
Room 3  
Santa Rosa, CA 95401

CITY OF SANTA ROSA  
P.O. Box 1678  
Santa Rosa, CA 95402

NOV 23 1994

DEPARTMENT OF  
COMMUNITY DEVELOPMENT

A  
I would ask that you support  
a wastewater system that meets  
public health objectives & is safe  
for the environment. This MUST  
be done in an economical manner.  
It must be affordable to the  
taxpayers without any waste.

Thank-you,

Kathy Keweenaw-Baskin  
Santa Rosa taxpayer



1512 Fair Oaks Court  
Santa Rosa, CA. 95404 028

Nov. 22, 1994

U.S. Army Corps of Engineers  
211 Main St. #802  
San Francisco, CA. 94105  
Attention: Wade Eakle

This letter concerns the studies to be made by the City of Santa Rosa regarding the long range plans for disposal of wastewater.

It is my understanding that the Corps of Engineers is requesting the city to include as one of its options, Ocean outfall. In regard to this request — it is absolutely ridiculous and should be immediately withdrawn by the Corps for the following reasons:

1. Ocean outfall has already been studied some years ago at considerable cost to the taxpayers. The idea was overwhelmingly unpopular with the citizens and remains so today.
2. With new technology, the wastewater has been upgraded and been made a valuable resource for irrigation for agriculture, wetlands, and city landscaping. It should not be thrown away but put to a beneficial use.
3. Spending any more taxpayers dollars on ocean outfall would be a slap in the face of the citizens, totally unacceptable, and a waste of their hard earned tax dollars. Enough is enough!

I strongly urge that you withdraw this preposterous request!

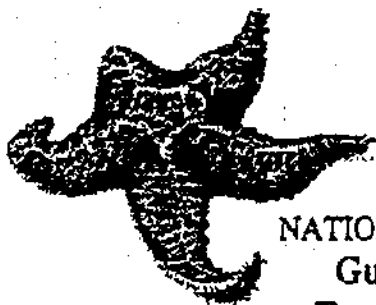
Sincerely,

Ernestine J. Smith

Copy to:  
Marie Meredith  
Santa Rosa Dept. of  
Community Development

CITY OF SANTA ROSA  
P.O. Box 1678  
Santa Rosa, CA 95401  
NOV 23 1994  
DEPARTMENT OF  
COMMUNITY DEVELOPMENT





UNITED STATES DEPARTMENT OF COMMERCE  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
Gulf of the Farallones National Marine Sanctuary  
Fort Mason, Building 201 San Francisco, CA 94123  
telephone: 415 556 3509 facsimile: 415 556 1419

FACSIMILE COVER SHEET

DATE: 11/23/94

SENDING: 3 PAGES (Including this page)

DIALING FACSIMILE NUMBER: 707/543 3218 - Marie  
415/744 3320 - Wade

TO: Marie Meredith, City of Santa Rosa  
Wade Egle, Army Corps of Engineers

FROM: Ed Ueber, Sanctuary Manager

SUBJECT: \_\_\_\_\_

SPECIAL INSTRUCTIONS: Due to comments made

at public hearing a thorough  
review and possible new proposal  
should be released. Letter  
of 14 February 1991 will be  
mailed with original of this  
document on 6 December 1994.



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL OCEAN SERVICE  
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT  
Gulf of the Farallones  
National Marine Sanctuary  
Fort Mason, Building 201  
San Francisco, CA 94123  
tel: 415/556-3509  
fax: 415/556-1419

16 November 1994

Marie Meredith  
City of Santa Rosa  
Dept. of Community Development  
100 Santa Rosa Ave., Rm. 3  
Santa Rosa, CA 94501

Wade Eakle  
Army Corps of Engineers  
211 Main Street, SF District  
San Francisco, CA 94105-1905

Dear Ms. Meredith and Mr. Eakle:

The Marine Protection, Research and Sanctuaries Act designates the Gulf of the Farallones National Marine Sanctuary (Sanctuary) the responsibility for protecting all living, historical and cultural resources found within its boundaries. Activities proposed by Santa Rosa's EIR/EIS could have a direct and detrimental effect on those resources for which the Sanctuary is responsible. The following comments address your NOP for this project.

A 1

The Sanctuary has been involved with this process for over seven years and continues to assist and cooperate with Santa Rosa. However, the distribution of this notice was not forthcoming to the Sanctuary, but had to be requested from Santa Rosa. This has also happened in the past where the Sanctuary had either been left off the mailing list or been required to travel to Santa Rosa to purchase a document. What this does is shorten the Sanctuaries response time and makes, in this case, a 30 day notice become a 22 day notice; which thwarts the purpose of the 30 day requirement. We also only received the entire NOP today 16 November, as parts were left out by Santa Rosa, further shortening the thirty day notice to nine days.

A  
We have particular problems with the 1% to 20% discharge to the Russian River being part of each option and then having it be an option by itself. How are we to discern which parts of which option will be needed if the percentage, in and of itself can fulfill the project needs? The percentage needs to be clarified first and then options developed on remaining needs (ie: 1% = M amount left; 5% = N amount left 10% = T amount left 15% = R amount left and 20% = zero amount left; where  $M > N > T > R > 0$ ). Then one can design a system to utilize; not generate; or dispose of the sewage water remaining after the Russian River discharge.





Marie Meredith  
Wade Eakle  
16 November 1994  
Page 2

A 2

I am dismayed that all the indirect discharges to the Marine and Estuarine environments are included, but the direct discharge proposed previously for an ocean outfall is not. Why is this?

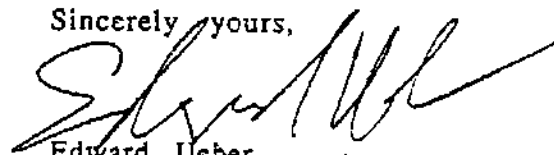
The Sanctuary has many questions on the West County project.

- B  
C  
D  
E  
F  
G done  
H
1. How much water will get into the Estero Americano and Estero de San Antonio (runoff, percolation, seepage and direct discharge)?
  2. What is in the water, including pesticides, metals, nutrients?
  3. When (time of year) will it get into the Esteros?
  4. What is the maximum, minimum and mean mode of water flow in wet, dry, extremely wet and drought years?
  5. Why is the same water use rate, of 0.67 million gallons/acre annually, used for agriculture in Rohnert Park, a very hot dry area, and also for Stemple Creek (west county) a very foggy cool area?
  6. Please include page 8: b.; Environmental requirements: "The Marine Protection, Resource and Sanctuaries Act."
  7. Please include the Names, acreage and crops farmers are going to grow in the Stemple Creek/Estero de San Antonio watershed and Americano Creek and Estero watershed.
  8. Please review NOAA's letter of 14 February 1991 (attached) for all these concerns still exist.

See  
044

Thank you for the opportunity to comment on this NOP. Please call if we can continue to be of assistance.

Sincerely yours,



Edward Ueber  
Sanctuary Manager  
Gulf of the Farallones and Cordell Bank  
National Marine Sanctuaries

EU: cmg/AP5

c: L. Moore, SRD  
J. Bybee, NMFS  
B. Tasto, CF&G



November 19, 1994

CITY OF SANTA ROSA  
P.O. Box 1678  
Santa Rosa, CA 95402

NOV 28 1994

DEPARTMENT OF  
COMMUNITY DEVELOPMENTMarie Meredith  
Environmental coordinator  
City of Santa Rosa  
P.O. Box 1678  
Santa Rosa, CA 95402RE: ATTACHMENT TO:  
"SANTA ROSA SUBREGIONAL  
LONG-TERM WASTEWATER PROJECT  
SCOPING COMMENT FORM"

Dear Ms. Meredith:

My name is James Vantine. My wife and I own two houses within the city limits of Santa Rosa. I am retired from Unocal Geothermal as an engineering geologist having worked at The Geysers since 1974; first as a consultant for PG&E and Unocal, then as a permanent Unocal employee between 1976-93. My duties with Unocal included identifying and developing alternative water supplies for artificially recharging The Geysers reservoir. This work included design of the initial water extraction facilities on Big Sulphur Creek for The Geysers reservoir recharge and project manager for a proposed dam. One of my reports written in the late 1970's indentified the concept of utilizing Santa Rosa's waste water for recharging The Geysers reservoir. Shortly thereafter inquiries were made to local officials and their consultants studying Santa Rosa's wastewater disposal options to use the water at The Geysers. At that time less was known about The Geysers reservoir, the storage capacity, heat transfer and how much recharge the industry could commit to for a very long period of time. A better understanding now exists. Most indications are that the reservoir can accept significant additional amounts of water for recharge for the foreseeable future. The amount which can be used for recharge is larger than the 18,000,000 gpd of wastewater Santa Rosa generates.

A  
Act  
T  
In my opinion, utilizing the water for recharge in The Geysers reservoir is cost effective and an environmentally acceptable solution. The wastewater is a valuable resource and can be used to generate additional electrical energy, sustain what was once the largest tax base in Sonoma County and sustain geothermal employment.

B  
X  
Before I start with my comments on the consultants scoping phase, there are a couple inconsistencies you might correct. In the first couple chapters The Geysers alternative is called "Alternative 5- Geysers Recharge" but later in scoping report the alternative is called "Alternative five-Geysers Discharge". It would also be more descriptive using "Alternative 5-Recharge of The Geysers Geothermal Field".

Now my comments regarding the scoping study which will pertain to Alternative 5--"The Geysers Recharge".

## COMMENTS ON THE SCOPING PHASE

### Energy Issue

C  
The discussion on energy regarding the alternative to recharge The Geysers reservoir is extremely important but essentially ignored. Yet in Appendix A under Supplemental Information, 3a. Significant issues, and page 7 of the U.S. Corps of Engineers letter, energy is listed as one of the significant issues.

Appendix B "Initial Study" presents a standard EIR checklist with preliminary comments. Item 23 is Energy.

D  
First under Item 23 is the discussion on use of substantial amounts of fuel or energy? The discussion only pertains to construction and operation of equipment. Not mentioned is the amount of energy needed to pump the waste water to The Geysers Geothermal Field. The amount of lift will be about 3,000 feet. The energy costs for this have been determined in an excellent report prepared by Bechtel Civil, Inc. "Evaluation of Wastewater Conveyance Systems to The Geysers and the Ocean" dated July 1986. The report, paid for by the geothermal industry, is a comprehensive economic comparison of conveying the Santa Rosa waste water to The Geysers with the then chosen ocean outfall alternative. Bechtel estimated capital cost of about \$50,000,000 for both alternatives. The pumping cost in 1986 dollars was estimated at \$10,000,000 per year (at \$0.08/kwh). However, this is only a fraction of the cost when the water is converted to steam and produced as electrical energy. The waste water could be pumped at night when excess and cheap power is available reducing pumping costs significantly.

E  
Completely ignored in the EIR/EIS are the potentially enormous economic benefits of increasing and/or sustaining electrical energy production by injecting wastewater into The Geysers reservoir. Briefly, the water equivalent of 4,000 gpm of steam is required for each 110MW power plant. After the steam goes through the turbine, it is condensed to a water temperature between 120 to 130 degrees F. by spraying cooler 70 degree F. water on the turbine's outlet to increase back pressure and produce more power. The 120 degree water is then pumped to a cooling tower which lowers the temperature to about 70 degrees.

At the cooling tower, about 75 percent of the 4,000 gpm (3,000gpm) produced from the reservoir is evaporated. The remaining 25 percent (about 1,000 gpm) is then injected back into the reservoir. Studies show that the 25 percent returned to the reservoir is heated within a short time and returned in the form of steam to production wells.

The installed capacity at The Geysers Geothermal Field approached 2,000 MW a few years ago; now somewhat lower. Most plants now operate at reduced capacity. Unused capacity amounts to a few hundred MW.

Electrical power production is slightly more than the 1,000 MW. At 1,000 MW, the net reservoir deficit between that extracted and that returned to the reservoir (condensate plus surface recharge) is in the order of 40,000 ac-ft/yr. To put this number in perspective, Clear Lake has a surface area of about 42,000 ac-ft and the 40,000 ac-ft would be equivalent to removing one foot of water from the lake.

F  
The scoping report states that 18,000,000 gallons per day (12,500 gpm or 20,000 ac-ft/year) will be treated and will require disposal. This amount is about half the estimated 40,000 ac-ft/yr deficit in The Geysers reservoir at a 1,000 MW production rate.

G  
How much is the 18,000,000 gallons per day of wastewater worth when heated to steam needs to be addressed in the EIR/EIS. If heated to the 500 degree reservoir temperature, and returned as steam, this could supply three 110MW power plants of installed but unused capacity. This amount is about the electrical power needs for a city with a population of 300,000. The retail cost of power by the time it arrives to our homes is about 12 cents per kilowatt (\$120/MWH). At 330MW the gross potential benefit of this much waste water injected (at 12 cents/kwh) is \$39,000 per hour, \$950,040 per day, or \$346,000,000 per year. As mentioned previously, Bechtel's pipeline cost estimate was \$50,000,000. This should be compared to what little potential economic benefit, if any, could be obtained from the other disposal alternatives.

H  
In the near future, additional sources of electrical power will be needed for California. The EIR/EIS should address the environmental benefit of not having to develop this much power by using coal, natural gas or other fuels.

I  
There are also possible ways to increase the economic benefit which should be mentioned in the EIR/EIS. The alternative calls for a simple pipeline. Sometime in the future, pumped storage could be added to take advantage of the 3,000 feet of head. Pumped storage would require the addition of two surface reservoirs; one at a high elevation and one at a low elevation. Water would be pumped during early morning hours when rates are low and when unused power is available. The water is then released to generate electrical power during peaking hours when demand is high as well as rates. Assuming the pipeline would be owned by Santa Rosa, the addition of future pumped storage could provide significant revenues.

## Other

A few other comments.

J The effect on Sonoma County tax base should be addressed if The Geysers alternative is not chosen. In the early 1980's the operators and utilities at The Geysers Geothermal Field paid about 20 percent of Sonoma's property taxes ( The Geysers geothermal Field and McLaughlin Mine Field Trip Guidebook, Association of Engineering Geologists 29 Annual Meeting, October 1986, by J. Vantine). There are no permanent residents at The Geysers and essentially no expenditures for fire, schools, and police. In essence, The Geysers taxes are used to help support the rest of Sonoma County. By utilizing the wastewater for The Geysers reservoir recharge, this will help sustain taxes.

K The effects of employment should also be addressed. A few years ago nearly 1,000 people worked at The Geysers with much higher than average salaries. The number now is much less but with recharge, present levels of employment could be sustained.

This was mentioned previously but I will mention it again. I feel it is essential that the value of the water for the different alternatives be compared in the EIR/EIS.

L On page 49 under the heading of Big Sulphur Creek Diversion Evaluation the statement is made that "reclaimed water discharge into (The) Geysers steamfield would reduce or eliminate the need for diversion of flows from Big Sulphur Creek". Chances are it would not reduce or eliminate the need.

## CONCLUDING COMMENTS

My opinion is that using Santa Rosa's waste water for recharging The Geysers reservoir is by far the best alternative. Utilized at The Geysers, the wastewater is a valuable resource. With some other alternatives the wastewater is not a resource but a liability and costly to dispose of. The highest value added is by far utilizing the wastewater for recharging The Geysers reservoir. This will help sustain energy production, taxation, employment and provide potentially large economic benefits to the community.

I have no problem with the other suggested waste water disposal alternatives. But after listening to the some of the public comments, many of which were highly emotional and irate, there will be intense, perhaps unfounded opposition to any solution and lawsuits. Except perhaps, utilizing the wastewater for reservoir recharge at The Geysers.

What's the old saying? "Don't look a gift horse in the mouth".

*Santa Rosa*

Subregional Long-Term Wastewater Project

**SCOPING COMMENT FORM**

Due December 5, 1994

Name: JAMES V. VANTINE

Date: 11/24/94

Address: 97 cottontail

City: Windsor State: CA Zip: 95492

Phone: (707) 838-6429

**How to use:**

Please fill out the above information. Please provide your written comments about the Summary EIR/EIS Consultants Draft Scope of Work or the Preliminary Scoping Report on the form below. Please print or write legibly, or attach this form to your typed comments. You may add additional pages of your own if needed. When completed fold the form so the City's address is showing and tape the edge together, (Do not use staples), and drop in the mail.

Comments: SEE ATTACHED

CITY OF SANTA ROSA

P.O. Box 1678  
Santa Rosa, CA 95402

NOV 28 1994

DEPARTMENT OF  
COMMUNITY DEVELOPMENT





**STATE WATER RESOURCES CONTROL BOARD**

DIVISION OF CLEAN WATER PROGRAMS

2014 T STREET, SUITE 130

P.O. BOX 944212

SACRAMENTO, CA 94244-2120

(916) 227-4480

(916) 227-4595 FAX



NOV 23 1994

CITY OF SANTA ROSA

P.O. Box 1678  
Santa Rosa, CA 95402

NOV 28 1994

DEPARTMENT OF  
COMMUNITY DEVELOPMENT

Ms. Marie Meredith  
Santa Rosa Department of Community Development  
P.O. Box 1678  
Santa Rosa, CA 95402

Dear Ms. Meredith:

NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT  
REPORT/STATEMENT (EIR/EIS) FOR THE SANTA ROSA SUBREGIONAL LONG-  
TERM WASTEWATER PROJECT, SRF LOAN NO. C-06-4062-110 (SCH# 940103069)

A  
↓  
Thank you for the opportunity to review the above document. As you may know, the State Water Resources Control Board, Division of Clean Water Programs (SWRCB) has approved a loan from the State Revolving Fund (SRF) program for the City of Santa Rosa's treatment plant expansion and water reclamation project. If the city will be seeking additional funding from the SWRCB, we will need to consider the EIR/EIS when deciding whether to approve an additional loan. Please send us a copy of the draft EIR/EIS when it becomes available. In addition, if this project will involve an SRF loan, please inform us any meetings or hearings regarding the project.

If an EIR/EIS which complies with the requirements under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) is prepared for this project, our State Environmental Review Process (SERP) requirements for SRF loans will be satisfied. To assure compliance, the EIR/EIS should be sent to the following agencies for review: The U.S. Environmental Protection Agency, Air Toxics Division; the U.S. Army Corps of Engineers, the Federal Emergency Management Agency; the U.S. Fish and Wildlife Service; the U.S. Soil Conservation Service; and the San Francisco Bay Conservation and Development Commission. In addition, please send us any information regarding compliance with Section 106 of the National Historic Preservation Act.

B  
In general, the Initial Study included with the Notice of Preparation provides a good basis for consideration of impacts to be analyzed in the EIR/EIS. However, inconsistencies with the descriptions of project alternatives create some confusion. For example, alternatives 5 and 6 do not include storage, yet the checklist refers to impacts associated with reservoir construction for these alternatives.

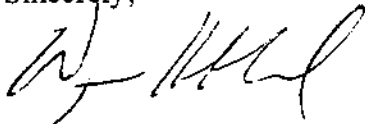
NOV 23 1994

Following are our environmental concerns regarding the project:

- C 1. The draft EIR/EIS should include results from the Biological Assessment and all other studies and analysis proposed in the Initial Study.
- D 2. The EIR/EIS should provide a comparative environmental evaluation of the alternatives summarized in a table.
- AD 3. The EIR/EIS should address impacts of a significant increase in wastewater flow for the planning period. As of January 31, 1994, unless circumstances provide for an exemption, SRF projects have been required to meet the Federal General Conformity Rule for the Federal Clean Air Act. A conformity determination may be made if the project is sized to meet only the needs of population projections that are in the applicable State Implementation Plan (SIP) for air quality. In the EIR/EIS, please provide the capacity, population, and air quality information as outlined in the applicable sections of the enclosed environmental guidelines, in order that a conformity determination can be made.
- F 4. Floodplain and wetland delineation should be shown in the EIR/EIS.
- G 5. An agriculture conversion analysis should be prepared in coordination with the U.S. Soil Conservation Service.
- H 6. Dewatering impacts should be discussed in the EIR/EIS.
- I 7. The City may need to file a petition to change the point of discharge with the SWRCB, Division of Water Rights. Please contact Mike Falkenstein at (916)657-1377 for more information.

Please call me at (916) 227-4480 if you have any questions.

Sincerely,



Wayne Hubbard  
Environmental Services Unit

Enclosure

cc: State Clearinghouse  
1400 Tenth Street  
Sacramento, CA 95814

Regional Water Quality Control Board  
North Coast Region (I)  
1440 Guerneville Road  
Santa Rosa, CA 95403

[Click here to go to next section.](#)